Uncertainty in IT Outsourcing of Large Financial Institutions

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A thesis submitted in partial fulfilment of the requirement of the Manchester Metropolitan University for the degree of Doctor of Philosophy

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March 2011

DECLARATION

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institution of learning.

ABSTRACT

According to the recent industry reports, relatively few European banks have benefited from information technology outsourcing to the extent originally anticipated by these institutions. Despite the setbacks, most intended to increase outsourcing activities in pursuit of reduced labour costs, specialized skills, process expertise, superior technical resources, and enable a better focus on their core business. Whether or not these reasons are justified, outsourcing often has unexpected impacts, both positive and negative, on the operation of an organisation.

Despite the lack of a commonly accepted interpretation of outsourcing outcomes, the practice of outsourcing in modern corporations is proliferating. This trend has forced both practitioners and academics to theorize and speculate on the underlying momentum towards outsourcing. So far the information technology outsourcing literature has mainly focused on the transaction itself, without investigating the strategic characteristics of the organization leaving out of sight a built-in social framework of the firm or social context it is located in. This trend captures the widely held perception that organisational members makeoutsourcing decisions based upon an economic rationale and regard social factors as negligible in an overall picture of outsourcing.

Agent-based modelling provides us with a tool for examining the implications of various social and organizational choices within organisations. This thesis examines how this can be done in the case of choosing to outsource (or not) the information technology needs within large banking organisations. This thesis introduces an alternative approach to the investigation of economic theories by means of evidence-based agent-based social simulation. It suggests and seeks an alternative metric for asset specificity with a more qualitative flavour. Williamson's transaction cost framework is replicated with autonomous, heterogeneous agents as actors of the modelled outsourcing process that can act according to changes in the environment they are located in. Social structures emerge from the interaction and information exchange between individuals in the market. The models succeed in producing a qualitative definition of the term asset specificity.

The modelling and the fieldwork were carried out by the same party with data engineering involving stakeholder interactions. A constructive and modular approach to model design was adopted. The rules for the agents' behaviour were derived partly from the relevant reports and partly from qualitative insight into the modelled target system. The first research stage involved gathering of relevant data in collaboration with industry partners. Based upon data collected from the fieldwork a prototype declarative agent-based coarse grained model was developed. Building a "mock-up" model first was intended in order to point out data requirements, and help to determine which data is important and which can be dismissed. This model allowed the identification of gaps in the current data set that need to be filled in order to develop a more informative model. In subsequent research stages additional interviews were conducted in order

to fill gaps, which became evident through the analysis of the mock-up model. Exploration and validation of the models' results happened in a constant feedback-loop, together with domain experts. The constant cross validation with stakeholders and domain experts facilitated the development of a simulation that was credible for practitioners, who came to participate in the research with sceptical views. This particular case study is presented as an example of a generalised approach that can be used to examine different aspects of organisational change.

DEDICATION

This thesis is dedicated in loving memory to my father who passed away while I was working on my research. Without fail, in every phone call , he and my mother would ask if I had finished my studies yet. I doubt I could ever explain sufficiently to him what Agent-Based Modelling actually is but I deeply regret I will never be able to say to him "Yes, I have finished!"

ACKNOWLEDGEMENTS

I am heavily indebted to my supervisors, Scott Moss and Bruce Edmonds for their role in nurturing my interest in social simulation and helping me to enter the realms of the academic world. Scott shepherded and guided this research, while Bruce supported me in all aspects of my work. They have helped me to see life and science in their full depth. I am indebted to my esteemed advisors for their constant support during some difficult times in my life. This dissertation would not have been possible without the extensive support of my family and in particular my mother. Her unfailing optimism, energy and love have given me great support.

The Centre for Policy Modelling is a wonderful and a 'fairly chaotic' place that has become my family for the time being of the research. Looking back, I am surprised and at the same time very grateful for all support I have received throughout these years. The Centre for Policy Modelling has certainly shaped me as a person and has led me where I am now. For this I am thankful to (in alphabetical order) Armando Geller, Bruce Edmonds, Chris Catlin, Emma Norling, Luis Isquierdo, Pablo Lucas dos Anjos, Richard Taylor, Rodolfo Sousa, Ruth Meyer and Scott Moss, Shah Jamal Alam.

Finally, thanks are also due to the members of the company who participated in the research, giving freely their time and energies to the project. For reasons of confidentiality they cannot be named however, their input is highly appreciated. Last but not the least I am grateful to the European Commission for funding my PhD studentship for three years through the FP6 Project CAVES.

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List of Abbreviations

ABM	Agent-Based Modelling
ABSS	Agent Based Social Simulation
ACE	Agent Based Computational Economics
C2V	Client-to-Vendor Network
CPM	Centre For Policy Modelling
EBO Model	Evidence-Based Outsourcing Model
FSU	Firm Skill Universe
IT	Information Technology
KPI	Key Performance Indicators
M&A	Mergers and Acquisitions
MAS	Multi-Agent System
PCS	Product Characteristics Space
RfI	Request for Information
RfP	Request for Proposals
SD	System Dynamics
SLA	Service Level Agreements
SR	Service Request
TCT	Transaction Cost Theory
TCT Model	Transaction Cost Theory Model
V2V	Vendor-to-Vendor Network

1 Introduction

"Failing occasionally is, maybe, unavoidable and nearly acceptable."
CIO of a mid-sized Ukrainian bank

"*How often has a vendor told you they would exceed your expectations and if so, how often did it happen?*" This was an introductory question during the first interviews of the field work. A sarcastic smile was mostly the answer to the question.

According to the recent report by the Boston Consulting Group (BCG, 2005), relatively few European banks have benefited from *Information Technology* (henceforth IT) outsourcing – obtaining IT services from external company – to the extent originally anticipated by these institutions. Despite the experienced setbacks, most intended to increase outsourcing activities in pursuit of reduced labour costs, specialized skills, process expertise, superior technical resources, and increased ability to focus on core business (BCG, 2005). Thus the reasons enlisted were multifaceted. This statement echoes the current tendencies in the financial industry precisely.

Taking into account the *status quo* above the overarching vision of this thesis is to contribute to the development of research methods for understanding uncertainty in IT Outsourcing projects – in particular those that arise from social interactions, or within organizational contexts of financial institutions. In particular this vision entails following aims:

- Understanding of the decision making process in the context of IT Outsourcing.
- Analysis of the decision making foundations from both theoretic and practitioners' perspective.
- Analysis of key metrics deployed in the process of decision making and uncovering of potential flaws and weaknesses.

In order to achieve the aims set out for the thesis a set of objectives have been defined:

- Precision of loose theoretic constructs – use of *Agent-Based Social Simulation* (henceforth ABSS) to devise precise statements about theoretic constructs from *Transaction Cost Theory* (henceforth TCT).

- Elaboration of research methods – combination of ABSS and empirical research in an iterative manner with elements of rapid prototyping. This approach allows for supplementing of statistical data with qualitatively expressed evidence.
- Tools for assistance of policy makers – development of an agent-based model that refrains from probabilistic elements or theoretic specifications but grounds on qualitative evidence.

Finally, this thesis contributed to the following three areas:

Theory

- A new approach to characterising asset specificity[1], a construct vital to TCT, is presented. That approach grounds on and relates better to how practitioners make decisions as to IT outsourcing and avoids the issue of subjective valuation that is inherent to the term of asset specificity within TCT.
- It was discovered that asset specificity is not central for dependency issues between buyer and vendor. Low asset specificity not being an indicator of fewer dependencies points to difficulties in the use of specificity measures within TCT for predicting dependency issues and hence predicting whether IT outsourcing might be straightforward.

Research method

- It is shown how rapid prototyping of agent-based "mock-up" models can greatly improve the elicitation of evidence and the level of realism of final models in the corresponding domain.
- A method to facilitate stakeholders' participation in all stages of modelling (data collection, design, programming and validation) is presented.

[1] The notion of asset specificity is particularised in section 2.2.2. Here a short explanation is provided since asset specificity represents one of the central objectives of the models presented in this thesis. In simple terms, it can be assumed that an asset is classified to be specific if there is no alternative use or demand for a given asset outside of the relationship. Thus the asset is required for the particular transaction it is used in and is worthless in any other transaction.
In TCT, as developed by Williamson (1975), the central notion is given to transaction specificity of assets in combination with opportunism and bounded rationality. If there are assets which are specific to the particular transaction – i.e. have no or substantially limited use outside given transaction – this will cause dependence between transaction partners which yields transaction costs if there is a risk of opportunism (the situation is described under assumed conditions where rationality is bounded). In such a case, primarily, Williamson assumes symmetric dependence (Nooteboom, 1993b). Thus if a producer uses assets that are specific to the transaction he will obtain a unique, or at least differentiated product, but then the discontinuity of the transaction will be a problem, not only for the producer but also for the customer. It is assumed that the customer will not find an alternative supplier of an equivalent product immediately and therefore will suffer discontinuity and higher costs of production.

Tools

- The first tool that allows practitioners to explore possible decision rules and outcomes regarding IT outsourcing domain is described, along with an evaluation of its effectiveness.

Section 1.1 introduces the background of the case study while section 1.2 presents the aims and objectives of the presented research. Section 1.3 discusses the key contributions of this research. Finally, in section 1.4 an outline of the structure and roadmap of this thesis is presented.

1.1 Background

Despite not being a new tool on the market, outsourcing still poses some challenges as a large number of IT outsourcing projects fail. According to Kern and Willcocks (2002), one-third of outsourcing ventures fail. These findings are supported by the recent survey conducted by Ventoro[2] among 5.200 IT professionals across the Europe, UK, US and Canada – 36% of interviewees claimed their outsourcing ventures failed (McCue, 2004).

As studies show, the companies that are extremely successful over a substantial period of time are characterised by the ability to carry out radical strategic changes without imperilling the operational effectiveness (Moeller, 2005). The question of what services and functions a company should produce in-house versus what it should acquire from third party vendors is at the heart of this process. The technical revolution of the 1990s altered the competitive landscape for financial services companies (cf. section 2.1.1). IT plays an increasingly important role in the banking area and, despite constant improvement in IT, banks still incur immense expenditures in this sector. Another study by Boston Consulting Group (BCG, 2003) showed that IT costs reached an all-time high from 2001 to 2002 and that about 10% of a typical bank's total revenues are spent on IT.

The competition between outsourcing market players is incredibly fierce, particularly around the bulge bracket (largest) banks. Many European banks are facing a critical challenge to their future competitiveness and profitability due to their current IT situation. Their core banking IT systems, having typically been developed and maintained in-house over many decades, are highly customized to the needs of the particular institution. They are built using proprietary technologies that are now becoming obsolete,

[2] The Ventoro Institute is an independent think tank focused on labour and economic development (http://www.ventoro.com/).

are performing poorly and abuse available resources. The continual patching of these legacy systems and their costly maintenance are the consequences. Despite the exigent need of renewing the IT structure many enterprises are reluctant to do so. As the most recent benchmarking study by Boston Consulting Group outlines, their hesitation generally stems from a desire (based on their past experience with failed big IT renewal projects) to avoid risks (BCG, 2006).

The industry is well aware of this process and of the threats that result from it. Despite the existence of many analytic projects and case studies carried out to find reasons for the frequent failure of IT projects, the answers delivered didn't prevent subsequent disasters. It may be indicated that an alternative approach of investigation – a new angle of looking at things – can bring some new insights into the process of ongoing failures or provide suggestions for underlying root causes. As mentioned above majority of failures is occurring due to complexity which, for reasons discussed elsewhere (cf. section 3.2.1), requires a bottom-up approach for its investigation. In order to understand the macro-level behaviour of these systems it may be necessary to investigate their micro-level behaviour first. A very small event can trigger a cascade of larger events and mushroom out of control. Activities on the micro level can lead to the emergence of patterns on a level which would be hard to predict even if the interactions of the parts are completely known, thus bringing uncertainty into the game (Bak *et al.*, 1987; Bak, 1997; Downing *et al.*, 2000; Moss and Kuznetsova, 1996; Moss, 2001a, 2001b, 2002; Moss *et al.*, 2000a; Moss and Edmonds, 2005; Nagel *et al.*, 2000; Lux, 1998; Lux and Marchesi, 1999).

Nowadays, individuals in business organizations are highly interconnected, thanks, in part, to IT and communication technologies. Furthermore, this interconnectivity doesn't stop with the boundaries of an organization – many work flows and processes involve collaboration with other businesses, for example, outsourcing and offshoring. Today's businesses are becoming more interconnected and complex in their structure (Bonabeau, 2002a, 2002b). As the number of interactions among them increase, so does the possibility of complexity in the sense of emergent phenomena entailing uncertainty.

1.1.1 Panacea or Disease

Outsourcing is sometimes portrayed by media as panacea – the solution to all these IT difficulties that hold an organisation back from achieving its business goals – and at the

same time as an axis of evil – dispatching jobs from the home market overseas and rising an unemployment rate. Thus the both ends of the spectrum are highly polarised.

The headlines of the financial newspapers in summer 2007 were dominated by the turmoil of the credit markets. Reasons for this were, *inter alia*, the unexpected rise in US subprime mortgage delinquencies, the resulting surprisingly big losses reported by banks and eventually the sharp shortage in liquidity. The aftershock phase is now characterized by deep recession. The course of these events did not help the banking sector to establish a reputation for having reliable risk management systems. As a result of the credit crunch new regulations like Stress Tests[3], Basel II[4] and Basel III[5] have been imposed upon financial institutions. The realisations of new regulatory frameworks are monitored by accountancy firms. This "under the hood" inspection of banking risk systems entails an audit of the whole IT landscape. Such audits bring to light devastating pictures of the aftermath of nearly twenty years of IT optimisation trough outsourcing.

The interviewed officer from a big four audit company reflects: "*The effects of the subprime crisis on our business are better than one would have assumed originally. Since banks depend on us to audit their risk management systems we are not short of mandates. The IT landscapes we discover are really 'adventurous'. During the whole outsourcing hype of the early 90s banks lost many qualified IT personnel and are lacking crucial knowhow now.* (...) *Many systems can only be maintained, not to mentioned customised or enhanced, since they* (systems) *either have been developed by people, who have been outsourced, or by external vendors, who are not contracted anymore.* (...) *It is alarming, however, that the bigger is the institution, the messier and thus more fragile is the IT landscape.*" This is by far, not an exclusive opinion and has been attested on multiple occasions in interviews with employees from other accountancy firms.

The strategic importance of IT in the banking sector is commonly accepted (BCG, 2006; OECD, 1992), yet banks still continue to outsource parts of their information services and some even outsource them entirely (Ang and Detmar, 2002). A recent report in the

[3] Stress Test for the bank shall reveal the bank's financial strength and show how it can withstand times of economy that may be worse than presently anticipated.

[4] Basel II is the second of the Basel Accords published on June 2004. Basel Accords represent a set of recommendations on banking laws and regulations issued by the Basel Committee on Banking Supervision.

[5] Basel III is the third of the Basel Accords on global regulatory standards on bank liquidity issues by the Basel Committee on Banking Supervision. Basel III was set up as a response to the insufficient and faulty financial regulation revealed by the credit crunch of 2008.

annual series of Boston Consulting Group's benchmarking publications stipulates that only relatively few European banks have benefited from IT outsourcing to the extent they anticipated. Nonetheless, neither admitted to cut back on outsourcing efforts (BCG, 2005). This statement echoes the current tendencies in the financial industry precisely – the number of outsourcing deals increases (Gartner, 2009; Forrester, 2010) while almost more than half of these deals fail (McCue, 2004; Deloitte, 2005). Table D-3 from Appendix D provides an index of statistical material regarding outsourcing from 2003 to 2010 which echoes the aforesaid.

At first glance, this outsourcing trend seems to be somewhat counterintuitive with the postulates of the classical theory of the firm where organizations are supposed to have a constant aspiration to autonomy. Thus organizations strive to take as many essential business activities under their wing as possible in order to maintain relative independence (Gouldner, 1959). On the other hand, the rapid economic growth of the late 1990s and the sudden crash of the early 2000s reinforced the wave of re-engineering issues in many corporations in order to survive in the face of volatile competition. During the downturn, outsourcing leaped to the fore as a cost-saving quick fix when budgets were squeezed. The widespread acceptance of the concept of core competency cultivated by Prahalad (Prahalad and Hammel, 1990) and Hamel (Hamel and Champy, 1993) led to a decade of re-engineering and downsizing. One theory which ties up with this stream in the IT outsourcing research is the TCT (Hirschheim and Dibbern, 2002).

1.1.2 Limits of Intuition

With respect to IT processes the uncertainty arising from social interactions affects financial organization. An ultimate response of senior managers to such uncertainty is intuition in the sense of decisions based upon their past experience (Bonabeau, 2003) and judgement. If, however, the business landscape is not stationary, the past might not be a good predictor of the future. Human intuition, which arguably has been shaped by biological evolution, might be reaching its limits in a world where dynamics are getting rapidly more complex (*ibid*). Moreover, Ormerod (2010) argues that institutions operate in such a complex environment that they are unable to learn sufficient from the past in order to obviate the same mistakes in future.

Uncertainty is pervasive in economic phenomena, and must be faced continually by policy-makers and analysts. Poor quality of data, econometric errors in estimation,

unpredictable shocks hitting the economy and social interactions are among many different factors causing uncertainty within an outsourcing context of financial institutions. A human organization is often subject to different kinds of risk in the sense of Knight (Knight, 1921). Knight used the term risk to describe decision situations where agents can be assumed to act as if they have in mind well-defined probabilities on possible outcomes and *uncertainty* for situations where they do not[6]. Following this distinction, uncertainty arises from the impossibility of an exhaustive classification of cases considered in decision making. Furthermore, Knight argues that most business decisions are made in conditions of uncertainty and that this uncertainty is responsible for the profit of an enterprise. This distinction has been used by neoclassical economists to rule out consideration of uncertainty as it is incompatible with the assumption of consistent choice and so does not fit into the modern theory of choice (LeRoy and Singell, 1987). Furthermore, according to Ormerod (2010) most of practical situations are closer to the paradigm of uncertainty rather than that of risk since the sample size and/or knowledge necessary to estimate probabilities are simply not given.

Nonetheless, the *status quo* is that the conventional apparatus of economics provides a feasible approach to risk and risk only, since under conditions of uncertainty results often do not have finite variance distribution (which are essential for risk-based approaches). Thus, uncertainty remains an open question. Conventional techniques eliminate uncertainty by neglecting social interactions thus losing the connection between the volatile behaviour on the macro-level and the social interactions on the micro-level. The current economic apparatus cannot provide any instruments to address issues of uncertainty and risk in the context of outsourcing projects (cf. section 2.2). In his analysis of the recent economic crises Ormerod (*ibid*) argues that economics in general provide a view of the world in which situations involving risks are systematically underestimated and situations involving uncertainty are not recognised. A similar assertion was made in the full swing of credit crunch by Udo Steffens, the chairman and president of the Frankfurt School of Finance and Management, suggesting that the misery of the financial sector originates from the fact that the involved institutions simply did not have enough experience in order to assess the real risks (Mohr, 2008).

[6] Knight's distinction between risk and uncertainty has entered the jargon of economist and decision theory. At the same time Knight's definition gave birth to probably as many interpretations of it as scholars who have sought to interpret it. In this thesis the most common definition with respect to objective and subjective probabilities is referred. See Knight (1921) for further references.

1.1.3 Change in the Attitude

The term Outsourcing 2.0[7] originally suggested by Dany Ertel, the founder of the Outsourcing Institute[8], has been coined by many authors and represents therefore an abundance of trends. Nonetheless the trend is clearly visible – relationship management wins on weight. The way outsourcing is done has changed dramatically since the landmark IT outsourcing contract signed by Eastman Kodak in 1989 (cf. section 2.1.1). That deal launched the so called Outsourcing 1.0 with long term mega-deals. The artefact of that era of outsourcing is the missing criticality of managing an outsourcing relationship. After a deal was closed an attention to the outsourcing contract slowly ceased. It was thought that the safeguarding contracts solicited by droves of highly skilled lawyers will do their job. Today the longstanding practice of Outsourcing 1.0 causes much dissatisfaction and frustration associated with the current *status quo*. The urgent need for change naturally moves the market to the tipping point to take the hurdle of launching the Outsourcing 2.0 era.

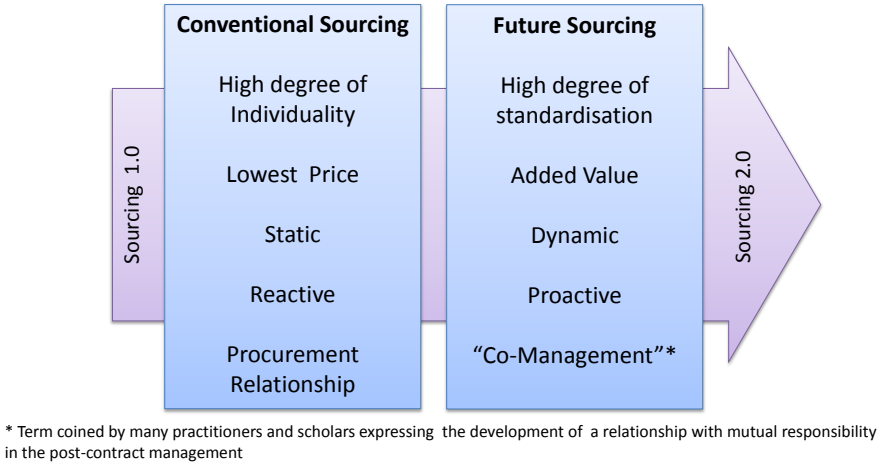

Figure 1.1-1: Transition from Outsourcing 1.0 to Outsourcing 2.0.

Outsourcing 2.0 is strongly affected by the attention paid to the relationship management of the parties involved in the contractual dyad and the new notion of multisourcing[9]. It is arguable that both characteristics of the new outsourcing era – relationship management

[7] A term coined by Dany Ertel that betokens a new era of outsourcing where relationship management plays a pivotal role (Casale, 2009).

[8] The Outsourcing Institute is an independent association dedicated to topics of and around outsourcing (www.outsourcing.com).

[9] A term coined by Linda Cohen in her book (Cohen and Young, 2005) that denotes blending and provisioning of IT and business services from an optimal set of vendor to achieve business goals. Multisourcing also treats IT in a more fine-grained way rather than conventional outsourcing paradigm. IT is seen as a portfolio of services and activities some of which should be outsourced to external vendors and others shall remain in-house.

and multisourcing – go hand in hand and influence each other strongly. Figure 1.1-1 juxtaposes both practices, that of Outsourcing 1.0 and of Outsourcing 2.0.

The above mentioned trend echoes through all layers of outsourcing research – from academics to practitioners. The theme for the 14th edition of the Summit IAOP[10] reads as follows "*Embracing Change – How Outsourcing Professionals Can Lead their Companies to Success in this New Outsourcing Landscape.*" Over the last decade, the outsourcing industry has changed the way outsourcing deals are conducted. Companies have found that outsourcing has shifted from a management option to a management necessity. With this, customer companies are looking at further expanding their future outsourcing programs across more divisions. The 2011 Outsourcing World Summit aims at delving into issues critical to today's professionals and companies. Below some relevant sessions from the 2011 Outsourcing World Summit[11] are introduced in abridged form:

- The New Outsourcing Landscape

  Both the recent turbulent climate and the continued evolution of outsourcing have contributed to the development of helpful new tools, technologies and innovative ways of thinking about outsourcing. Sessions in this track will examine specific customer implementations within various industries and functions, as well as in an ever-expanding number of locations around the globe.
- Special Topics

  This track will address topics that IAOP membership and the outsourcing community regard with high topicality. The examination of the ever-growing concern over multi-vendor management has been chosen as a leading theme of that track and mirrors the sentiment of the outsourcing market.

The collage of topics from the Outsourcing World Summit illustrates that outsourcing is not seen as a pure cost cutting tool any more, it become more an instrument to improve performance. An advert of a multinational offshore company in the recent Issue of "Globalization Today"[12] (IAOP, 2010) supports the statement above. Despite the cost

[10] IAOP (International Association of Outsourcing Professionals) is the global, standard-setting organization for the outsourcing profession. IAOP is the leading professional association for organizations and individuals involved in transforming the world of business through outsourcing, offshoring, and shared services.
[11] (http://www.outsourcingprofessional.org/content/23/154/1099/)
[12] Official Magazine of the international Association of Outsourcing Professionals (www.globalizationtoday.com)

reduction being the first bullet point the majority of the advertisement is devoted to marketing of performance and business performance.

> *Need to improve operational performance? Talk to a business process outsourcing service provider with a strong track record for delivery.*
> ***50% reduction** in operational costs for a major financial services company*
> ***80% reduction** in customer complaints for a leading energy company*
> ***40% savings** in finance and administration for a global insurance company*
> ***60% reduction** in customer complaints for a major airline*
> ***50% increase** in offline telesales for a major travel company*
> ***50% savings** on credit card fraud for a major travel agency*
> *With over 21,000 employees located in 21 delivery centers around the world, WNS extends the enterprise of over 200 organizations by improving their business performance.*

Unfortunately this change in the attitude did not trickle down to the theoretical frameworks used by scholars and practitioners. As shown in the literature review (cf. section 2.1) the predominance of the neo-classical economic theories that are deployed to account for outsourcing decisions is being slowly established or, as some opponents of these theories would argue, has already been established. These theories cannot encompass the rich social context in which outsourcing is taking place. The author argues that the shift to Outsourcing 2.0 has already happened in the practitioners' world but has not yet been recognised in the academic literature. In the following, the research aims and objectives of the study with regard to the issues above are discussed.

1.2 Research Aims and Objectives of the Study

The recent credit crunch revealed a dramatic example of inadequacies of conventional economics in terms of incorrect risk assessment, unrealistic theoretic assumptions and disregard of interconnectedness of modern economic systems (Squazzoni, 2010; Ormerod, 2010). Considering the complex environments firms operate the necessity to model economic processes and theories used for decision making in the practise becomes eminent. In such environments, the understanding of the interaction between micro and macro processes becomes pivotal as the example of Société Générale makes evident. Who, from the involved bank staff, could have thought that a single trader could produce such extensive damage without being discovered by the technology systems, which have checks and balances built in? The French bank made a loss of £3.6bn (Handelsbaltt, 2008) following unauthorised activity of a swindler trader who managed to cover up fraudulent activity as a result of his understanding of the bank's fraud control systems. He risked billions by betting on future trends in the stock market. The failure to detect fraudulent

activity from an employee on this scale emphasizes the need for banks to constantly monitor and upgrade their fraud systems. History is, however, being repeated. In February of 1995, one man single-handedly bankrupted the bank that financed, *inter alia*, the Napoleonic Wars, and was Queen Elizabeth's personal bank – Barings bank (Bonabeau, 2002b). These incidents make the usefulness of agent-based bottom-up approach in economic theory eminent.

1.2.1 Motivation

IT outsourcing has been a topic of academic research for the last fifteen years. Despite the lack of commonly accepted experience of outsourcing outcomes, the practice of outsourcing in modern corporations is proliferating. This trend led both practitioners and academics to theorize and speculate on the underlying momentum towards outsourcing. A review of available academic and practitioners' literature brought forward the following three stances that the motivation of the thesis at hand is based on:

- *Undersocialised view*

  Past research on IT outsourcing has mainly focused on the transaction itself, without investigating the strategic characteristics of the organization not to mention a built-in social framework of the firm or social context a firm is located in. This subordinated notion of social components captures the widely held perception that organisational members make outsourcing decisions based entirely upon an economic rationale and regard social factors as negligible in their influence on the overall picture of outsourcing. Therefore, a dominant strand of research on IT outsourcing has used the TCT (Williamson, 1975) to investigate make-or-buy decisions (cf. section 2.2).

- *Lack of precision in theoretic terms*

  In spite of the fact that TCT suffers from being widely criticized for some ambiguities in the terms used, mainstream IT outsourcing research adopted the theory (Lacity and Willcocks, 1995; Ghoshal and Moran, 1996). Dissatisfaction with different measures, dimensions or metrics used in TCT or for its evaluation is not new to outsourcing research (Aubert and Weber, 2001; Aubert and Croteau, 2005). One of such bones of contention is the notion of asset specificity which is central to the whole concept of the transaction-cost-based framework. It is rather crucial for TCT, to understand what is meant by asset specificity to make a credible statement whether the given theory accounts for empirical evidence or not. In many papers asset specificity is used only as guidance without quantifying it. Scholars are talking about "commodisation" of IT

outsourcing and suggest that asset specificity is the way out but admit at the same time that there is a measurement issue present (cf. section 2.2.3.1).

- *Silo view of the outsourcing landscape*

  This point follows from a general inadequacy of conventional economic models with absence of nonlinear interactions (Squazzoni, 2010). Apart from other controversial assumptions in economic models like rational agents and rational expectations (*ibid*; Ormerod, 2010) the neglect of relevance of interaction in a densely linked outsourcing network represents a crucial flaw. In the face of the 2008 credit crunch the potential of cascading shocks due to interconnectedness of the market entities is constantly gaining on topicality in practitioners' circles. In his LSE lecture (Vinkram, 2009) with a title "The Future of Banking in a Global Economy" Vinkram Pandit, CEO of Citi, warns about an encapsulated view on the economic system that undermines risks arising from great interconnectivity of system's entities. George Soros, a famous investor and philanthropist, noted in his MIT lecture titled "The New Paradigm for Financial Markets" (Soros, 2008) that an isolated consideration of market entities is wrong and that more attention has to be paid to the interplay of market components. Both statements make clear that the current economic approach does not take sufficiently into account the interconnectedness of the economic system. This is even more a problem in the new era of multisourcing where players of the market are highly interconnected through the dense network of contractual relationships.

1.2.2 Aims

The aforementioned stances led to the formulation of the overarching vision for this thesis, that is, to contribute to the development of research methods for understanding uncertainty in IT Outsourcing projects – in particular those that arise from social interactions, or within organizational contexts of financial institutions. This main idea can be broken down into further three fragments:

- *Understanding of the decision making process in the context of IT Outsourcing.*

  There are many factors that play pivotal role in the process of outsourcing and have to be taken into account prior to any actions. The interference and interaction of these factors with each other is obscured as they are frequently examined in an isolated manner. Thus, in order to make credible assumptions all factors flowing into decision making process of outsourcing issues have to be considered jointly.

- *Analysis of the decision making foundations from both theoretic and practitioners' perspective.*

  It is not a secret that the trickle-down-effect also applies for academic frameworks and theories that eventually trickle down to practitioners' level and land in their portfolio of functional instruments. However, these theories are sometimes blindly adopted without deep understanding of concepts deployed by these theories. Therefore, in the context of Outsourcing, both decision foundations, that of practitioners and academics, have to be examined.

- *Analysis of key metrics deployed in the process of decision making and uncovering of potential flaws and weaknesses.*

  The aforementioned blind adaption of dominant economic theories by practitioners entails operationalization of theoretic constructs. Sometimes, these constructs are already ill defined by theory itself. The customisation of the term for the operational level of practitioners only adds to the already existent distortion of the concept.

Sections 1.2.3.1, 1.2.3.2 and 1.2.3.3 introduce objectives that will support the achievement of the aforementioned aims of the research.

1.2.3 Objectives

The thesis at hand comprehends the following three objectives:

- *Precision of loose theoretic constructs*

  Use of agent-based social simulation to devise precise statements about theoretic constructs from TCT.

- *Elaboration of research methods*

  Combination of ABSS and empirical research in an iterative manner with elements of rapid prototyping. This approach allows for supplementing of statistical data with qualitatively expressed evidence.

- *Tools for assistance of policy makers*

  Development of an agent-based model that refrains from probabilistic elements or theoretic specifications but grounds on qualitative evidence.

1.2.3.1 *Objective I – Precision of Theory*

This thesis introduces a novel approach for the investigation of various theories used to account for make-or-buy decisions. The approach is ABSS in which heterogeneous software agents represent actors in the outsourcing process (cf. section 3.2). This

approach is contrary to a widely held perception of econometric standard literature with its assumption of homogeneous actors[13]. Both models (cf. chapter 5 and 6) presented in this thesis represent an attempt to assign to asset specificity a tangible value and act according to TCT dogmas. It was hoped to find out whether it is possible to define an *objective* measurement of asset specificity. The developed models demonstrate that any such measure is necessarily subjective. It is not intended to claim that asset specificity represents an insufficient condition for dependence. However, it is intended to claim that asset specificity in not central for the notion of dependency arising in the dyad of an outsourcing relationship. This would undermine existing claims of TCT literature that gives asset specificity the cardinal emphasis with regard to potential dependency issues.

Organizations are inherently complex – they are their own brand of society (Chang and Harrington, 2006). As complex systems are often counterintuitive, reliance upon intuition is unwise (Bonabeau, 2003). The distinctive property of organizations is that the active elements are human beings as *social* individuals (Dietz, 2006). This matches the structure of ABSS. An ABSS approach views an organization as a complex adaptive system with a collection of agents that interact with one another and produce some output. Hence it allows modelling the emergent collective behaviour of an organization or of a part of an organization in a certain context at certain level of description. Scientists, therefore, can study the micro processes that are responsible for macro outcomes, as well as reciprocal effects between both (Squazzoni, 2010).

1.2.3.2 *Objective II – Elaboration of Research Methods*

As was mentioned in the introduction of this chapter the purpose of this thesis is to contribute to the development of research methods for understanding uncertainty in IT projects. So far, the kind of understanding needed cannot be drawn from the rich sources of management sciences because of its narrow functional orientation and its concentration upon static organizational structures (Dietz, 2006). According to Dietz (*ibid*) the two fundamental questions in this context that need to be answered are: *How to discover this knowledge concerning the construction and the operation of an organization?* and *How to extract it from the observable surface structures that tend to obscure this?*

[13] Econometrics uses heterogeneous agents but fixed preferences whereas ABSS uses heterogeneous agents and changing preferences over time.

As population densities and the number of interactions among people increase, so does the likelihood of emergent phenomena. Furthermore, some businesses are becoming much more interconnected and complicated. The outsourcing context contains important sources of complexity such as heterogeneity and interdependencies which are difficult to explore with usual statistical apparatus (Ormerod, 2010; Squazzoni, 2010). Modelling the agents as individuals helps to capture the heterogeneity of the real world, which TCT fails to encompass. A model that explicitly represents situations of uncertainty and endows individual agents with cognitive and social characteristics of real world actors would therefore achieve a closer ontological correspondence between the model and the real world system that is modelled rather than one where these characteristics are disregarded (*ibid*).

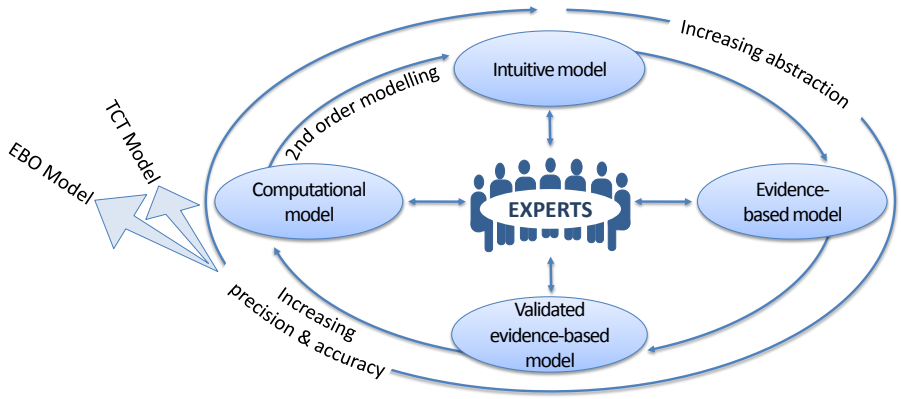

Figure 1.2-1: Iterative development of the model (in style of Geller and Moss (2007)).

The method suggested in this research is the combination of agent-based social simulation and empirical research with iterative elements (cf. section 3.4). Figure 1.2-1 captures the iterative process of model development involving stakeholders at all stages – data collection, design, implementation and validation. Figure 1.2-1 also suggests that it would be beneficial and more appropriate to use ABSS in conjunction with a case study approach. This would mitigate scarce data samples and reduce assumptions that have to be made otherwise without the possibility of falling back on the well-studied field. That is, the theoretic and statistical (or other numerical) data can be supplemented with qualitatively expressed evidence. Furthermore, the thesis shall demonstrate that a declarative[14] (rule-based) capturing of stakeholders' input fosters a tighter link between the simulation, simulation results and practitioners (cf. section 3.4).

[14] In this thesis the term declarative is used in a slightly non-standard way, namely meaning a rule-based structure for information processing and storage. This usage of the term was established and extensively

1.2.3.3 *Objective III – Tools for Policy Makers*

By way of model illustration, the author aims to look at some of the key problems and issues experienced in outsourcing initiatives. Furthermore, in order to make the work valuable for practitioners, steps have to be suggested, that need to be taken to counter the risks posed by aforementioned difficulties. Especially in social context, frequently the intangible benefits and cost are clearly predominant. In order to increase the tangibility it is necessary to understand why the biggest part of population or a single agent is doing something – this is the most desirable bit of information. Only if one is able to understand why people take certain decisions under certain circumstances will one be able to grasp the effect of uncertainty on their actions.

Modelling techniques used to investigate issues of uncertainty[15] should be cautious while deploying probabilistic elements. As was mentioned in section 1.1.2, most of practical situations are closer to the Knight's paradigm of uncertainty that renders probability an inadequate basis for decision making. Further many decisions are taken on impulse, without consideration of the possible outcomes of actions (Edwards, 1962; Fellner, 1961; Krantz *et al*., 1971; Tversky, 1967; Tversky and Kahnemann, 1974; Williams, 1966).

Furthermore probability is used as a way of summarizing the observed evidence based upon a population. Probability always assumes some knowledge about secondary information which, in turn, is not always available – estimation of the probability requires exhaustive classification of cases. Aggregate patterns provided by probability calculus will indicate which part of population is doing something but not *why* it is doing it. The thesis attempts to demonstrate that ABSS coupled with extensive evidence from fieldwork is able to answer the why question and provide a useful tool for support of practitioners in the process of policy making.

1.3 Contributions of the Study

The contributions of the study at hand have been briefly introduced at the beginning of this chapter. These can be grouped into three distinct areas with regard to the field of relevance – *economic theory*, *research methods* and *tools*. Following chapters deal with each contribution field separately.

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used at the Centre For Policy Modelling, Manchester Metropolitan University. The definition of the term is provided in section 3.2.4.

[15] Here the term uncertainty is referred to in Knight's view – for situation where it is not possible to calculate probabilities. See Knight (1921) for further references.

1.3.1 Economic Theory

The IT outsourcing has mainly focused on the transaction itself with the use of the TCT as a primary investigation framework. The notion of asset specificity was blindly accepted in its primary definition, which embodies a bone of contention for many academics due to its looseness of definition. In management literature asset specificity is used as guidance without quantifying it. Scholars are talking about "commodisation" of the IT outsourcing and suggest that asset specificity is the way out but admit at the same time that there is a measurement issue present. The *Transaction Cost Theory Model* (henceforth TCT Model) reported in this thesis was used to investigate a particular issue of the TCT concerning the formalization of the term asset specificity. The TCT Model as well as the *Evidence-Based Outsourcing Model* (henceforth EBO Model), both succeeded in an attempt to assign to asset specificity a measurable, so called tangible, value. The models introduced an alternative measure of asset specificity which is not based on the numerical value but has a qualitative character.

The TCT Model replicates agents' cognition in terms of pure selfishness. The main idea was to develop a model which reproduces the behaviour of individuals inspired by TCT and abstract from any thoughts of social components that might matter in the target system. After such a model was validated against outcomes expected by TCT, it was validated against social evidence. While the results were in line with the TCT literature, they diverged significantly from the experience of practitioner-informants. The resulting distribution of economic activity across different organizational forms emerges bottom-up from processes of interaction between agents and their adaptation of future decisions according to agents' past experience. However, the theory grounded model failed to capture all necessary facets of the social context.

It needs to be emphasized that this research does not make the concept of asset specificity illegitimate. While it is a useful concept, it lacks the exactness of definition needed for its proper instrumentalisation. For this kind of problem, the proposed method becomes more convincing and attractive by demonstrating its concrete advantages in comparison with other existing methods, which is the purpose and achievement of the TCT Model. The EBO Model went beyond characterising asset specificity in non-subjective way and showed that asset specificity is not central for the notion of dependence between buyer and provider of services. This fact clearly shows that asset specificity

cannot be used as a sole indicator for dependency issues as is conveyed by TCT literature. However, it has also to be mentioned that it is not claimed to view asset specificity is an insufficient condition for dependence. The simulation results exhibit patterns of dependence in cases of asset specific transactions as well as in cases of less specific assets.

1.3.2 Research Methods

Agent-based modelling provides researchers with a tool for examining the implications of various social and organisational choices within organisations. This thesis examined how this can be done in the case of choosing to outsource (or not) the information technology needs within large banking organisations. Based upon survey data collected from a number of banking organisations a prototype model has been developed which provided some initial findings, but more importantly, has been used to identify the gaps in the available desk research data that needed to be filled in order to develop more informative models. This particular case study is presented to demonstrate an approach that can be used to examine different aspects of organisational change more generally. The explanatory accounts about the system were provided.

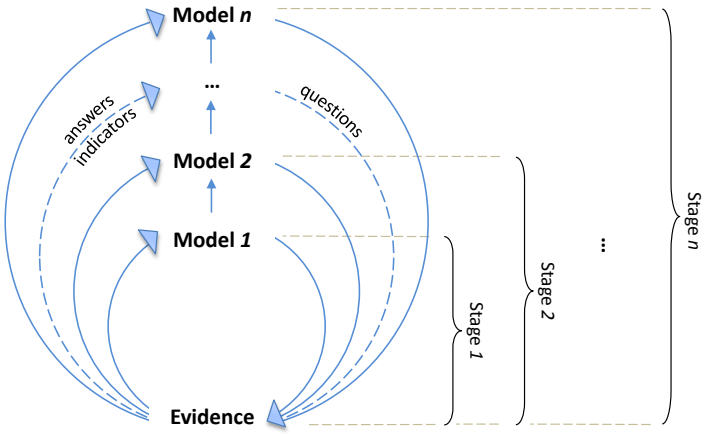


Figure 1.3-1: Multi-stage development process of the model.

The author suggests that an iterative approach to modelling is essential when modelling complex organisational or social structures. This suggested approach is put at test by the thesis. The process that is presented in this thesis is a multi-stage modelling and analysis process, with the development of the prototype and the analysis of its results feeding into the data collection for the development of the subsequent models on the way towards the final model. Figure 1.3-1 schematises the multi-stage development process of the final model with *n* modelling stages. Each development stage consists of several loops,

where the questions produced on grounds of a concrete model are consulted against available evidence.

In practice, the subsequent stage of data collection may still fail to capture all the relevant information, and this may necessitate further data collection and refinement of the model which adds an iterative flavour to the whole process. Not being able to capture the full extent of relevant information is an unavoidable complication when modelling such systems – because they are not fully understood, building a model is difficult. During the development of the model, the limitations of existing data force the modeller to make assumptions, and these assumptions must be noted and addressed during the subsequent development.

Furthermore the chosen combination of evidence based simulation with declarative components proved to be a holistically helpful tool in the process of model development and elaborated the participatory approach. The aforementioned paradigm offered good support in every stage of the methodological process of developing a simulation as proposed by Edmonds in (Edmonds, 2010; Norling *et al.*, 2011).

1.3.3 Tools

Every outsourcing initiative carries a number of risks (cf. section 2.1.4) that need to be identified, their severity and likelihood recognized, and countermeasures put in place and monitored. Many organisations find that concluding an outsourcing deal increasingly becomes a strategic task instead of a procurement exercise. Selecting the right[16] vendor, setting up an appropriate contract bears more strategic thinking than it is assumed by majority of inexperienced "outsourcers". Therefore, if some promising contractual relationship controls have to be set up, the outsourcing process cannot be rushed and policies have to be thoroughly investigated. However, today's abundance of the practitioners' management literature dealing with outsourcing issues pays much attention to best practices on the operational level overlooking the strategic issues on the very same level. Table D-4 in Appendix D represents an assemblage of publications from 248 computing business magazines like Silicon.com, CIO, CFO, eWeek, ZDNet, Wallstreet & Technology, to name a few, that discuss outsourcing since 2003. The analysis of these articles supports the aforementioned statement. Therefore, organisational learning based

[16] The best vendor might be the best of breed but still not the right one for the particular setting of a particular organization.

upon past experience is often non-existent leading to multiple and repeated failures. The EBO Model succeeded in incorporating practitioner's feedback and creating a tool that can be used as a test bed for strategic *what-if* scenarios.

IT outsourcing often has unexpected impacts, both positive and negative, on the operation of an organisation. The impact of outsourcing is, however, not the focus of this thesis. Instead, the focus is on the process of exploring organizational choices using agent-based modelling, using the case of outsourcing IT in the banking industry as an example. It was already mentioned in section 1.2.1 that current economic approach uses silo view of the industry and lacks a global reach of its evaluation tools. Only if a system is taken as a whole will one be able to understand the effects of local decisions and actions on the macro level. The developed models are concerned with IT services outsourcing relationships between clients in large scale financial institutions, i.e. banks, and vendors in the corresponding narrow market. The goal to better understand the influence of the social setting that banks are located in, on the outcomes of the outsourcing contracts is reached via qualitative examination of the micro-macro link provided by the model.

By capturing complexities in the multisourced society the EBO Model allows for "rewinding the time" and exploring different scenarios and policies. The EBO model succeeded in providing a different mind-set for further investigations. Potential tendencies on the outsourcing market can now be analysed on grounds of "concrete" models and not on practitioners' "gut feelings" like it was discovered in the fieldwork research. The feedback given by a subject matter expert during the presentation of results of the EBO Model summarizes the aforesaid: "(...) *actually some of it* (the results) *is pretty much obvious but we were so busy with the day-to-day business on the level of operation that we did not manage to zoom out and see the whole thing* (outsourcing market/system) *with a birds eye perspective.*"

1.4 Outline of the Thesis

As indicated in section 1.3, this thesis has three important strands in terms of contribution to knowledge. First, it contributes to the body of knowledge of economics by adding rigor and precision to economic theory. It introduces a new approach to characterise the term of asset specificity, a notion vital to TCT. The suggested approach avoids the issue of subjective valuation that is inherent to the term of asset specificity within the context of TCT. Furthermore, it contributes to precision of economic theory by

dismissing the centrality of asset specificity for dependency issue that arises between buyer and provider of services. As a result the inadequacies of TCT are clearly shown and an adequate alternative is demonstrated. Second, it contributes to research methods for understanding uncertainty in IT Outsourcing projects by showing the potentiality of rapid prototyping of agent-based "mock-up" models in greatly improving the elicitation of evidence and the level of realism of final models in the corresponding domain. Also a method to facilitate stakeholders' participation in all stages of modelling (data collection, design, programming and validation) is suggested. Third, it contributes to the body of knowledge of policymakers in the outsourcing field by introducing a first tool that allows practitioners to explore possible decision rules and outcomes regarding IT outsourcing domain. A hypothetic use of the tool is described, along with an evaluation of its effectiveness.

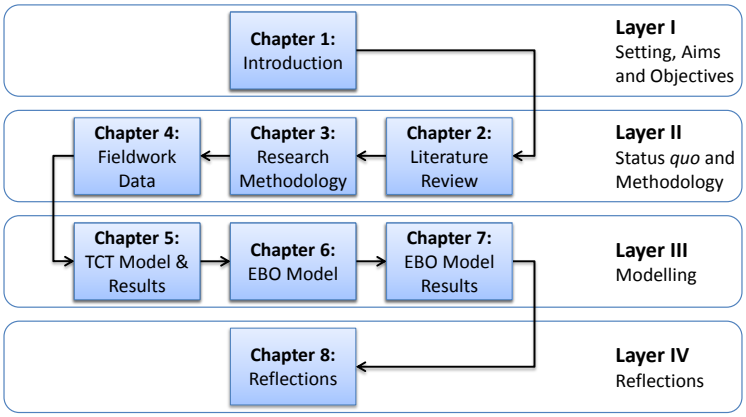


Figure 1.4-1: Thematic outline of the thesis and an optimal reading path.

Figure 1.4-1 represents the chapter sequence in this thesis. The architecture is rather sequential with thematic grouping of chapters. Thematically grouped chapters build four layers. Layer I and IV start the thesis with overview of objectives and finish with some reflective thoughts. Layer II consists of three chapters – literature review, research methodology and fieldwork – building a foundation for the third layer. Layer III consists of model descriptions and simulation results.

Arrows in Figure 1.4-1 depict the relation of chapters to one another and suggest an optimal reading path. The author suggests a sequential reading pathway to readers. In the following each layer with corresponding chapters is briefly outlined.

Layer I: Setting, aims and objectives

Chapter 1

This chapter provides the introduction to the presented research. It starts with the background on how the research topic has emerged. The research motivation, formulated aims and defined objectives of the study are outlined together with a brief summary of the suggested approach. Consequently the contributions of the study, grouped by the particular areas of knowledge, are discussed. Finally the outline of the thesis with brief introduction of each layer and chapter is provided.

Layer II: Status quo and methodology

This thematic layer groups together the methodology, the literature review and the fieldwork chapters. Chapter 2 defines the scope of the term IT outsourcing and deals with the *status quo* of the IT outsourcing research. Chapter 3 identifies the need for the approach in dealing with issues arising from the literature review and sets out the methodology used in the current research. Whereas chapter 4 describes how theoretic elements from chapter 2 are mirrored by practitioners and which additional emergent themes were discovered during the fieldwork interviews.

Chapter 2

First, this chapter starts with answering the general question "*what is outsourcing?*" and sets the scope of the term outsourcing. The answer encompasses the definition of the term outsourcing in general, history of outsourcing and the discussion of various forms of outsourcing followed by an overview of reasons why IT outsourcing is applied by practitioners. Second, an overview of the contemporary outsourcing research is provided. After a short introduction of the evolution of the outsourcing research the *status quo* – dominance of Transaction Cost Theory – is introduced. Current outsourcing research harks back on many of the key principles formalised in 1975 by Oliver E. Williamson as conclusions drawn from thinking about Transactional Cost Theory. Some weaknesses of the Williamson's theoretic framework – looseness of the definitions used and the absence of a social view of the context – are pointed out. Third, the approach of dealing with the flaws of the framework is outlined.

Chapter 3

This chapter relates to the second objective of this thesis (cf. 1.2.3.2) and discusses how a combination of ABSS together with empirical research, done in an iterative way including

elements of rapid prototyping, allows for supplementing statistical data with qualitatively expressed evidence.

This chapter outlines the chosen methodology and gives answers to questions "*Why ABSS was used?*", "*Which simulation tool was used?*" and "*How the domain experts interact with simulations and validate the model and findings?*" The idea of this section is to give a brief introduction to relevant aspects of social simulation and to identify its strength and weaknesses for investigative issues – make or buy decisions related to IT systems. Some general descriptions were given regarding the methodology and models. After the basic principles of agent-based simulation and procedural-declarative controversy are introduced, a short outline of declarative package developed at the Centre for Policy Modelling is given followed by its use for the models presented in this thesis. Finally, the iterative approach of model development is outlined. Also the concept of cyclic data collection with reoccurring interviews is introduced.

Layer III: Modelling

The third layer provides an overarching scope for all chapters dealing with developed models and simulation results – chapter 5, chapter 6 and chapter 7. Both models presented in this thematic layer – the TCT and the EBO Model – are developed in the course of the ongoing PhD research on outsourcing behaviour at financial institutions. Both models introduce a novel approach for investigation of the TCT that uses means of the ABSS to model actors of the outsourcing process as autonomous and heterogeneous agents that can act according to changes in the environment they are located in. The figure 3.1-3 shows the linkage of the two models to each other and their sources of evidence that augmented both models.

Chapter 4

This chapter starts with the description of issues encountered while approaching involved stakeholders. It also gives a summary of the gist of the findings from the field research. The evidence introduced concerns the relevant areas of institutional behaviour, the structure of contractual relationship networks and contextual evidence such as outsourcing market patterns and trends (i.e. price development, geopolitical events, factors of influence). The chapter also provides an overview of collaborating firms in general, the cases studied and how they have been selected, reports on the use of economic theory postulates by practitioners and its implications for the daily business. It

describes various supportive tools deployed by practitioners for conduct of activities in an IT outsourcing project. Finally, emergent themes from the field research are outlined and briefly discussed.

Chapter 5

This chapter relates to the first objective of this thesis (cf. 1.2.3.1). It discusses how ABSS provided the means of increasing rigor through formalism by devising precise statements about ill-defined theoretic constructs of TCT. The TCT Model reported in chapter 5 was used to investigate a particular issue of the TCT concerning the formalization of the term asset specificity. The TCT Model includes a direct representation of relevant assumptions from the transaction cost theory. The main objective of the presented model is the reproduction of the individuals' behaviour as described by TCT and deliberate abstraction from any thoughts of the social components that might matter in the target system.

The TCT Model is based on economic theory and introduces a measure for the notion of asset specificity. Vendors, customers, and how they interact are modelled with an agent-based system. A "production space" is defined to model customers and vendors and the services they are seeking or offering. Rules govern how customers and vendors modify what they are seeking or offering. The results of the cross-validation of the model through domain experts are reported. While the results were in line with the theoretical literature, they diverged significantly from the experience of the informants involved in the research. Subsequently, it is introduced how results of the TCT Model and the validation results have been used to inform the first version of the EBO Model. In later stages the EBO Model was further elaborated by interaction with stakeholders and industry experts.

Chapter 6

This chapter presents the second of the two declarative evidence-driven agent-based models, developed in the course of the outsourcing research, which is to capture some of the main features that govern the outsourcing process and the dynamics of that process. In the same way as the TCT Model the EBO Model was developed as proposed in the chapter 3. Thus, the model has undergone several iterative alteration stages while incorporating evidence from desk research, media and stakeholders' feedback. This is related to the second and third objectives of this research (cf. sections 1.2.3.2 and 1.2.3.3), i.e. to capture the salient features of the case study and develop a tool to assist

policy makers while elaborating the participatory modelling approach. The model builds upon the fieldwork described in chapter 4 and demonstrates application of the participatory modelling methodology discussed in chapter 3. By incorporating the available evidence, the model identifies gaps in the empirical data, which have been filled in by plausible assumptions suggested by involved stakeholders and other industry experts.

An overview of the model along general lines together with an abstract structure of a situation found here is given. The chapter discusses how a number of research questions raised by the field research in chapter 4 have been mapped into corresponding assumptions while designing the model. Further, it is investigated in detail how some details of the case study were incorporated into the model regarding their technical and conceptual realization. Also it discusses how empirical data of the case study are being integrated in the design process of the EBO Model. This is done by juxtaposing sections from chapter 6 with theses from chapter 4.

Chapter 7

This chapter provides an overview of the simulation results that were produced with the EBO Model described in the previous chapter. Results are discussed with macro and micro views on the EBO Model. The macro view subdivides into further two parts – consideration of the model behaviour upon a set of varying but representative EBO Model runs and a series of parameter explorations. The micro view provides insights into an agent's life by means of simulation output excerpt analysis with respect to some findings from the macro view section. Further it is demonstrated how EBO Model deals with emergent topics that represented a focal interest of involved industry experts by juxtaposing sections from chapter 7 with these from chapter 4.

Layer IV: Reflections

This thematic layer deals with implications of the current research regarding participation of stakeholders and applicability of social simulation discipline to model complex systems on behalf of practitioners. This draws on research conducted with both models introduced in chapter 5 and chapter 6.

Chapter 8

The chapter contextualizes issues the project encountered in the collaboration with involved stakeholders whilst eliciting and translating the qualitative and quantitative data into both models. Furthermore, the section reflects on the outcomes of the stakeholder involvement, and positions the contribution to knowledge of this research in terms of participatory methodology. This part relates to the second objective (cf. 1.2.3.2), which relates to elaboration of participatory research methods. Here some recommendations regarding the implications for the methodology of the participatory approach are put forward.

Particular strengths and weaknesses of the chosen approach that came to light in the course of the model development are described. This discussion relates to the third objective of this thesis (cf. 1.2.3.3). Whereas the model, that aims to assist policy makers, is described in the chapter 6 the chapter 8 deals with assets and drawbacks of the social simulation discipline in terms of developing such models from practitioners' point of view.

Also the implications for evidence driven ABSS with respect to relationship between declarative and procedural paradigms and their interoperability are discussed. The chapter concludes with a discussion on the model's limitations and reflection on the areas deserving further work.

2 Literature Review

"Coase: I discovered there was something economists left out of their analysis of market competition, namely the costs of using the market, something which has become known--although I didn't invent the term--as "transaction costs."
(Hazlet 1997)

This chapter reviews the literature on IT outsourcing research and provides an outlook on various developments in the field together with a historical analysis of IT outsourcing in general. First, some exemplary definitions of the term outsourcing are given followed by the author's precision of the term for the purposes of the current thesis. Subsequently, section 2.1.1 offers a historical reflection on the outsourcing as a discipline. Section 2.1.2 introduces various forms of the outsourcing continuum and reduces the multitude of available options to the few investigated in the thesis. Section 2.1.3 offers variety of reasons for and against outsourcing and section 2.1.4 reviews risks and chances of outsourcing that have been researched in the academic literature. Finally, section 2.1.5 reflects on the inclusion of social factors in the contemporary IT outsourcing research. Second part of the chapter reviews the theoretical underpinning of the IT outsourcing research (cf. section 2.2.1) and, in particular, enlightens the predominant theoretic strand of transaction cost economics (cf. section 2.2.2). Finally section 2.2.3 discusses the shortcomings of the transaction cost economics in terms of language ambiguities and undersocialised view. Section 2.3 concludes with an outlook on how transaction cost economics was approached by the research so far and how it is intended to approach the theory in the current thesis.

2.1 What is Outsourcing

The term outsourcing has been already used several times without giving it a precise definition yet. The author deliberately chose to define the term postponed as he argues that there is some intuitive understanding of what IT outsourcing might mean. Despite being widely used the term outsourcing does not have a commonly accepted definition (Levina and Ross, 2003; Chapman and Andrade, 1998). Table 2.1-1 provides a compilation

of some frequently used definitions of the term with their sources to exemplify the rich diversity of definitions.

"*Outsourcing, in most basic form, can be conceived of as the purchase of good or service that was previously provided internally*" (Lacity and Hirschheim, 1993)
"*We define IT outsourcing as the significant contribution by external vendors*[17] *of the physical and/or human resources associated with the entire or specific components of the IT infrastructure in the user organization*" (Loh and Venkatraman, 1992)
"The operation of shifting a transaction previously governed internally to an external supplier through a long-term contract, and involving the transfer of staff to the vendor" (Quélin and Duhamel, 2003: p. 648)
"The provision of services by a vendor firm to a client" (Klepper, 1995)
"The act of subcontracting a part, or all, of an organization's Information Systems work to external vendor(s), to manage on its behalf" (Altinkenmer, 1994)
"Managing a firm's IT infrastructure through governance mechanisms with other firms" (Loh, 1992)
"Turning over to a vendor some or all of the IS functions" (Apte *et al.*, 1997: p. 289)
"The organisational decision to turn over part or all of an organisation's IS functions to external service provider(s) in order for an organisation to be able to achieve its goals" (Cheon *et al.*, 1995: p. 209)
"A decision taken by an organisation to contract-out or sell the organisation's IT assets, people, and/or activities to a third party vendor, who in exchange provides and manages assets and services for monetary returns over an agreed time period" (Kern, 1997: p. 37)
"Handing over to a third party management of IT/IS assets, resources, and/or activities for required results" (Willcocks and Kern, 1998: p. 2)
"Business practice in which a company contracts all or part of its information systems operations to one or more outside information service suppliers" (Hu *et al.*, 1997: p. 288)
"IS outsourcing refers to the third party management of IS assets, people and/or activities required to meet pre-specified performance levels" (Lacity and Hirschheim, 1995)
"Outsourcing is the practice of hiring functions experts to handle business units that are outside of your firm's core business. It is also a method of staff augmentation without adding to head count" (Dominguez, 2005)
"Outsourcing involves the sourcing of goods and services previously produced internally within the sourcing organisation from external suppliers. (...) *Outsourcing can also involve the transfer of both people and physical assets to the supplier"* (McIvor, 2005)
"The assumption of management and operational responsibility for a noncore business function or functions by a third party" (Halvey and Melby, 2005)
(i) "Outsourcing refers to those activities that are undertaken by outside suppliers" (ii) "Outsourcing refers to the transfer of activities and possibly assets from a firm to an outside supplier" (iii) "Outsourcing refers to these activities that are undertaken by outside suppliers but could also be undertaken by the firm" (Mol, 2007: p. 4)

Table 2.1-1: Definitions of the term outsourcing with supporting literature.

The definition of outsourcing adopted for this thesis incorporates all forms of outsourcing and includes purchasing. Therefore the author would like to introduce the following distinction of terms henceforth:

[17] Both terms vendor and provider are used interchangeably in Table 2.1-1 and throughout the thesis.

1. The term *outsourcing* refers to any forms of transfer of existing activities and assets connected to these activities from a client firm to an outside supplier.
2. The term *sourcing* refers to any forms of transfer of new activities and assets connected to these activities from an outside supplier to a client firm.
3. In the following both aforementioned terms will be referred to as *outsourcing*. Where difference of both terms is vital for the context an explicit distinction will be made.

Although the above definitions of outsourcing encompass business process and services in the broader business context, this thesis focuses primarily on IT outsourcing.

2.1.1 History of Outsourcing in a Nutshell

The current outsourcing wave has emerged in 1980s and appears to have been triggered by a number of interrelated events (Mol, 2007). Figure 2.1-1 captures the key dates preceding the outsourcing wave of 1990s. In the following a brief description of the key events is provided.

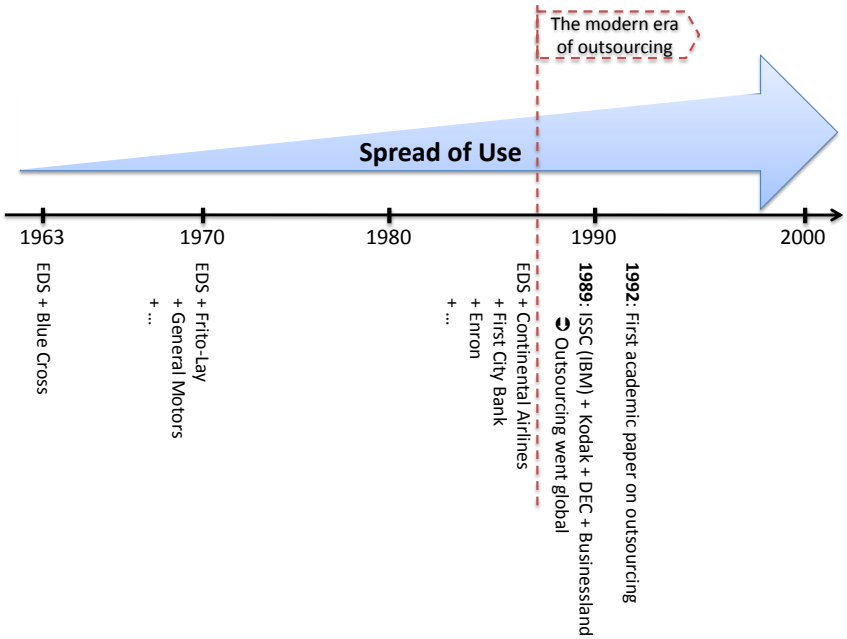


Figure 2.1-1: Historic development of the outsourcing regarding the spread of the concept.

In the era of mainframe computers in 1960s various computer bureaus emerged that were selling mainframe time to other organisations for data processing. It was too expensive for many companies to invest in own hardware, maintenance and specialized operators needed to run their own machines. Sparrow (2003) suggests that this

represented one of the earliest examples of IT outsourcing. Thus, IT outsourcing consisted of an external vendor providing a single basic function to the customer. The first occurrence of a large business handing over its entire data processing department to a third party is a contract signed between Perrot's Electronic Data Systems (EDS) and Blue Cross. This deal can be considered as a milestone in outsourcing history as it was entirely different from other facilities management deals of this era. For the first time a third party company, EDS, took over the responsibility over buyer's staff, data processing department of Blue Cross (Dibbern *et al.,* 2004). Corporations like General Motors and Frito-Lay rapidly followed suit by imitating the success story of Blue Cross and become EDS's customers.

In the course of the 1970s and 1980s first personal computers and servers were introduced and had a dramatic impact on the cost of computing power for organisations. Data centre maintenance costs fell to a level that was justifiable for companies of nearly all sizes to owe and control their own IT assets. IT started to be seen as a source of competitive advantage (Sparrow, 2003). This trend weekend the interest of publicity in outsourcing. As the use of IT become widespread it came to be seen as a necessity rather than a unique competitive advantage. The attention fell on the outcomes of investments in IT rather than its impact on organisation's effectiveness or efficiency (Cross, 1995; Lacity and Hirschheim, 1993; Sparrow, 2003). The real interest in outsourcing was awakened afresh in mid 1980s when EDS signed the contract with heavyweights First City Bank, Continental Airlines and Enron (Dibbern *et al.,* 2004). According to Dibbern (*ibid*) these deals substantiated the acceptance of outsourcing which did not exist until that point. All three deals put EDS at an equity position regarding its clients. The end of 1980s was characterised by competing of IBM's ISSC division against EDS.

First mega-deal to receive worldwide publicity was in 1989 the announcement by Eastman Kodak that it was hiring outsiders to buy, operate and maintain its information processing systems. Eastman Kodak outsourced its IT services and systems to Businessland, IBM and DEC awarding each provider with an outsourcing contract worth in total approximately £500 million. It was a first deal where such a well-known organisation where IT was regarded as a strategic asset contracted a third party provider for delivery

of these services. Dibbern (*ibid*) argues that this move of Kodak irrevocably legitimised outsourcing as a strategic tool. Inspired by success of Kodak other, well known, companies like General Dynamics, Xerox, Dupont, JP Morgan and Delata Airlines soon followed suit. At the same time outsourcing went global with deals of Lufthansa in Germany, BP in UK, Swiss Bank in Swizerland and Common Wealth Bank of Australia in Australia just to name a few. This development is well illustrated with the search on "outsourcing" with Google timeline[18] in Figure 2.1-2.

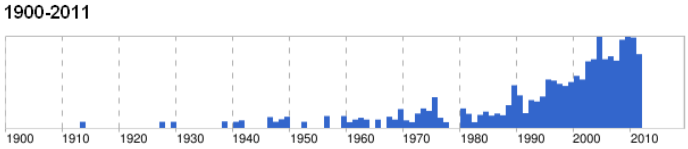


Figure 2.1-2: Historic development of the outsourcing discipline regarding the topicality in mass media.

The time line in Figure 2.1-2 makes evident that the discipline of outsourcing was continuously disregarded by the mass media until the 1980s where the public interest in outsourcing was stimulated by the aforementioned megadeals. In the course of the aforementioned historic development outsourcing has evolved from the exclusive vendor-client relationship to arrangements involving multiple vendors and multiple clients. From an academic perspective IT outsourcing represents an entirely practitioner-driven phenomenon (*ibid*). Since important trends in management practice get eventually academic attention, the first paper on outsourcing was published in 1992 as a reactive response of academic world on the growing phenomenon of outsourcing (*ibid*).

2.1.2 Various forms of Outsourcing

In the extremely political and emotional issue of outsourcing, many terms have been wrongly conflated blurring the borders of service delivery between the buyer and provider. In particular terms outsourcing and offshoring have been coined by many authors, admittedly, with different meanings. Carmel and Tjia (2005) suggest that the term offshore has morphed in the marketing departments and provide a following list of terms for demonstration: Onshore, Offshore, Nearshore, Best Shore, Anyshore, Rightshore, Farshore, Dualshore, Offshourcing, Offshoring, Nearshoring, Nearsourcing

[18] Google News Timeline is a web application that organizes search results chronologically. It allows users to view news and other data sources on a browsable, graphical timeline. Available data sources include recent and historical news, scanned newspapers and magazines, blog posts, sports scores, and information about various types of media, like music albums, and movies on a zoomable, graphical timeline (http://newstimeline.googlelabs.com/).

and Multishore. In recent years an observation of the outsourcing issue is tightly coupled with an issue of offshoring which is believed to be a special case of the former. Since outsourcing does not imply where and offshoring does not imply who is performing the work, in the following, the term, outsourcing, domestic and non-domestic will be used to avoid confusion.

An ample discussion of adopted taxonomies of outsourcing decisions is provided by Dibbern *et al.* (2005). Figure 2.1-3 depicts the possible outsourcing strategies for obtaining IT services based on the outsourcing continuum of Wibbelsman and Maiero (1994), as cited by Dibbern *et al.*, (2004).

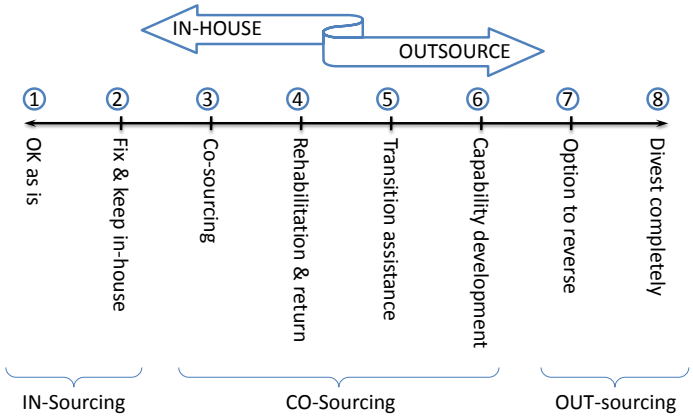


Figure 2.1-3: Continuum of outsourcing.

In the following the strategies from the outsourcing continuum in Figure 2.1-3 are briefly introduced:

- *OK as is*

  The status *quo* of service delivery is considered as the best outsourcing strategy (in-house delivery is assumed).

- *Fix & keep in-house*

  comparable to the option above with the difference that internal IT departments need to adopt better practices to become more efficient and effective (in-house delivery is assumed).

- *Co-sourcing*

  Various definitions of this strategy exist. The author summarizes that strategy as outsourcing strategy where business goals of the client are tightly linked to these of a supplier who is providing services for that client.

- *Rehabilitation & return*

  Strategy where internal IT department is reformed through the assistance of a vendor and the IT functions and services are kept in-house.

- *Transition assistance*

  Strategy where certain IT functions and services are outsourced to a vendor while the internal IT department transitions itself to a new set of skills.

- *Capability development*

  Strategy where IT functions and services are outsourced to a vendor whereas the internal IT department develops new capabilities and focuses on certain core capabilities.

- *Option to reverse*

  Strategy where IT functions and services are outsourced to a vendor but there is an option of returning these outsourced functions back in-house smoothly, if desired, at a later date.

- *Divest completely*

  Strategy where IT functions and services that are qualified to be non-core business functions and are best handled by a vendor are outsourced permanently.

There are multiple different forms of outsourcing. However all of them have one common feature – that of obtaining IT services from an external company. Following the feedback from fieldwork the author simplifies the continuum from Figure 2.1-3 into a generic form of outsourcing with choices of either outsourcing a service completely or keeping it in-house. Thus leaving two points of the continuum – "*OK as is*" and "*Divest completely*". Both models developed in the scope of this thesis (cf. chapters 5 and 6) draw back on the generic form of outsourcing. This allows for application of simulation results to any conceptual form of outsourcing.

2.1.3 Reasons for Outsourcing

"*The winners of tomorrow may not be today's strongest, nor today's most intelligent companies, but those companies which are most adaptable to change*" – a business school aphorism offered by an interviewed CIO from a bank insurance group as an answer to a question why did his company went offshore with their end user management services recently. This statement expresses the current sentiment among interviewed

industry experts. The fieldwork suggests that outsourcing is a result of the aforementioned business change initiatives, ranging from IT enabled change to local infrastructure projects. Organizations seek to cut costs, improve productivity, and justify every aspect of their operations. That said, it is a common myth that the main reason that companies outsource their IT operations is to cut IT costs. The following paragraph provides an ample selection of possible reasons for outsourcing that do not have cost cuts in the foreground. Although the potential for immediate capital and overall costs savings exists, it is not always realized, nor is it necessarily the primary or sole objective in pursuing outsourcing.

Previous research has shown that organisation balance arguments for providing essential IT related services in-house or purchasing them from a third party on manifold reasons. Table 2.1.-2 provides a good overview of multiple factors that influence the IT-decisions of organisations with supporting literature.

Main risk categories	Main references
Improve business performance	Lundeberg et al., 2006
Competitive advantage	Barney, 1991 Ives and Learmonth, 1984 Lacity and Willcocks, 2001
Reduction of costs for IT related services	Ang and Straub, 1998 Ang and Straub, 2002 Lacity and Hirschheim, 1993 Loh and Venkatraman, 1992 McFarlan and Nolan, 1995 Smith *et al.*, 1998 Willcocks *et al.*, 1995
Adress abilities to increase revenues	Lacity and Willcocks, 2001
Focus on core competencies	Hancox and Hackney, 2000
Increase delivery quality	McFarlan and Nolan, 1995
Improve business processes	Lacity and Willcocks, 2001
Innovate	Weeks and Feeny, 2008
Enhance quality of service	Lacity and Willcocks, 2000 Lacity and Willcocks, 2001
Achieve more flexible capacities	Lacity and Willcocks, 2000 Zahn *et al.*, 1999
Adapt to institutional or market forces	Ang and Cummings, 1997 Gupta and Gupta, 1995 Loh and Venkatraman, 1992
Consider technical issues	Gupta and Gupta, 1995
Gain access to scarce IS skills	Lacity and Willcocks, 2000
Infuse new technology	Lacity and Willcocks, 2001
Deal with technological uncertainty	Ang and Cummings, 1997 Poppo and Zenger, 1998

Table 2.1-2: Overview of outsourcing drivers and their supporting literature (Ulbrich, 2009).

The reasons for outsourcing are manifold and depend frequently on the strategy of the organization. Apart from the aforementioned repertoire such as IT cost reduction, better services, ability to focus IT staff on core IT activities and financial restructuring of the IT cost structure outsourcing has increasingly been used as an organisational development tool. The latter is often deployed in the context of post-merger integration projects in order to find some common denominator on which to base the future service delivery structure.

2.1.4 Risks and Chances

Outsourcing is a controversial topic indeed and the decision makers in this field are forced to walk a tightrope each time a decision is made. It is frequently the case that things that were classified as chances easily become risks. Figure 2.1-4 illustrates this issue by juxtaposing chances and risks as perceived by practitioners. Each line depicts an outsourcing chance with the corresponding threat that may or may not arise from that chance.

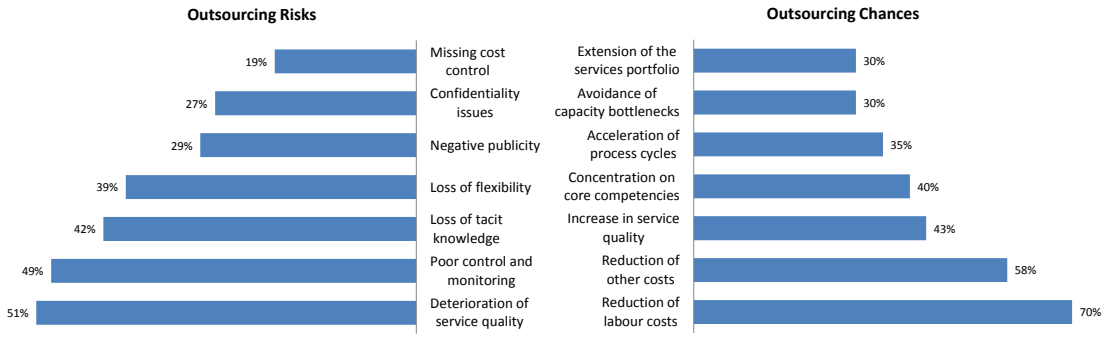


Figure 2.1-4: Perceived outsourcing risks and chances.

Academic literature reveals a plethora of potential risks that may occur in an outsourcing relationship. See table D-2 in appendix D for an overview on risks and corresponding supporting literature. However, there is consensus on most critical risks (Quinn and Hilmer, 1995; Lonsdale and Cox, 1998). These are loss of knowledge and threat of dependency. The evidence from the fieldwork mirrors this sentiment. In the following these two risks are introduced.

One of the pervasive risks in this enterprise is the threat of knowledge transfer. According to Lonsdale and Cox (*ibid*) this kind of risk represents the most important risk of outsourcing. As a matter of fact one should assume that a non-domestic service provider

offers its services to a multitude of clients. Thus the initial training courses of the vendor's staff might be thought as a direct knowledge transfer to the competition. Unfortunately this kind of thread is pervasive and cannot be avoided but only mitigated via artful management approaches. The recent business process outsourcing wave gained some media attention due to threats of knowledge transfer (Kotabe and Mol, 2004: p. 16). It was suggested that due to knowledge transfer within an outsourcing relationship foreign suppliers move up the knowledge chain faster than buyers of services have originally anticipated. Consequently that would undermine buyer's ability to differentiate themselves from their foreign suppliers in the marketplace. However, the fieldwork suggests that only bits that get standardised get outsourced (cf. section 4.5.2). Following stakeholders' feedback the suppliers for IT services overtook the buyers of services regarding the performance and efficiency long time ago. Furthermore only providers with service performance exceeding that of a client will be considered as potential contractual partners.

It is generally considered less risky do not to rely on a single provider, thus not to outsource all IT functions to one supplier (Sparrow, 2003). The potential threat of overdependence on one vendor can soar the costs of moving to another supplier. The so called lock-in to one supplier puts the buyer organisation at risk of opportunistic behaviour on the side of a vendor and at risk of deteriorating services delivery. Lonsdale and Cox (1998) relate this issue to supply interruptions whereas Sparrow (2003) goes further and suggests bankruptcies that are possible due to overdependence on service providers. Certainly, some dependency on the service provider is natural and unavoidable. However, the degree of dependency is hard to foresee and in some cases it gets out of control (Disselbeck, 2007: p. 182). The aftermath scenarios of lock-in dependencies that gone bad vary from simple hold-up in service delivery to complete insolvencies of buyers. Disselbeck (*ibid*) argues that it is natural for a buyer to miss required assets for an instantaneous delivery of outsourced services in-house. However, such a hold-up can be quickly resolved if the services being outsourced are standard. With core specific services being outsourced the impact on the buyer in case of attempted vendor switch or in-house delivery is much greater and can be devastating (*ibid*).

To complete the picture and accommodate the evidence from fieldwork the author would also like to mention some risks connected with offshoring. Despite these being for the most part incorporated in the aforementioned risks of knowledge loss and dependency interviewed stakeholders made strong distinction between outsourcing and offshoring risks. Stakeholders suggest that offshoring risks shall not be seen in the same category as outsourcing risks as they differ in nature. According to Carmel and Tija (2005) any cross-border business increases risks and they see it as a constant in the international business environment which might affect business continuity. Furthermore they emphasize country risk as the most important one. Country risk represents an umbrella term for various political and financial risks. Interviewed stakeholders mentioned geopolitical risks in this context, thus expanding the definition of Carmel and Tija (*ibid*) by another dimension – natural disasters. The risk categories that are introduced and may be greater due to offshoring according to Carmel and Tija (*ibid*) are: country, intellectual property, loss of proprietary knowledge, data security, corruption, system security, contractual, infrastructure and social and regulatory changes in the home country.

2.1.5 Social Aspects

It seems somewhat grotesque at first to find such an apparent ignorance of social factors in academic literature on outsourcing while observing the available plethora of management literature for practitioners which addresses interpersonal issues within outsourcing context. However, a more thorough review of the available management literature at stakeholders' disposal resembles a unifying pattern character – résumé of best practices filtered with regard to conducted case studies and practical examples. At the same time the abundance of academic literature on outsourcing research exhibits stronger adherence to mainstream economic theories (cf. section 2.2). Thus, the practitioner literature emphasizes the importance of social interaction whilst the academic literature ignores it.

Following Ulbrich (2009), in Figure 2.1-5, the author suggests a generic model to emphasize the impact of social factors on the outsourcing behaviour of the company. Social issues are intertwined with technical, business and economic factors and influence the resulting outsourcing behaviour of the company.

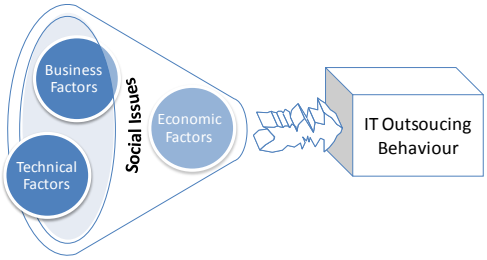


Figure 2.1-5: Impact of social influence on IT outsourcing outcome (in style of Ulbrich (2009) expanding Lacity *et al.* (1996)).

The illustration in Figure 2.1-5 shows that resistance on the social level can distort the reasons for making a particular IT outsourcing decisions that was originally based on rational factors. Unfortunately, mainstream IT outsourcing decision frameworks are based on rational decision theory and therefore disregard the influence of social factors. By deploying frameworks that are grounded in rational-choice theory, actors are expected to break down important influences on the quantifiable variables to be included. Unfortunately the hidden implication is that those aspects that are difficult to quantify or do not "fit" into the framework have often been neglected or, at best, treated as part of the business factors (*ibid*). Arguably, insights from organizational science and organizational behaviour would enrich these frameworks.

According to Willmott and Bridgman (2006) as well as Orlikowski and Iacono (2001) it is a received wisdom in the literature to view the technology as being independent of the social context in which it is developed and deployed. This discussion is well exemplified by an excerpt from an interview with an IT CFO from a Ukrainian mid-sized insurance company: "*(…) there is no payoff matrix in heads of board members. They* (the decision-makers) *are confronted with multiple spread sheets and ranking matrices suggesting the superiority of some certain provider. In the long run, frequently, they end up making their choices based on the provider beauty contest due to subjective impressions created by sales people.*" Thus, IT outsourcing decisions are likely to be influenced by social aspects to a greater degree as anticipated by conventional decision frameworks.

2.2 IT Outsourcing Research

The topic of IT outsourcing has been around in academic research for the last fifteen years (Dibbern *et al.*, 2004). A huge body of academic literature emerged in that time and continues to evolve rapidly. During this evolutionary, process a large number of theoretical foundations was used to study outsourcing. In the beginning, academics were

relatively slow to research the outsourcing phenomenon (cf. section 2.1.1). Thus the area was largely driven by the practitioners community (Hirschheim and Dibbern, 2002). More recently, the topic of outsourcing has enjoyed an abundance of academic attention.

Research offers a wide variety of issues which have been examined over time including understanding of the decision making, risk analysis and mitigation, contractual relationships and proportion of IT to be outsourced. The primary purpose of the theories utilised in the outsourcing research is to guide the decision to initiate outsourcing projects and to align this decision according to goals, organizational characteristics and technological, behavioural, or economic biases (Gottschalk and Solli-Saether, 2005: p. 71). However, these topics can be reduced to two key issues which unavoidably arise if one is talking about IT outsourcing: *How to decide which IT activities should be outsourced with respect to their characteristics?* and *How should IT outsourcing contracts be structured?* (Aubert and Croteau, 2005).

Since the 1990s an increasing variety of theoretical perspectives that inform current outsourcing research has been developed. Still, despite proliferating IT research, no satisfactory coherent theory is currently proposed (Klein, 2002). The next section gives an overview of the current trends in the area of theoretical and methodological foundations used in IT outsourcing research up to date.

2.2.1 Conceptual Perspectives

The introduction or comparison of alternative schools of IT outsourcing is a science of its own and is beyond the scope of this thesis. An ample overview of theoretic roots of IT outsourcing can be found in Dibbern and Heinzl (2002). This section outlines current trends and issues in the field of IT outsourcing research.

In general, the study of outsourcing research is theoretically many-sided and pluralistic at the same time. As one can see from table D-1 in the appendix D, there are numerous different theories used to examine IT outsourcing. Table D-1 summarizes the mainstream theoretical frameworks used in outsourcing research to account for outsourcing versus insourcing decisions. Table D-1 also lists the supporting literature for further reading. Basic assumptions of the theoretical foundations are shortly introduced and focus of theoretical research is given. Also the level of analysis, how fine-grained a theoretical

foundation considers a firm, is presented. These frameworks tend to offer a selection of aspects to arrive at rational outsourcing decisions, and they rely heavily on factors that are easy to quantify. On the one hand, this kind of simplification makes these frameworks easy to apply in organizations. On the other hand, the simplification carries with it the risk of missing important aspects (Ulbrich, 2009).

The depicted theories can be vaguely grouped into three categories: strategic, economic and social/organizational. The primary theoretical approach to IT outsourcing is economic, followed closely by a strategic perspective (Dibbern *et al.*, 2004). This evidence shows that social issues in theorising about IT outsourcing have not carried much weight. Yet economic theories in general, and transaction cost economics in particular, are widely used in outsourcing research (*ibid*).

So far the IT outsourcing literature has mainly focused on the transaction itself, without investigating the strategic characteristics of the organization (Aubert and Croteau, 2005), not to mention a built-in social framework of the firm or social context it is located in. This trend captures the widely held perception that organisational members make outsourcing decisions based upon an economic rationale and regard social factors as negligible in their influence on the overall picture of outsourcing. Therefore, a representative strand of research on IT outsourcing has used the transaction cost economics (Williamson, 1975) to investigate make-or-buy decisions. Organizations seek to cut costs, improve productivity, and justify every aspect of their operations. Conducting a cost analysis seems to be the most logical way to support these business decisions strategically. Here TCT offered a supporting framework. The literature research indicated that frequently a combination of theories is taken by researchers to propose an umbrella-like theoretical framework which hypothesizes the determinants of the firms' IT outsourcing behaviour. These frameworks are then supported by various case studies and empirical data. Dibbern and Heinzl (2002) suggest a combination of the theory of the firm as a basis with transaction cost theory and the resource-based theory.

TCT has been comprehensively applied in the context of IT outsourcing (Lacity and Willcocks, 1995; Ang and Straub, 1998). Amberg and Wiener (2006) argues that so far TCT has been the predominant theoretical archetype to understand and explain IT

outsourcing decisions. The concept of *asset specificity* and TCT as a single or a combined approach was applied by Aubert *et al.* (2004), Loh (1994) and Dibbern *et al.* (2005) to account for various outsourcing issues in their studies. These studies, which, by far, do not form an exhaustive list, provided a strong empirical claim for the TCT framework. The TCT framework is reviewed in the next section.

2.2.2 Transaction Cost Economics

Opponents of the TCT frequently tell the story of two hikers camping in the tiger country. One morning they wake up and find a tiger lurking close to their tent. While one of the hikers is puzzled as to what to do, the other one immediately reaches for his running shoes. On the reminder of his partner that he could not possibly outrun the tiger, he responds that he does not need to outrun the tiger at all. The only thing he has to do is to outrun the partner. This somewhat macabre joke is a powerful reminder on the assumption which is incorporated into Williamson's transaction cost framework – opportunistic behaviour. By reaching for his shoes, the hiker behaves in an opportunistic manner in deciding to abandon his partner. The reason for this behaviour is rather simple – in the world where everybody is opportunistic the hiker who decides to outrun the partner cannot be, *ex-ante*, sure that his partner will not behave opportunistically. Therefore, he doesn't spare any thought for the cooperative actions but tries to forestall his partner. Largely, the success of the transaction depends on the affinity of the actors towards opportunism. The smaller the number of actors, the larger the bias towards opportunistic behaviour (so called small numbers problem).

A representative strand of research on IT outsourcing has used the transaction cost theory to investigate the make-or-buy decisions. The foundation for TCT was laid by the seminal work of Coase (1937). The theory arose out of a lecture given to his students at the School of Economics and Commerce in Dundee, Scotland. Later on this work was published in the seminal work "The Nature of the Firm". Coase stated in his paper that market price is not the sole factor for make-or-buy decision of the firm – search, contracting, coordination and transaction costs have to be considered as well. He looked at the market and the firm as two alternative mechanisms that could be facilitated to conduct a transaction between parties. This proposition by Coase has been theorized, refined and used extensively in the last two decades (Hammer and Champy, 1993). This

theory was later developed further by Williamson (Williamson, 1975, 1985, 1996; Williamson and Ouchi, 1981) and has been subsequently adopted as the rational for outsourcing decisions.

TCT's tripod, as defined by Williamson (1975), constructs of costs, transaction type, threat of opportunism, uncertainty and information impactedness. Uncertainty is distinguished further to parametric uncertainty and behavioural uncertainty (Williamson, 1985: pp. 57-60). The remaining influencing factors of the transaction are accumulated in transaction atmosphere (Williamson 1975, p. 37). „*The principal dimension with respect to which transactions differ are asset specificity, uncertainty, and frequency. The first is the most important and most distinguishes transaction cost economics from other treatments of economic organizations, but the other two play significant roles*" (Williamson, 1985: p. 52).

Williamson's description of the representative actor as boundedly rational (which suggests one cannot identify his or his own best behaviour), opportunistic (which suggests one cannot predict others' behaviour) and risk neutral agent can be found in (Williamson, 1985: p. 45, p. 388). This is a variant of the standard utility-maximization assumption in economic theory. It says that agents always want more of what they like, and this may imply that interests are pursued in an opportunistic fashion (Williamson, 1985: p. 47). Opportunism is always assumed to be present in a TCT. Both agent and principals are subject to bounded rationality defined as limited ability of the human brain to reason. This assumption is always claimed in TCT. The concept of bounded rationality was originated by the work of Herbert Simon and incorporated into mainstream economic theory. Simon defined bounded rationality as limited information-processing and computational capacities (Moss and Kuznetsova, 1996).

The essence of bounded rationality is that agents' computational and information processing capacities are limited (Moss *et al.*, 1997). Simon (1957) defines bounded rationality as a concept based on the fact that rationality of individuals is limited by information they have and by the cognitive limitations they exhibit. The latter means that agents have limited computational ability in terms of processing information to inform

decisions as to how agents should act. Furthermore, agents have an imperfect information about the environment in which they act.

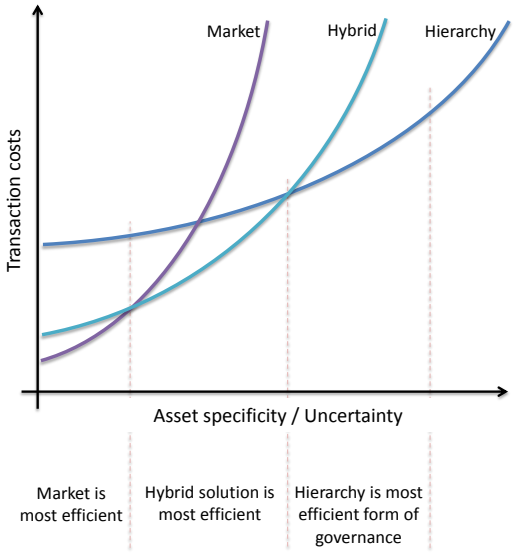


Figure 2.2-1: Most efficient governance form with respect to asset specificity.

A fundamental assumption of TCT is that the parties involved in a transaction ought to be able to measure the quality and the quantity of the exchanged goods in completing a transaction (Aubert and Croateau, 2005). In practice the production and transaction costs are often difficult to assess. Williamson, however, provides a heuristic model for estimating costs based on the inherent nature of the transaction type which favours in-sourcing or outsourcing. Transaction type is classified based on two dimensions – the frequency of occurrence and the degree of asset specificity (Williamson 1985: p. 60). Using these two dimensions Williamson creates a framework for categorizing the most efficient mechanism of governance – in the case of outsourcing it is a classical contract, neo-classical contract or relational contract. The chart in Figure 2.2-1 illustrates the interplay between possible institutional arrangements depending on asset specificity. Transactions involving a high asset specificity factor are better managed in a hierarchical form of institution, whereas low asset specificity allows for market constellations. The hierarchical choice is described in (Williamson, 1985: p. 74, p. 78, 1991: p. 279) and the market governance form choice is described in (Williamson, 1985: p. 73, p. 90, 1991: p. 278). However, Williamson's framework assumes that a degree of certainty

exists. The framework also assumes that there is a large number of providers in the marketplace[19].

For simplification reasons, it will be distinguished between two forms of institutional arrangements depending on transaction properties – market and hierarchy. These institutional arrangements represent the end points of the Williamson's organizational continuum. The intermediate hybrid forms incorporate both, market and hierarchy elements. Transaction costs economics explains the choice of organizational form as matching transactions that have certain transactional characteristics with the appropriate governance mechanisms.

The TCT framework decomposes all economic costs in *production costs* – costs of transforming inputs into outputs or direct production expenses alternatively – and *transaction costs* – costs of making exchange or the so called indirect production expenses (Wallis and North, 1986: p. 97). Furthermore, the transaction costs are subdivided into *motivation costs* – costs of motivating agents to alight their interests – and *coordination costs* – costs of coordinating the actions between agents (Milgrom and Roberts, 1992: p. 29). Williamson distinguishes between *ex ante* and *ex post* transaction costs (Williamson, 1985: p. 20). For simplification reasons the production costs are frequently assumed to be constant and therefore are excluded from the analysis *a priori*. One assumes that two alternatives would differ only in their transaction costs. Hence, an implicit *ceteris paribus* condition is assumed. In modern economies, and in the IT field especially, transaction costs have become as important as production costs. This is quite a shift from the early economic theory (e.g. the perfect market economy) which focused entirely on production costs assuming that transaction costs did not exist. Table 2.2-1 points out the dependencies between the two types of cost and dimensions of the transaction type.

	Asset Specificity	Uncertainty	Frequency
Production Costs	⇩	n/a	⇩
Transaction Costs	⇧	⇧	⇩

(⇩ decrease in costs, ⇧ increase in costs)

Table 2.2-1: Influence of the transaction dimension on the costs[20].

[19] For the sake of discussion this thesis deals with the issue of asset specificity only.

The notion of asset specificity needs to be explained a bit further at this point as it ought to be one of the central objectives of the models presented in this thesis. In simple terms, we can assume that an asset is classified to be specific if there is no alternative use or demand for a given asset outside of the relationship. Thus the asset is required for the particular transaction it is used in and is worthless in any other transaction. In the context of IT asset specificity measures the degree to which investments in the management and operations of IT yield value only in the idiosyncratic IT environment. Figure 2.2-2 shows a simplified relationship between asset specificity and the decision to produce in-house or outsource. Area from P_1 to P_2 represents the trade-off area between production cost advantages and transaction costs disadvantages where it is still lucrative to outsource (ΔTC – transaction cost, ΔPC – production cost). Beginning with P_2 the disadvantages of outsourcing outweigh the advantages and production has to be shifted in-house.

TCT assumes that any action in the market economy is adherent to cost. The efficiency of the transaction is an important driver – the most parsimonious deployment of scarce resources. Transaction is efficient when both parties involved in it choose an appropriate organization form that both, the production costs and transaction costs are minimal (Williamson, 1985: p. 22).

Probably the most comprehensive way of explaining asset specificity is to draw parallels with the usage of an asset within an organization. When the value of the next best use of an asset is less than the value associated with its primary use (also called opportunity costs), a lock-in between parties exists thus creating a risk associated with the investment of the relevant asset (Aubert and Croateau, 2005). The choice of the services and activities to outsource is purported upon the matching of the IT activities to optimal governance form. Whereas IT activities differ in attributes they possess and governance forms differ in the performance they offer (Williamson, 1991). The central question with respect to outsourcing IT which bothers organizational economists is how to choose which activities or services to outsource to maximize performance (Poppo and Lacity, 2006). Thus the concepts of TCT seem to be plausible in the outsourcing context that

[20] It is assumed that the dependence of the costs in accordance to the transaction dimensions is observed in the exclusive relationship between two transaction partners.

allows the facilitation of the framework as a supporting tool in the decision making process.

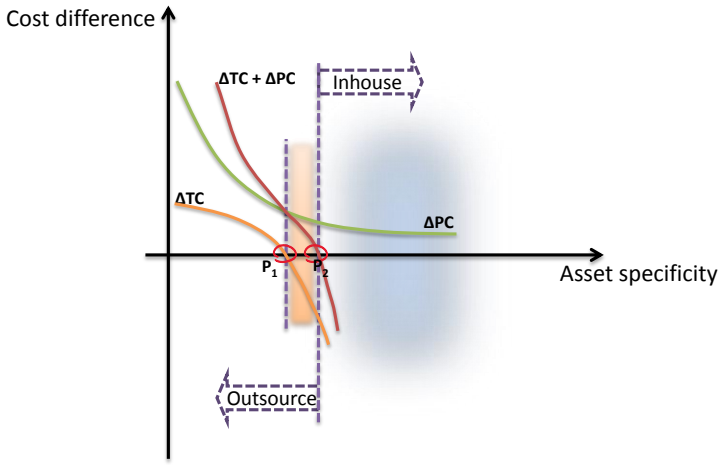


Figure 2.2-2: Relationship between asset specificity, production and transaction costs (adapted from Williamson (1982: p. 560) and Dibbern *et al.* (1999)).

In TCT, as developed by Williamson, the central notion is given to transaction specificity of assets in combination with opportunism and bounded rationality. If there are assets which are specific to the particular transaction – i.e. have no or substantially limited use outside given transaction – this will cause dependence between transaction partners which yields transaction costs if there is a risk of opportunism[21]. The buyback of the initially released resources causes considerable initial investments (Amberg and Wiener, 2006). In such a case, primarily, Williamson assumes symmetric dependence (Nooteboom, 1993b). Thus if a producer uses assets that are specific to the transaction he will obtain a unique, or at least differentiated product, but then the discontinuity of the transaction will be a problem, not only for the producer but also for the customer[22].

Switching costs (or also referred to as switching barriers) pose an impediment to a customer's changing of suppliers. It is implied that consumers are forced to incur costs when switching from one supplier to another. These costs are called switching costs and can come in many different shapes: exit fees, legal sanctions, search costs, learning costs, cognitive efforts, financial risk, social risk etc. Some of the aforementioned costs are easy to estimate. Exit fees include contractual obligations that must be paid to the current

[21] The situation is described under assumed conditions where rationality is bounded.
[22] It is assumed that the customer will not find an alternative supplier of an equivalent product immediately and therefore will suffer discontinuity and higher costs of production.

suppliers and compensatory damages that may be awarded for breach of contract. Search and learning costs are not that easy to estimate but usually expected.

2.2.3 Caveats and Need for Action

Indeed, as an analytical tool TCT is mostly used to explain economic problems where asset specificity plays the key role. According to the TCT proponents it provides a logically consistent and ubiquitous framework. However, it is subject to certain anomalies and after a closer look at the theory's roots mentioned above one will find major difficulties in operationalizing this theory with regard to IT outsourcing domain. Although, many scholars have contributed to the expanding domain of TCT and as a result there are now several different stands of the theory, this thesis focuses only on the version that has been developed by Williamson (Williamson, 1975).

It is argued that TCT provides potentially useful framework for several reasons. *First*, TCT specifically addresses outsourcing decisions, that is, the decision to produce goods or services internally or purchase it externally from the vendor. *Second*, TCT captures the widely held perception that organizational members make outsourcing decisions based upon an economic rationale. *Third*, many practitioners use terminology consistent with transaction cost theory to explain why outsourcing is predicted to reduce IT costs. *Fourth*, TCT enjoyed an abundance of empirical and theoretical academic attention by leading academics and thus remains an attractive choice for other research into interpretation of organizational reality.

Even if the reasons above are sound and TCT seems to be a universal instrument and is widely regarded as a classic contribution to the study of organizations, economics and law and in particular, to outsourcing decisions it is hard to accept this theory due to the following shortcomings – language ambiguity and disregard of social factors. As stated by Williamson (1985: p. 85), asset specificity is the most important dimension of the transaction, followed by uncertainty and frequency. Thus having a valid and reliable (these concepts are highly subjective) measure of asset specificity, is central to undertake a robust test of TCT (Aubert and Weber, 2001). Williamson's framework assumes that a degree of certainty exists thus ruling out uncertainty (presumably it was classified as non-measurable). Nevertheless, asset specificity remains a long-running issue with wide usage

of the concept in the empirical studies (Lacity and Willcocks, 1995; Aubert and Weber, 2001).

In any case these arguments seem to leave lots of space for justification of TCT even in cases where anomalies in the results are encountered. It is always possible to argue that the measurements of assets specificity were inappropriate or the measures of uncertainty[23] were wrong. Many critics of TCT use language ambiguities as plea for difficult operationalization of the framework. Of particular note, some critics have claimed that TCT is irrefutable because of its ad hoc appeals to language ambiguities can always be used to address any anomalies (Lacity and Willcocks, 1995). Arguably, no tool is perfect, and TCT suffers from many criticisms. These result from the ill-defined terms to express drives, the social concerns left unrecognized in the present attributes consideration, and the fact that some outsourcing concerns fall properly under the realm of ethics, rather than economics.

2.2.3.1 *Language Ambiguity*

It has been widely criticized that TCT contains some ambiguities with respect to the lack of precision in terms used. Dissatisfaction with different measures, dimensions or metrics used in TCT, or for its evaluation, is not new to outsourcing research (Aubert and Weber, 2001; Aubert and Croteau, 2005). One such bone of contention is the notion of asset specificity, which is central to the whole concept of Williamson's transaction based framework. It is rather crucial for TCT to understand what is meant by asset specificity to make a credible statement, whether the given theory accounts for empirical evidence or not.

As stated by Williamson (1985; p. 85), asset specificity is the most important dimension of the transaction, followed by uncertainty and frequency. Thus having a valid and reliable (although these concepts are highly subjective) measure of asset specificity, is central to undertake robust tests of TCT (Aubert and Weber, 2001). In any case these arguments seem to leave a lot of room for justification of TCT even in cases where anomalies in the results are encountered. It is always possible to argue that the measurements of asset specificity were inappropriate or the measures of uncertainty were wrong. Many critics of

[23] Discussion about uncertainty is an issue in itself and is beyond the scope of this paper. For further reading refer to the seminal work on this topic by Frank H. Knight (1921).

TCT use language ambiguities as a plea for difficult operationalization of the framework. Of particular note, some critics have claimed that TCT is irrefutable because of its ad hoc appeals to language ambiguities that can always be used to address any anomalies.

The argument put forward here is that in Williamson's TCT version there is too much looseness in the application of the concept of specificity, leading to misrepresentation of relations of dependence between buyer and supplier. The concept of transaction specificity of assets and its consequences seemed simple enough at the start but, on closer analysis, one finds oneself asking questions about the exact meaning of this term. It has to be emphasized that it is not intended to claim that asset specificity is an insufficient condition for dependence. The only claim made at this stage is that asset specificity does not have a commonly accepted metric due to its looseness of the definition. All of a sudden the economics, which is always aimed at quantification of all and everything, is lacking numerical tangibility on that issue.

TCT is fraught with imprecise constructs that are difficult to operationalize. Partly, it is due to different concepts of asset specificity that are present in the contemporary literature. Arguably, all eventual anomalies of empiric studies can be explained by reinterpretation of the asset specificity notion. Lacity and Willcocks (1995) argue that language ambiguities can result in a theory capable of simultaneously explaining everything (taking the TCT proponents view) or nothing (taking the TCT opponents perspective), depending on the interpretation of terms. A short review of the book by Hirschheim *et al.* (2002), reveals that authors of compiled papers use the notion of *asset specificity* in a non-standardized way, deliberately leaving a wide scope of interpretations.

2.2.3.2 *Undersocialised View*

A second source of contention comes from the side of social scientists – it is a strong disregard of social aspects by TCT. The framework ignores the contextual grounding of human actions and, therefore, presents an undersocialised view (Ghoshal and Moran, 1996). Williamson (1979) argues that decision makers use cost efficiency as the sole criterion. He recognizes that politics play a role in organizational process, though he argues that economizing is a more superordinate construct than political strategizing. Thus Williamson's framework does not allow for any kind of social effects to be

considered. According to Williamson and TCT proponents, transaction costs become the sole criterion for the outsourcing decision if production costs are comparable to a vendor. This argument however is contradictory to the findings in the recent reports coming from non-academic research as these reports exhibit that one should not simply disregard social factors in outsourcing considerations. To the contrary, these studies stipulated through evidence that social factors proved to be the most crucial factors in the outsourcing projects (BCG, 2003, 2005, 2006).

Poppo and Lacity (2002) found that managers are increasingly aiming to complement their investment in contract customization with the development of social relations. In the long run, doing so improves the performance of the outsourced activity. Thus organizations start looking beyond existing contractual orchestration to explore the long term potential to create win-win situations for all parties involved. This contradicts the assumption of opportunism in Williamson's framework as, according to TCT, it is imprudent to assume that exchange parties will forego opportunistic behaviour. Whereas incentives of exchange participants are frequently specified in the contract and are of a monetary nature, the resulting behaviour of involved parties can be impacted by the cultivation of the relationship , thus actions that result in partnership style of relationship (Hirschheim and Dibbern, 2002). The fundamental critique of TCT is that it isolates organizational economic actions when such actions should be considered more appropriately as socially embedded in ongoing relationships with internal and external institutional constituents (Ang and Straub, 2002; Ang and Cummings, 1997; Granovetter, 1992).

Reputation and trust are not considered. Transactions are treated as though they occur without any knowledge of previous transactions involving the parties concerned. Yet the evidence indicates that trust does develop between actors as they do business with each other (cf. section 5.2.6). It is also plausible that a reputation for trustworthiness is an important business asset that firms will often be reluctant to jeopardize. An expanding academic literature in the fields of psychology and organization theory provides an evidence that attitudes and behaviour exist as separate and distinct concepts and that these are affected by individual propensities as well as by the situation that shapes the

individual's perceptions (Ghoshal and Maron, 1996). This is an important source of uncertainty of organizations that is reduced to minimum by TCT. The source of uncertainty lies inside the organization in the discretionary behaviour of individuals. This opinion echoes the proposition of Ghosahl and Moran[24] (*ibid*).

Learning from hazards for future choices of behaviour in transactions cannot be instrumentalised in the given framework. This point is absent in TCT *a priori* as it is static and belongs to the realm of equilibrium theories and can, therefore, be regarded as a snapshot in time. The framework does not allow for translation of the processes. Langlos (1992) suggested dynamic transaction cost to place the theory within the context of the passage of time and account for costs arising in the face of change, notably technological and organization innovation. The usage of transaction as the unit of analysis by Williamson overlooks the broader historical context which frequently sheds light on outsourcing decisions.

2.3 Approaching TCT

TCT is often given a status of empirical success story. A survey by Boerner and Macher concerning empirical research with usage of TCT as theoretical framework encountered more than 600 articles that empirically tested some aspect of the theory (Plunket and Saussier, 2003). Furthermore the authors argue that despite the large body of empirical research that is available, most of the findings are equivocal in their ability to support the underlying logics of the theory. Notwithstanding, the literature research up to the present day did not reveal a tendency of contemporary science to bring more clarity in the field by creating a uniformity of metrics used. Instead a more common practice is to introduce conducted surveys and try to distil best practices out of them with an attempt to generalize the results obtained for a wider range of projects.

An abundance of empirical and theoretical academic attention by leading economists and huge body of academic literature suggest that other researchers find TCT to be a useful interpretation of organizational reality (Lacity and Willcocks, 1995). TCT is simple since it assumes only few attributes. Given these attributes, there is little wonder that pressures

[24] Ghoshal and Moran (1996) suggest furthermore another source of uncertainty arising from the complexity and dynamism of technologies and markets.

to apply the technique to important decisions are growing. The notion of asset specificity was blindly accepted despite its loose definition. Nevertheless adoption of theories from other disciplines needs to be critically examined within the discipline it is going to be adopted in.

Empirical research case studies in (Hirschheim *et al.*, 2002) provide an extensive survey with consequent application of principal components factor analysis, linear regression or econometric models to conclude which framework succeeds or fails to describe outsourcing decisions. In the case of data anomalies produced, these are re-interpreted with different metrics to make them fit into one of the mainstream theories (cf. table D-1 in appendix D). Thus a predominance of these theories is gradually developing.

The author suggests to put forward a methodology of agent-based social simulation for critical examination, observation and formalization of the theory which is expressed in the verbal form. The process of formalization, which is a necessary intermediate step to developing a model, helps to translate textual or verbal description of TCT into a more formal and precise constructs thus helping to gain a better understanding of the theoretical assumptions. This methodology introduces an alternative approach to the investigation of economic theories by means of ABSS and seeks to find an alternative metric for asset specificity with a qualitative flare. Williamson's transaction cost framework is replicated with autonomous, heterogeneous agents as actors of the modelled outsourcing process.

So far agent-based modelling has not been used to develop TCT in relation to outsourcing. There are several models on supply chains that can be classified as outsourcing relevant as they deal with isolated concepts from the outsourcing research. The only research the author is aware of, that remotely comes close to the investigation of TCT with agent-based paradigm is (Nooteboom 1993a, 1999; Nooteboom, 1997; Klos and Nooteboom, 2001). Contrary to the ABSS paradigm suggested for this thesis, Kloss makes use of agent-based computational economics[25]. The approach taken by Kloss operates on

[25] The comparison of agent-based computational economics (ACE) and agent-based social simulation paradigms is beyond the scope of this thesis. The reader shall be referred to (Tesfatsion, 2002; Tesfatsion and Judd, 2006) for introductory literature on ACE. Also further reading on topic of ACE can be found on ACE-website maintained by Leigh Tesfatsion (http://econ2.econ.iastate.edu/tesfatsi/ace.htm).

the level of individual and adaptive agents with bounded rationality. Agents are allowed to interact with each other and adapt their behaviour according to their experience regarding these interactions. Thus, from the cursory look, Kloss's approach resembles similarities to the approach suggested by this thesis (cf. section 3.1.4). The distinctions are becoming apparent while examining the way how models are built under both approaches. Whereas TCT and EBO Models both are based upon evidence, the model of Kloss exhibits stronger theoretic grounding and mathematic rigour by describing events and decision paths of agents through formulas – e.g. use of Cobb-Douglas functional form for adaption of weights for trust and loyalty, functional dependency between potential profit and trust in order to let both variables interact, functional representation for increase of trust with the duration of a relationship. The TCT and EBO Models also mimic stakeholders' concept of loyalty and trust but do not assume functional dependency for any circumstances. Instead, where possible, evidence from fieldwork is used (cf. section 3.4). Also rule-based implementation allows for abandonment of functional representations to the most part and substitution of these through rules stemming from stakeholders' feedback.

Agent-based computational economics has many agent-based models of organizations, including agency theory and team theory. However these models are rather restrictive with respect to: *(i)* the assumptions applied to agents' behaviour, *(ii)* the number and heterogeneity of agents, *(iii)* and the features of the environment due to limited power of analytical methods used (Chang and Harrington, 2006). Agent-based social simulation overcomes these limitations but requires a different mind-set. One of the benefits of having an agent-based model of an organization is that it can reveal in a very concise form some of the possible impacts of low-level decisions on the high-level behaviour, therefore allowing the investigation of uncertainty. Abstraction from unnecessary details makes it an ideal starting point for discussing current operational problems and suggesting solutions. Bios (Tessin and Darley, 2004), Cap Gemini Ernst & Young (Meyer and Davis, 2003) and Icosystem Corporation (Bonabeau, 2002) already successfully apply ABSS for their consultancy tasks. Agent-based modelling is a powerful simulation modelling technique that has seen a number of applications to real-world issues in recent years (*ibid*).

The chosen methodological pathway of ABSS and its implications on outsourcing research with respect to TCT are discussed in the following methodology chapter.

2.4 Conclusion

This chapter reviewed the literature on IT outsourcing research, looking at various developments in the corresponding field including a historical analysis of IT outsourcing itself. To begin with, various exemplary definitions of the term outsourcing were given. Due to multitude of available definitions and for prevention of possible confusions the author has introduced a distinction of the terms *sourcing* and *outsourcing*. Subsequently, the term *outsourcing* combines both terms and is used throughout the thesis. Furthermore, the author reduced for the thesis the continuum of outsourcing strategies with regard to international operations and vendor-client collaboration to *domestic* and *non-domestic* as well as *ok as is* and *divest completely* options.

The topic of IT outsourcing has been around in academic research for the last fifteen years. Whereas, in the meantime a voluminous body of academic literature has and continues to evolve rapidly academics were slow to pick up on research of the phenomenon in the beginning. Hence, the area was largely driven by the practitioners community. Research offers a wide variety of issues which have been examined over time including understanding of the decision making, risk analysis and mitigation, contractual relationships and proportion of IT to be outsourced. The primary purpose of the theories used in the outsourcing research is to guide the decision to initiate outsourcing projects according to goals, organizational characters and technological, behavioural, or economic biases. The literature review showed, however, these topics can be reduced to two key issues: *How to decide which IT activities should be outsourced with respect to their characteristics?* and *How should IT outsourcing contracts be structured?*

The main finding of the literature review is that it has identified a gap between the management and academic literature regarding the neglect of social aspects by the latter. The available plethora of management literature for practitioners clearly addresses interpersonal issues within outsourcing context and even sees these as critical for achieving success in outsourcing arrangements. This posture of practitioner literature comes from ample *résumés* of best practices filtered upon conducted case studies and

practical examples. At the same time the abundance of academic literature on outsourcing research exhibits stronger adherence to mainstream economic theories and ignores social interaction whereas practitioner literature emphasizes the importance of it.

The theories utilized for outsourcing research can be vaguely grouped into three categories: strategic, economic and social-organizational. The review of academic literature showed unequivocally that the primary theoretical approach to IT outsourcing is economic (TCE in particular), followed closely by a strategic perspective leaving the social perspective subordinate. So far the IT outsourcing literature has mainly focused on the transaction itself, without investigating the strategic characteristics of the organization leaving out of sight a built-in social framework of the firm or social context it is located in. This trend captures the widely held perception that organisational members make outsourcing decisions based upon an economic rationale and regard social factors as negligible in their influence on the overall picture of outsourcing.

Since the 1990s an increasing variety of theoretical perspectives that inform current outsourcing research has been developed. Still, despite proliferating IT outsourcing research, no satisfactory coherent theory is currently proposed. Instead, literature review revealed an approach, frequently deployed by researchers in the field, of combining theories to propose an umbrella-like theoretical framework which hypothesizes the determinants of the firms' IT outsourcing behaviour. Such frameworks are then supported by various case studies and empirical data.

The TCE concept is simple since it assumes only few attributes and seems to be plausible in the outsourcing context that allows the facilitation of the framework as a supporting tool in the decision making process. According to the TCE proponents it provides a logically consistent and ubiquitous framework. However, the theory is subject to certain anomalies and bears major difficulties in operationalizing this theory with regard to IT outsourcing decisions due to the following shortcomings – language ambiguity and disregard of social factors. Many critics of TCE use language ambiguities as plea for difficult operationalization of the framework. It was even claimed that TCE is irrefutable because its *ad hoc* appeals to language ambiguities can always be used to address any anomalies.

The argument put forward here is that in Williamson's TCE version there is too much looseness in the application of the concept of specificity, leading to misrepresentation of relations of dependence between buyer and supplier. Williamson considers asset specificity as the most important dimension of the transaction, followed by uncertainty and frequency. Thus having a valid measure of asset specificity is central to undertake a robust test of TCE. It has to be emphasized that it is not intended to claim that asset specificity is an insufficient condition for dependence as this has to be scrutinised through the models developed in the course of this thesis. The only claim that can be made at this stage is that asset specificity does not have a commonly accepted metric due to its looseness of the definition.

The second source of contention that was found out in the literature research comes from the side of social scientists, namely a strong disregard of social aspects by TCE. Williamson argued that decision makers use cost efficiency as the sole criterion. He recognizes that politics play a role in organizational process, though he argues that economizing is a more superordinate construct than political strategizing. The framework ignores the contextual grounding of human actions and, therefore, presents an undersocialised view. According to Williamson and TCE proponents, transaction costs become the sole criterion for the outsourcing decision if production costs are comparable to these of a vendor. This argument, however, contradicts the findings from the literature review of recent reports coming from "non-academic consultancies" research as these reports and studies stipulate through evidence that social factors proved to be the most crucial factors for the success of outsourcing and offshoring projects.

The fundamental critique of TCE is that it isolates organizational economic actions when such actions should be considered more appropriately as socially embedded in ongoing relationships with internal and external institutional constituents. Learning from hazards in future choices of behaviour in transactions cannot be instrumentalised in the given framework. This point is absent in TCE *a priori* as it is static and belongs to the realm of equilibrium theories and can, therefore, be regarded as a snapshot in time. The framework does not allow for translation of the processes. The usage of transaction as

the unit of analysis by Williamson overlooks the broader historical context which frequently sheds light on outsourcing decisions.

The difficulty in operationalizing TCE result from the ill-defined terms to express drives, the social concerns left unrecognized in the present attributes consideration, and the fact that some outsourcing concerns fall properly under the realm of ethics, rather than economics. Therefore, adoption of theories from other disciplines needs to be critically examined within the discipline it is going to be adapted in. It is rather crucial for TCE to understand what is meant by asset specificity to make a credible statement, whether the given theory accounts for empirical evidence or not. Therefore it is suggested to put forward a methodology of ABSS as a toolkit for critical examination, observation and formalization of the theory expressed in the verbal form. The process of formalization, which is a necessary intermediate step to developing a model, helps to translate textual or verbal description of TCE into a more formal and precise constructs thus helping to gain a better understanding of the theoretical assumptions. Williamson's transaction cost framework is replicated with autonomous, heterogeneous agents as actors of the modelled outsourcing process. This methodology introduces an alternative approach to the investigation of economic theories by means of ABSS and seeks to find an alternative metric for asset specificity with a qualitative flare. The models developed in this context and their simulation results are discussed in chapter 5, chapter 6 and chapter 7.

3 Research Methodology

"A journey of a thousand miles begins with a single step."
Lao-tzu, The Way of Lao-tzu
Chinese philosopher (604 BC - 531 BC)

This chapter is concerned with the methodological problem of how to overcome qualitative and quantitative problems of current outsourcing research while addressing the research objectives introduced in section 1.2. Supplementary, the research at hand addresses whether and how agent-based social simulation can provide a superior alternative to conventional methods of economic analysis. In particular, models constrained by evidence rather than theory provide a better guide to policy.

A methodology of evidence-based modelling was adapted. The rules for the agents were derived partly from the relevant reports and partly from qualitative insight into the modelled target system. These insights were gained from semi-structured interviews with domain experts. Internal and published support documents were collected. The stakeholders were used not only as a primary source of qualitative data but were engaged in the model validation process. The modelling and the field work were done by the same party with data engineering involving stakeholder interactions. A constructive and modular approach to model design was adopted. The first research stage consisted of collaborative fieldwork with industry partners: gathering of relevant data, developing the structure and focus of the future model. Subsequently a mock-up declarative agent-based coarse grained model, based on gathered, scarce data, was developed. Building a mock-up model first was intended to identify data requirements and help to determine which data is important and which can be dismissed. Within the scope of this work two models were developed – TCT Model (cf. chapter 5) and an EBO Model (cf. chapter 6). Exploration and validation of the final models' results happened in a feedback-loop manner together with domain experts leading to changes, alterations and the addition of relevant organisational modules.

Section 3.1 details the process of methodology choice with respect to the requirements stemming from research objectives. Also the rationale for choosing the particular methodology and tools is described. The potential of bottom-up methodology such as *Multi Agent Systems* (henceforth MAS) to analyse the social intrusion into the traditional

economic theory is discussed. The ability of MAS to deal with interactions between social and organizational dynamics as well as motivation for evidence-driven modelling is highlighted. This analysis is linked to the detailed discussion of separate techniques and tools used in subsequent sections of the thesis.

Continuing on from discussion on methodology choice in section 3.1, section 3.2 outlines some principles of evidence-driven research, and the particular considerations that needed to be taken into account for the thesis. The stakeholder participation method, which was central to the evidence-driven approach is described. The instrumental use of agent-based social simulation for the research at hand is explained. Also, a declarative package, that was developed within the scope of this thesis to accommodate the proposed declarative evidence-driven *Agent-Based Modelling* (henceforth ABM) methodology is introduced. Section 3.3 represents a technical take on the ABSS methodology used in this thesis and describes tools deployed and their integration with each other.

Finally, section 3.4 describes the data collection methodology. It outlines how a suitable peer group was identified and approached. Also described is the process of how research objectives were established in collaboration with the experts of the matter in later stages of fieldwork. In particular it is elaborated on the feedback loops with model results evaluation which contributed largely to the emergence of the unplanned EBO Model. The influence of stakeholders' input on the research design, research objectives and model development is described.

3.1 Choosing the Methodology

An experience, shared during the interview session by the IT executive of a Russian bank, that encountered severe problems while expending to the Western market, become the guiding slogan for the methodology choice of the thesis at hand: "*In the beginning there was a problem that seemed to be an ordinary one* (...) *we've consulted best practices for the solution but it seemed that none of these* (best practices) *could be applied to our case, which apparently turned out to be not all that ordinary as we thought initially* (...) *In the end, we had to come up with something of our own.*"[26] This statement also outlines the problem that was faced by the author at the beginning of presented research, as the

[26] The original statement during the interview was in Russian, translation in English is done by the author.

elicitation of the academic literature (cf. chapter 2) did not reveal adequate suggestions with respect to approaching the given research objectives (cf. section 1.2.3)

The author argues that the guidance in the choice of the methodology has to be tightly linked to the nature of the problem and the target system under investigation. These are the characteristics of the target phenomena, and not the theoretic paradigm, that determines whether quantitative or qualitative research is applied and whether modelling or statistics is the way forward in addressing the issue. When a new knowledge elicitation endeavour is started, it can be difficult and harmful to decide the course of actions *a priori*. Constraining the mining of knowledge by a theory upfront will offer some support at the beginning but will limit the reach of vision. Knowledge exploration and mining is an iterative process. Since no road map can be produced in advance, researchers need to feel their way along, adjusting their course as they proceed. Thus a methodology was required, that would allow for enough flexibility to accommodate new knowledge as it becomes available. In the following, the needs and requirements to the methodological approach are outlined.

3.1.1 Micro-Macro link needed (Emergence)

Emergence is an essential characteristic of social systems, yet not addressed properly by the contemporary outsourcing research (cf. section 3.2.2). Traditional approaches like spread sheet and regression analysis or even *System Dynamics*[27] (henceforth SD) are used for prediction of emergent phenomena. Such approaches claim to work from the top down, taking global equations and frameworks and applying them to a situation, whereas the behaviour of emergent phenomena is formed from the bottom up, starting with the local interactions of different independent agents (Bonabeau, 2002b). With an increase of population densities and the number of interactions among entities under investigation, the likelihood of emergent phenomena increases as a consequence. Furthermore, globalization causes great interconnection of market players leading to intertwined relationship networks. Abstracting from the conventional economic assumption of the homogeneous agent with pay-off matrix in his mind and modelling the agents as individuals with a non-game-theoretic approach helps to capture the heterogeneity of the real world.

[27] Popular business-modelling technique that relies on sets of differential equations. See section 3.2.1 for comparison of ABM with SD approaches.

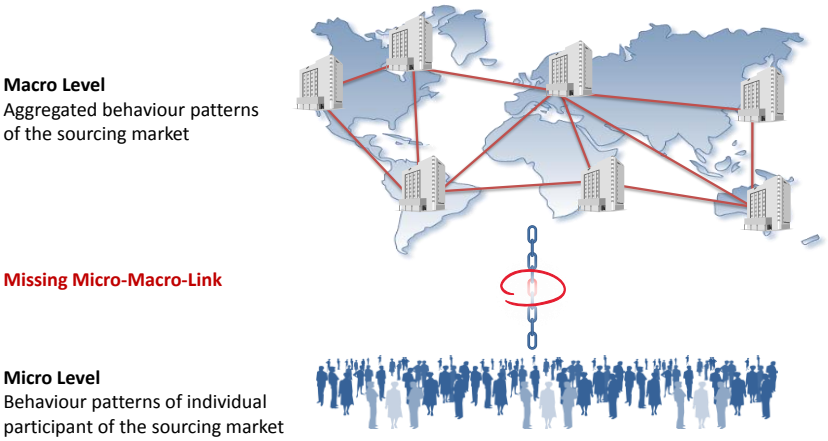


Figure 3.1-1: Missing micro-macro link.

Social behaviour needs to be included in the outsourcing research on a more elaborate basis rather than just excluding it from the outset. Figure 3.1-1 exemplifies the aforementioned issue of the contemporary research with respect to the missing link between micro and macro levels while investigating a target system. As already mentioned in the literature review section, a majority of research is based and conducted on the macro level using aggregated data. It is hypothetical whether policy implications for the micro level behaviour stemming from scrutiny on the macro level are reliable and, above all, relevant to practitioners, whose radius of action is based on the micro level (Lucas, 2011). In order to investigate how interactions of economic agents on the micro level can affect their very own performance and the behaviour on the macro level a tool was needed that will take actors' interactions into account.

3.1.2 Formalization

At first, formalizing and adding precision to the theory seems to be an odd task even tough, the literature review revealed a vast lack of formalism in TCT. Immediately a question appears – *how to formalize something that is apparently already formalized?* Further, literature review showed that research on application of the TCT to the outsourcing issue is positioned on an aggregate level of system abstraction which poses difficulties in applying developed frameworks straightforwardly by practitioners. Rather than making heroic assumptions in order to validate them on the macro level with aggregated data a different strategy is required. A method had to be found, that would allow for a participatory approach and at the same time would allow stakeholders to relate to the expressed theoretic constructs that are under investigation.

Section 2.2.3.1 showed that TCT is incompletely formalized in that such a core concept as asset specificity has no precise definition. Yet, to make it operational for practitioners,

precision is required. Consequently, in order to either support the theory or point out obscurities and eventually suggest alternative metrics an approach was needed that allows for formal description of the theory but on the level of presentation that practitioners and subject matter experts could relate to. Thus, the theory has to be represented in a way that makes it more tangible for both, academics, who can review the assumptions, and non-academics, who practically apply the theory. Arguably, such a model, in contrast to the conventional economics, grounded in the black-box thinking with no sense of progress, is already a progress in social sciences as it is more tangible and thus criticisable. The nature of that precision and the content of the result should be determined in consultation with practitioners in order to ensure as far as possible that the outcome is operational and attractive to them.

Finally, it was proposed to developing a theoretical model, able to capture the main features that govern the outsourcing process with respect to the postulates of TCT. This target could only be pursued by a model able to encompass practitioners' input on outsourcing process and involved social networks. Moreover, the model has to be calibrated using primary data collected in the interview sessions. The research methodology has to support formalization of theoretic axioms and vague statements of stakeholders.

3.1.3 Data Issue

A majority of IT research is of qualitative nature and the tendency is growing but, following up the argument from the previous section, the data gathered and used by researchers is represented in a highly aggregated manner and not appropriate for the modelling of entities on the micro level as intended by the author (see Figure 3.2-2). Aggregated statistics can provide an aggregated behaviour pattern for a certain percentage of interviewees but one still does not know what were the underlying motives of the individuals. Above all, apart from containing generalized and averaged data, the available studies are always lagging the actual development of the investigated field. This is even more the case in such a dynamic field as outsourcing.

Understanding incentives is not always a common sense of the mainstream economists, as otherwise a controversial book by Levitt and Dubner (2005) wouldn't have received from authors such a provoking title as Freakonomics. In the book analytical tools from economics are used to address a range of questions that, at first glance, seem to be

remote from the discipline of the "dismal science". Books like "Numbers Rule Your World" by Kaiser (2010) and "Super Crunchers" by Ayres (2007) with their strong adherence to probabilities and statistics land on the bestseller lists. However, moving on to the micro level of observation, sometimes parametric statistics become meaningless due to fat-tailed and leptokurtic distributions. Moss (2001a, 2002) tries to identify the conditions in which these problems arise. Also, Gallegati *et al.* (2006) and Bentley *et al.* (2009) has reported results on skewed distributions more generally.

The fundamental questions in this context are: *How to discover the knowledge needed for the construction and the operation of an organization, the rules governing interactions?* and *How to extract them from observational evidence?* Extraction of model relevant evidence from the past benchmarking studies was not applicable for the reported research due to the reasons quoted above. Thus the decision was made to conduct new fieldwork studies in order to gain evidence appropriate for modelling.

3.1.4 The Choice

The method suggested in this research is the combination of agent-based social simulation and empirical research (Janssen and Ostrom, 2006). Reflecting on the scope of requirements outlined in the previous section, led to the model design involving multiple interacting entities, i.e. a MAS[28] with a decentralised architecture and composed of autonomously acting agents. Contrary to traditional modelling techniques, MASs are not expressed in terms of variables, functions and equations, but in terms of agents, objects and environment. In addition to providing a natural and intuitive description of a system, they can capture emergent phenomena resulting from the interactions of individual entities on the micro level[29]. In the field of economics, MAS provide an alternative to classical economic thinking in which the behaviour of a group of individuals is represented by a homogeneous meta-agent. Instead, such a group can be seen as a set of interactions among heterogeneous individuals, generating aggregate behaviour that differs from the meta-agent's behaviour.

After some initial difficulties, the agent-based approach is recognised as one of the most promising new tools of investigation in the field of social sciences (Taylor and

[28] A MAS can be defined as a collection of autonomous entities interacting with each other and with their environment.

[29] This is why they are sometimes called "bottom-up" models and are closely linked to the concept of complex systems.

Morone, 2005). The agent-based technique allows for capturing complexity and dynamics of a target system, such as those involved in outsourcing, which constitute an interaction-rich processes. A further important and more general motive here is a deeper and better understanding of relations between processes on the micro level – actions, decisions and behaviours of economic entities – and the emergence of stylised facts on the aggregated level in the model output. That would create the missing macro-micro level link that is missing in the contemporary outsourcing literature. If so, the ABM approach to the issue of outsourcing research offers an innovative and promising way of modelling the actors' behaviour. The apparatus given by MAS provides a powerful tool for the investigation of how macro-level behaviour can emerge from interaction and decisions at the local, individual level. Due to the fact that study of complex systems is an attempt to understand better systems that are difficult to grasp with conventional analytical apparatus, often the way to investigate such systems is through simulation (Gilbert and Troitzsch, 1999). ABSS is used to grasp the underlying mechanisms that can allow us to explain the outcomes, by stressing significant qualitative and quantitative parameters and by extending the experimental evidence (Squazzoni and Boero, 2008).

The propositions listed below summarize facts that served as a motivation for ABM over a variety of other modelling paradigms available for social simulation research:

- Ability to encompass emergence and natural description
    - "Local" description of decision-making.
    - Quantification of assumptions is facilitated.
    - Qualitative as well as quantitative validation is made easier.
    - Emergent properties result from interactions among agents.
- Scalability
    - The level of complexity of the agents can be tuned (adaptability, learning, evolution).
    - The number and type of characteristics of each agent can be tuned.
    - The number of agents can be tuned.
- Ability to incorporate stakeholders into the modelling process
    - Users can more easily connect and relate to the model (self-assessment).
    - ABM fosters formalism regarding loose theory definitions.
    - Narrative strength of ABM results.

While dealing with complex social phenomena ABM often does a tightrope walk between simplification and detailing – introducing too little evidence will make the model too abstract and the results too general. Introducing too much evidence will clutter up the model and obscure significant results. Although ABM employs simulation, it does not aim at providing an accurate representation of a particular empirical application. Instead, ABM enriches our understanding of fundamental processes that may appear in the target system. This requires adhering to the KIDS principle, which stands for the army-like slogan "Keep it Declarative, Stupid" (Edmonds and Scott, 2004). For this thesis the author developed further the approach suggested originally by Gilbert and Troitsch (1999) and refined further in (Drogoul *et al.*, 2002). As further improvement the author added two feedback loops from the data collected and from the knowledge gained (see dotted lines in Figure 3.1-2).

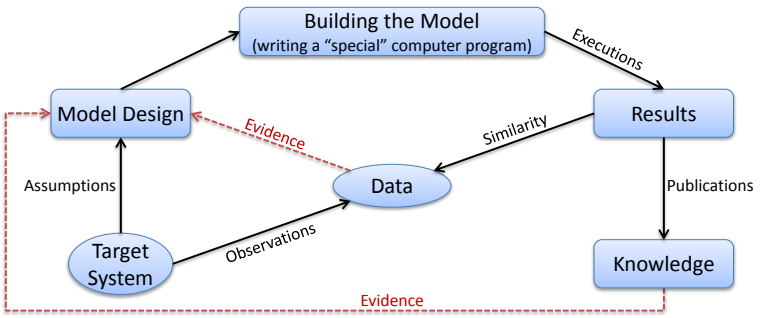


Figure 3.1-2: Process of building a model (in style of Gilbert and Troitzsch (1999)).

Furthermore, as is evident from the Figure 3.1-2, it is suggested that it would be beneficial and more appropriate to use ABM in conjunction with a case study approach. The ABM is a bottom-up approach to generate signatures of the system to be analysed, just by specifying the agents' endorsements and the institutional rules. But many niches of the economic world are still an absolute novelty for ABM. Therefore, one is forced to make own assumptions without the possibility of falling back on the well-studied field. This shortcoming of the investigation is mitigated via usage of an evidence-driven modelling approach (cf. section 3.2.3) that can handle scarce data samples. One way around is to get the qualitative account of gaps in the data through interviews with stakeholders. A highly descriptive account can be obtained through such collaborations. This way the gaps in the model that are not defined by the theory a priori are filled by the evidence stemming from the interviews. Figure 3.1-3 outlines the origins of both models – theory based TCT Model and evidence based EBO Model – with regard to the evidence

sources used for development and validation process. The thickness of the arrows represents the influence grade of components on each other.

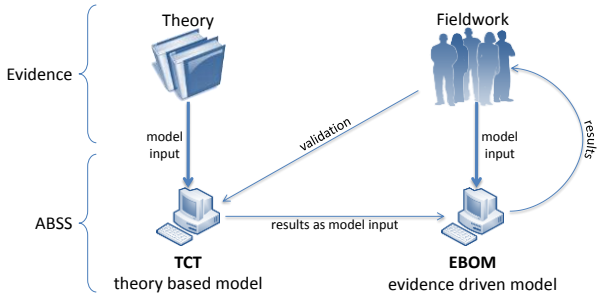


Figure 3.1-3: Interplay of theory and evidence in the development of TCT and EBO models.

The most important and desirable ability of stakeholders in the presented research is that the practitioners should be able to recognise and relate to model behaviour that is consistent with their observations or their own behaviour patterns. Therefore a type of model was needed that would capture behaviour and allow for a participatory approach. The author argues that a declarative capturing of stakeholders' input fosters a tighter link between the simulation, simulation results and practitioners. The process of behaviour analysis and validation is crucial for the type of research carried out because the stakeholders can more easily identify and reason with the model. Furthermore, it can be argued that, when stakeholders feedback is involved, fine grained and detailed models – thus models capturing facets of agents' communication – would be a more natural choice for modelling than coarse grain models that are able to capture only the aggregate system's behaviour. Declarative representation (cf. section 3.2.4) stores information in the form that offers apparent resemblance to the form that is used by stakeholders[30]. The closer the models are based on the target system, as it is in the case of fieldwork based models, the easier it should be for the stakeholders to understand or conceptualise them. On the contrary, more general models, that capture aggregated behaviour patterns, would be more difficult for stakeholders to relate to. Also general models will fail to generate an understanding of the intricacies that might have led to the aggregated system's behaviour. Data from stakeholders will support the specification of the behaviour patterns for each agent type. The properties and technical realisation of the declarative representation in the presented research are discussed at length in section 3.2.4 and 3.3.3.

[30] It can be argued that mathematics (equations) are declarative representations too but are not expressed in the form that stakeholders would recognize. As was emphasized in the chapter 1 already, the term declarative is used in this thesis with primary emphasis on rule-based structure.

3.2 Agent-Based Social Simulation

The purpose of this section is to explore the potential of bottom-up models, in particular ABM, to analyse the social intrusion into the traditional economic theory. The enrichment of the ABM methodology with evidence-driven features is introduced and the benefits of this integration are highlighted.

Dynamic networks of interacting entities are present in ecosystems, financial markets, cities and many other realms of everyday life. To attempt to discover general principles or rules underlying these complex structures bottom-up simulation models such as cellular automata and agent-based models are deployed. An agent-based model is a programme of self-contained entities called agents and a system is modelled as a collection of these autonomous decision making agents. Each agent separately assesses its situation and makes decisions determined by given set of rules. Agents might carry out behaviour patterns appropriate for the domain they represent (i.e. consuming, producing, etc.). Simulation of social agents in particular is summarized in the generic term ABSS.

ABSS is a transdisciplinary field and therefore satisfies multiple requirements of various fields (see Figure 3.2-1). Instrumental interest from sociological point of view is quite legitimate – interest of sociologists is not on understanding the preconditions of the action but on the actions themselves. At the same time it allows for precision of statements with a touch of generalization.

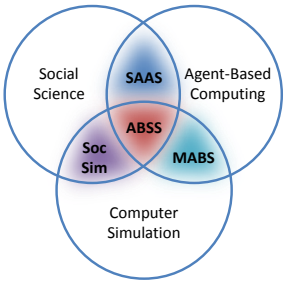


Figure 3.2-1: ABSS and its components.

Figure 3.2-1 illustrates the research area of ABSS as an intersection of the three scientific fields – agent-based computing, social science and computer simulation. It becomes clear that the main focus of ABSS according to the characterisation and point of view adopted here is the area where all three fields intersect. ABSS applies agent-based computing and, in particular and naturally, multi agent systems to social modelling and analysis. Social simulation differs from agent-based computing in having a strong emphasis on interaction amongst agents and resulting complexity.

Despite all the promise of ABSS, a simulation represents only a descriptive attempt to model an investigated part of the domain, the explanatory power is constrained by the assumptions made and translated into a formal model. Implementation of computational representations of organizations confronts a trade-off between the sophistication of the representation of individual cognition on the one hand and the complexity of the modelled organization on the other hand (Moss *et al.*, 1997). If so, when is the use of ABM justified? The answer to this question is provided in the next section.

3.2.1 When is ABM appropriate

As to the question of when the ABM paradigm is appropriate, it is argued that it is most useful in situations when social interaction and (or) cognitive biases are known to be important, when individual behaviour emerges bottom-up, when equation-based modelling would impose too many restrictions, and when controlled experimentation is infeasible. If the behaviour one is trying to model can be aggregated in a set of equations, then ABM is not the way forward. ABM is appropriate when important aspects of the behaviour cannot be aggregated, i.e., when the target system is “lumpy” or “rough” such that it cannot be modelled as “smooth” or “homogeneous”, or when the “lumpiness” or “roughness” is precisely what one is interested in optimizing or exploiting.

ABM stems from the field of distributed artificial intelligence. The approach of distributed artificial intelligence deals with systems consisting of multiple entities that possess some level of autonomy, social ability, proactive behaviour and are capable of interacting with each other. These components are able to perceive their environment and also react to changes in that environment in accordance with their goals. ABM makes strong use of bottom-up design. Consequently, lower level behavioural rules are specified first, thus preceding the specification of higher level or aggregate layers (Taylor, 2003). For human-centred systems, when it is important to consider a heterogeneous population, the agent-based paradigm seems to be the most useful approach to use for the modelling process. There is a structural correspondence between the real system and the model representation, which makes them more intuitive and easier to understand.

A bottom-up approach does not rely on any centralized control or blackboard like systems. The control of the systems supposed to emerge autonomously from the specification of the lower level behaviour rules (specified interaction processes amongst

the entities). This appeal to the phenomenon of emergence is representative for ABM (Waldrop, 1993; Taylor, 2003).

The very general purpose of simulations is to understand or illustrate some aspects of the target system of interest. A widely cited definition of a model given by Gilbert and Troitzsch (1999: p. 2) in their textbook, which is often quoted as a good introduction to the field of social simulation modelling, reads as follows: "*model is a simplification – smaller, less detailed, less complex, or all of these together – of some other structure or system.*" The model should be less complex than the real system, and lead to some improved understanding of how the real system functions or might function. The authors also argue that computer-based approaches to social simulation can help researchers achieve a variety of different objectives (Gilbert and Troitzsch, 1999: p. 4-6; Edmonds, 2001). Researchers might use social simulation tools in order to:

- Obtain a better understanding of social processes, especially dynamic ones.
- Make predictions about the occurrence of certain social events (e.g. demographic predictions or business forecasting).
- Simulate human abilities by modelling knowledge with expert systems.
- Aid theory development by formalising theories and testing via simulation.

Considering the aforesaid, agents can be thought of as intelligent, autonomous programs that interact with other components of the system and their environment in order to affect a certain set of programmed goals. Figure 3.2-2 illustrates the abstraction level of any target system with respect to the two distinct modelling worlds – AMB and SD paradigm.

If the researcher believes that the entities in the target system are heterogeneous in the sense that they respond under different situations, and their actions are strongly influenced by their interactions with a subset of other entities, then ABM provides an efficient "language" to formalize the stated hypothesis. On the other hand, if it is believed that the entities are still heterogeneous, but their actions are mainly driven not by their interactions with others, but by environmental factors (agents influence each other indirectly via the environment), SD may provide an efficient language in formalizing and analysing this system. The mathematical modelling technique of SD makes a strong use of feedback loops with flows and stocks. In contrary to ABM, SD exhibits a fixed probability of moving between different states.

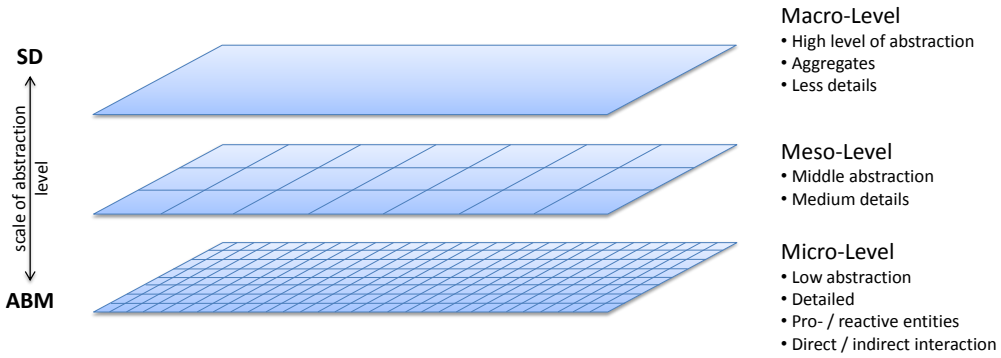


Figure 3.2-2: Abstraction levels of ABM and SD approaches.

ABM is clearly distinguished from other kinds of modelling research by this focus on the concept of agents. It is a relatively new research field, and as such there is a lack of established theory and research methodology underpinning the design of models, standards for programming platforms, verification and validation of models, techniques for comparison of models and for establishing the generality of models. However, agent-based modelling is now rapidly gaining attention in many different areas due to its interdisciplinary appeal. In the field of agent-based simulation therefore there is wide use of "toy models" – simple systems which bear little resemblance to reality because they are based on assumptions derived from a more general theory. This type of model may therefore be classified as exploratory and focused on theory building. A series of mock-up models developed for the first interview round with stakeholders represents this type of models.

Described characteristics of ABSS suggest that particular strengths of the approach are obvious in the context of heterogeneous environments with interacting agents. Whether it is a useful advantage with respect to outsourcing research is going to be discussed in the next section.

3.2.2 Implications for Outsourcing Research

The first question that needs to be answered in this context is whether replicating TCT foundations in the context of heterogeneous actors will add any value to the theory? The answer to this question is not straightforward.

For example, the mathematical treatment of diverse problems in economics has longstanding and well established foundations. One should recall equation based modelling as an example of the aforementioned mathematical treatment. However this kind of problem treatment requires the environment to be considered as homogeneous, which means that the method is really only suitable for the class of problems where

entities can be represented as such. If one recalls the issue of social embeddedness of TCT mentioned above, one should seriously consider expansion of TCT examination in the heterogeneous contexts thus enriching the purely econometric observation.

Central to all modelling research is the issue of power of expression and descriptiveness of models (typified by qualitative approaches such as ethnography) on the one hand, and clarity of expression and precision of formal methods (typified by quantitative approaches such as mathematical modelling) on the other. As explained by Moss (1999), due to very different backgrounds and training, researchers normally approach the problem from just one point of view, and there will be not much traffic between those aligned on opposite sides. Moss argues that agent-based modelling occupies a middle ground, and is a very powerful approach because it combines the rigor of formal logic with the descriptiveness of the agent paradigm for representing social actors and their interactions. Through this approach it will be possible to "shift out the trade-off" (Moss, 2000) between relevance and rigour in models of social processes.

Therefore the theory based model described in chapter 5 offers a step towards a formalization of some TCT aspects. Terms which were ambitiously used with no exact definitions in the guidance to outsourcing will ought to prove their validity on the test bench of a modelling toolkit.

3.2.3 Evidence Driven

As introduced in section 3.1.4 a methodology of evidence-based modelling was adopted. The rules for the agents' behaviour were derived partly from the relevant reports, partly from qualitative insight into the modelled target system and partly from feedback loops upon preliminary model results during the fieldwork research.

The term evidence based modelling has become one of the key themes in leading simulation forums and mailing lists (e.g. SimSoc[31], SocNet[32], Naacsos[33], Nep-Cbe[34], Scelist[35]). Compared to classical modelling processes in which researchers build models in

[31] News and discussion about computer Simulation in the Social Sciences (www.jiscmail.ac.uk/lists/simsoc.html)
[32] International Network for Social Network Analysis (http://www.insna.org/pubs/socnet.html)
[33] North American Association for Computational Social and Organization Sciences (http://www.casos.cs.cmu.edu/naacsos/)
[34] New Economic Papers Report on Cognitive and Behavioural Economics (http://lists.repec.org/mailman/listinfo/nep-cbe)
[35] Society for Computational Economics Announcement List (http://lists.repec.org/cgi-bin/mailman/listinfo/scelist)

their laboratories before presenting them to policy-makers, such an approach is based on the assumption that an increased participation of local stakeholders in the construction of models dealing with issues affecting them would benefit not only the local stakeholders, but also the researchers and the policy-makers. It is important that the modelled processes and structures resemble the processes and structures identified in the target system (Boero and Squazzoni, 2005). ABSS models go beyond mere input-output models as the analytical focus lies on agency, structure and how the two bring about social reality.

It is argued that models informed by evidence about the target system are descriptively more accurate. Admittedly, the information for the model can emanate from empirically tested theories, stakeholder and subject matter experts or case studies. Geller *et al.* (2007, 2010) argues for triangulation of these information sources in order to mitigate the issue of bias. Furthermore, the model is considered to be evidence-driven if these sources contribute to and inform the agents' representation, their reasoning, their environment and the rules for agents' behaviour. In the particular case of the research at hand it means that any decisions with respect to how many types of agents are implemented, who the agents are, how they reason and act upon specific social stimuli and situation, have to be drawn from evidence available. To date, however, this approach has been a niche activity in the social simulation research (Geller and Moss, 2008a).

Following the need of tighter link with stakeholders the exploration and validation of the models' results happened in a feedback-loop manner, together with domain experts (cf. Figure 3.2-3). Thus, through constant cross validation with stakeholders and domain experts, the author claims to be on the right path for achieving "good social science" according to Moss and Edmonds (2005). In the modelling process the author went from evidence and was forced to add some assumptions as it is not possible to move completely to evidence based models. It is argued that by means of constant cross validation with stakeholders and domain experts instead of matching results to circumstantial evidence the simulation results gained credibility. Inclusion of stakeholders into the process of mapping the social entities' cognitive processes and consequent validation of their final state being influenced by both endogenous and exogenous factors allowed practitioners to relate to the models' outcomes.

In the presented research the following validation strategies, also proposed in (Alam *et al.*, 2009; Geller *et al.*, 2007, 2010) have been applied:

- Numerical output of the models has been analysed statistically and the resulting signatures are compared with signatures obtained from target system data.
- To ensure models' construct validity the models have been validated internally. In order to reveal any structural and process similarities between the model and the target system the data generation mechanisms in the simulation and in the target system have juxtaposed to each other.
- Simulation was reviewed for traces of circumstantial evidence existing in the target system.

Every validation strategy entails some strengths and weaknesses as there will be some parts of the model that are well validated and some will be more of an exploratory nature. Thus, the aforementioned strategies have been used in combination as far as possible.

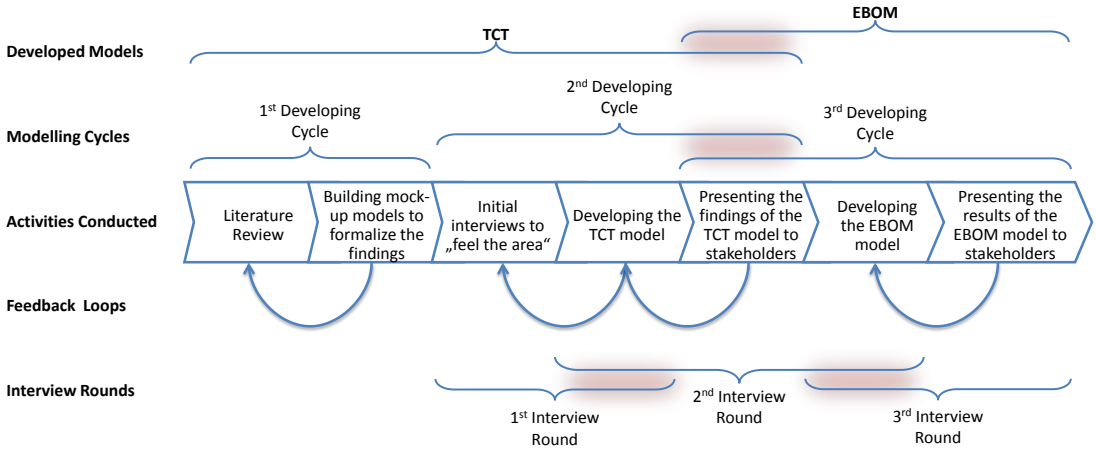


Figure 3.2-3: Research roadmap.

Due to the reasons above an activity schedule was designed that allows for a strong interaction bandwidth between modelling and the fieldwork research as they form a cohesive team (see Figure 3.2-3).

Essential to evidence-driven modelling is stakeholders' involvement in the model development process. In this participatory approach, relevant actors, whose behaviour is to be mapped into the model contribute to evidence gathering, validation and results exploration process. As evident from Figure 3.2-3 the behavioural rules of the agents were gained from semi-structured interviews with domain experts. Additional to interviews some internal and published support documents were collected. Arguably, the close

participation of stakeholders insured that models captured issues that are of relevance to them. The involved stakeholders have been used not only as a primary source of qualitative data but also have been incorporated into the model validation process. It should be remembered that the sample used for qualitative studies was opportunistic. Selection process of stakeholder peer groups is discussed at length in section 3.4.1.

3.2.4 Declarative

The design of agents in ABM can be either procedural (driving agent behaviour by algorithms implemented in a language such as Java or C++) or declarative (driving agent behaviour by logic-like, *if-then* rules) so that the behaviour and social processes emerge only at runtime. Therefore, before the modelling could start a decision had to be made which paradigm of information retrieval and storage to follow. This section juxtaposes both programming styles and elaborates shortly on the model-to-model[36] comparison project that the author participated in with regard to the aforementioned issue. It will be shown that in order to address challenges posed in the previous sections it is natural, convenient and effective for purposes of validation (Moss and Edmonds, 2005) to model agents' behaviour declaratively.

The term declarative is used in the thesis in a slightly non-standard way, namely to emphasize the rule-based structure for information processing and storage. This definition of the term is confirm with the one developed and extensively used at the Centre For Policy Modelling (henceforth CPM), Manchester Metropolitan University. For reasons of clarity the author provides a definition of the term declarative as used in the thesis:

> *A program is declarative if it applies facts and rules to model the target system's behaviour. Facts describe the system's state or, if used in agent-based simulations, the agents' knowledge about the system. Rules are used to produce new facts and delete or alter existing facts, or in other words, to manipulate the agents' knowledge. Each rule consists of a set of conditions and a set of actions to be performed when there are facts that match the conditions. The sequence of rules that will fire and the particular facts that will match them are determined only as the program is running. The sequence of actions represents the process of agent behaviour and leads in each case to a*

[36] For further reading on model-to-model comparison and analysis refer to Hales *et al*. (2003).

> *new state of the environment. If all agents are implemented declaratively, then they will be changing the state of the environment for one another and the pattern of rules and therefore actions of all of the agents taken together will be influenced by one another.*

The outcomes for the model as a whole are, in these circumstances, impossible to predict with any exactitude. Frequently, such models exhibit the sort of episodic volatility associated with complexity. The same effect can be achieved by other means, but declarative representations of agents have a number of virtues in terms of ease of development as new evidence becomes available and in terms of yielding comprehensible outputs.

The procedural approach is clearly useful and enormously successful in physical science applications. At the same time, procedural programming supports only a poor representation of human cognition because, as one gains experience and is influenced by others, one reasons about one's decision making procedures and might, as a result, change the steps and (or) the order of the steps one takes in reaching decisions. Moreover, the order in which one considers issues and the conclusions one draws are contingent on both environmental stimuli and one's own internal states. It is much easier to represent this view of cognition as a logic like process in which statements on a database activate rules that add further clauses to the database. The order in which rules fire can be consistent with a formal logic or by some arbitrary conflict resolution scheme (Moss *et al.*, 1997). Perhaps the biggest advantage of declarative implementations is the ability of agents to use knowledge in ways that the model designer did not foresee.

According to Moss *et al.* (2000b), for a proper involvement of stakeholders it is the responsibility of the modeller to ensure that the developed models add to the stakeholders' understanding of the internal process which lead to results they observe or believe to be plausible. Also, the models should allow stakeholders further exploration of the consequences of their actions. *De rigueur* is the requirement to ensure that stakeholders can track how the information they supply during interview sessions is implemented into the model. All of the aforementioned imperatives are provided by the declarative modelling approach.

Rule-based programs are everywhere and thus do not pose a novelty to an average consumer. Their applications include everything from mail filtering to order configuration, from monitoring chemical plants or diagnosing medical and software-hardware problems to giving advice on the PayPal platform (see Figure 3.2-4). The wide pervasiveness of rule-based paradigm in the everyday life was hoped to facilitate collaboration with stakeholders.

Figure 3.2-4: PayPal Louise – a rule-based agent as How-To adviser for the PayPal platform.

It is author's understanding that declarative modelling is often the most appropriate technique to capture social phenomena (Moss and Edmonds, 2005) whereas many physical or biological processes are best described by numerically based formalisms. Also, the author is confident that programming languages that are closer to natural language make observed phenomena easier to describe.

3.2.4.1 *Declarative vs. Procedural*

The procedural and declarative controversy has been a topic of hot discussions for a long time in the scene of artificial intelligence (Moss and Wallis, 1995; Winograd, 1975). Much of the programming people do is procedural[37]. In procedural programming the programmer tells the computer what to do, how to do it and in what order. Thus procedural programming is well suited for problems in which the inputs are well specified and for which a known set of steps can be carried out to solve the problem. This is not the case in real life as it is not deterministic – procedures are contingent upon outcomes and are found to be linked in a non-linear way. Moreover social scientists never have the complete set of input parameters, have to juggle with the ones supplied and have to derive assumptions of the model. Declarative (rule-based) modelling can provide the way out since only parts of the simulation are modelled in procedural way. However the

[37] Here the word procedural is used in a slightly different way than it is widely used in the information scientist's *metier*. Object-oriented programming is traditionally contrasted with the older procedural programming paradigm. Moreover, much Object-oriented programming follows procedural structures. In both procedural and object-oriented programming, the programmer writes all the logic that controls the program flow. For the purposes of this discussion, the two terms are set equivalent.

opponents of the declarative approach might criticize it as the rule firing order is left to the “arbitrariness” of the rule-inference engine.

While procedural programming is well-suited for well-structured problems, declarative programming is better suited for capturing the agent’s cognition and behavioural rules. As Moss (2007) has argued, representing agents’ rules declaratively facilitates their qualitative validation by the stakeholders. Declarative programming requires a more descriptive style. The modeller must translate the relationships that hold between various entities. The virtues of declarative knowledge representation for the social scientist are the ability to use knowledge in ways that the model designer did not foresee and some extent of freedom given by the rule-based approach. It is possible to supply a system with a limited number of rules to reason with and to observe the outcomes. Thus, declarative paradigm provides a suitable basis for bottom-up simulations.

Declarative programming is much more intuitive than imperative programming in many situations, in particular situations requiring the aforementioned sort of reasoning. Rather than making heroic assumptions on behaviour and the environment in order to ensure that one can roll out comparative statistics, one can use agent-based modelling methods. Rule-based programs excel at solving problems that are difficult to solve using traditional algorithmic methods, and they work even when the input data is incomplete, which will obviously be the case in any qualitative research. However, when there is no statistical data available for the target system declarative models do entail an advantage over procedural models insofar as they yield to qualitatively intelligible output which can be cross-validated by means of qualitative data analysis. Thus, declarative models enable the researcher to track the logical path of agent dynamics. Moreover, at any time emerging qualitative output as produced by declarative models can be regarded as a complementary source of epistemological evidence to statistical output.

Committing to the declarative approach was a tricky decision in earlier times of social simulation. This decision required deep consideration as declarative programs (models) were much slower than their procedural counterparts. It was a necessity to limit the complexity of computational models in order to achieve some valuable results. However it is not proclaimed that declarative style is useful in every situation. A particular architecture may use both declarative and procedural knowledge at different times, taking advantage of their different strengths. This is the route that the author took for the

research at hand – a declarative add-on package was developed (cf. section 3.3.3). The distinction between declarative and procedural representations is somewhat artificial in that they may easily be exchanged, depending on the type of processing that is done on them.

It is a widely discussed issue that outcomes of ABM models, especially if they are individual based, are reproducible only by exactly reproducing its software implementation (Ropella *et al.*, 2002). With a declarative approach for the research at hand it was aimed to escape the problem of close dependence of the result of an ABM on its implementation by making at least the simulation flow independent from implementation. On can still argue that using another inference engine will not produce the same data but this discussion is going beyond the scope of this paper. However, the author suggests that the relevant question is *Whether the model design and outputs are validated* rather than *Whether another rule engine would produce different results*. It is also conceivable that different rule engines might produce equally plausible but nonetheless different results.

3.2.4.2 *Model-to-Model comparison*

From the early days of ABM, the computer science and the Artificial Intelligence community have argued over the advantages and disadvantages of the two modelling styles, especially their capacity to incorporate social evidence, i.e. qualitative and (or) quantitative data describing a particular social phenomenon. In parallel to the research presented here an investigation on Model-to-Model comparison was made in collaboration with researchers from CPM. Within the scope of investigation three different agent-based social simulation models, each of which is once procedurally and once declaratively implemented were scrutinized under the presumption that procedural programming deals more efficiently with highly formalised problems, such as theories, while declarative programming is better suited to cope with ambiguous evidence-based information describing agent cognition or behavioural rules. A lacuna in this respect is the question if the two implementation styles lead to qualitatively different model results at the micro and macro level. The first model is a simple, although not trivial intuitive model on passengers' seating preferences in a public transportation bus (Alam and Werth, 2008). The second model is informed by evidence-based theories of contemporary conflict and addresses the issue at a higher, meso-level of abstraction (Geller and

Moss, 2008b). The third model is about the impact of socio-economic stressors in a village in South Africa (Alam and Meyer, 2010).

All three models have been implemented in Repast, while the declarative versions make use of the JESS libraries in conjunction with Repast (cf. section 3.3.3). Werth and Moss (2007a) have reported on their experiments about integrating JESS and Repast. Model-to-Model comparison is beyond scope of this thesis, however, being involved in the model comparison project induces confidence in the modelling tools chosen and developed for the outsourcing models. In the following, an abridged summary of preliminary results are presented (Alam and Werth, 2008):

- There is an early indication that declarative models of social simulation, while being more time consuming in the development process, are able to take more social evidence into account than are procedural models.
- From the development process it is evident that with growing scope of simulations, the declarative models allow for ease of re-development when new evidence becomes available to the researchers.
- declarative approach allows for iterative development which facilitates the stages of research where the field study is not complete yet and researchers do not possess the full information portfolio needed for the simulation.
- Field work conducted for aforementioned models showed that with scarce or absent statistical data available for the target system, declarative models do entail a slight advantage over procedural models regarding models' output. Declarative models yield to qualitatively intelligible output which was cross-validated by means of qualitative data analysis. Thus, declarative models enable the researcher to track the logical path of agent dynamics.
- Finally, the emerging qualitative output produced by declarative models can be regarded as a complementary source of epistemological evidence to statistical output.

3.2.5 Endorsements[38]

Focusing on what agents reason about in order to make a decision requires a dimensional analysis of an agent's decision space that includes the agent's context. Questions concerned with a dimensional analysis such as *who is preferred over who*, *why* and *when*, provide essential insight into social relations and their underlying causes, and in a broader

[38] Some parts of this chapter are based on (Alam, 2009; Geller *et al*., 2007, 2010).

sense into the social structure an individual is embedded in (Geller *et al.*, 2010). Interactions between at least two actors play a pivotal role in most agent-based models. The computational implementation of these interactions must be based on certain grounds. This can be knowledge an actor has about another actor, experiences an actor has had in the past within his environment or actor's socio-cultural situatedness. Endorsements are a "natural" way of computationally implementing reasoning about this knowledge or experience.

3.2.5.1 *Who endorses whom?*

Endorsements were introduced by Cohen (1985)[39] as a device for resolving conflicts in rule-based expert systems (see also Moss, 1998). Endorsements can be used to describe cognitive trajectories aimed at achieving information and preferential clarity over an agent or object from the perspective of the endorsing agent himself. The author used endorsements exactly in this sense, namely to capture a process of reasoning about preferences and the establishment of a preferential ordering (Moss, 2000; Moss and Edmonds, 2005).

Because endorsements capture the reasoning process of one agent, the endorser, about another agent, the endorsee, the information collected by the endorser is not objective but of a subjective nature. During the endorsement process the endorser's endorsement scheme is projected onto the endorsee. In the case of the EBO Model (cf. section 6.2.1.2), if a client endorses a vendor, he has no basis to rate whether the vendor would be a better contractual partner if he is internationally active or not. But the individual endorsement scheme tells the client how important it is for him that the vendor has offshore subsidiaries. If this is done for each of the endorsee's attributes, the so called overall endorsement value E_{stat} for the endorsee can be calculated as depicted in equation below

$$E_{stat} = \sum_{e_i \geq 0} b^{e_i} - \sum_{e_i < 0} b^{|e_i|}$$

while b is the number base and e_i is the value of the i^{th} endorsement token. E_{stat} allows the endorser to choose the preferred one among a number of endorsees. The concept of endorsements presented above is binary – either an endorsee receives a label reliable or unreliable attached to him by endorser or not. The degree of reliability is not expressed in

[39] First mentioning of the endorsements concept by Cohen is in (Cohen and Grinberg, 1983).

endorsements and the author strongly argues for the reasons explained elsewhere that personal feelings and perceptions of modelled agents should not be expressed numerically.

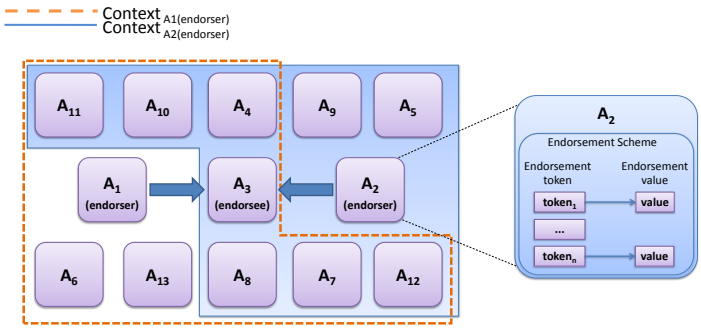


Figure 3.2-5: Schematic representation of the embeddedness of the endorsement process.

The process of choosing an agent is embedded in an agent's context, i.e. the agents visible or known to him. Relying on endorsements allows an agent to find the agent most appropriate to him within his context. This implies that the chosen agent may not be preferable to differently embedded agents with a different endorsement scheme. Figure 3.2-5 depicts two agents, A_1 and A_2, in the process of endorsing a third agent, A_3. A_1 and A_2 have different contexts and different preferences which have an influence on their decision to choose an agent to endorse. It has to be remarked that endorsements do not build or try to reproduce an optimizing process. In the optimizing process the agents A_1 and A_2 would endorse the endorsee A_3 as the "best choice". Instead the two endorser agents, A_1 and A_2, endorse the endorsee, A_3, with respect to their specific context. The proverbial idea of utility maximisation assumes a rational choice and this is not the case in the models developed by the researcher. There is no transitivity across agents. Indeed, since 1930s economists have largely rejected the possibility of interpersonal utility comparisons (Drakopoulos, 1989; Kaneko, 1984). Thus, endorsement values are not comparable between agents.

The main advantage in applying the idea of endorsements lies in the fact that they allow for combining the efficiency properties of numerical measures with the richness and subtleties of non-numerical measures of interest or belief. The *endorsement scheme* is constructed like a HashMap in the Java programming language – it contains *endorsement tokens* and their corresponding *endorsement values*. The endorsement token is something like a characteristic of the object (i.e. reliable, unreliable, same ethnicity, different ethnicity, etc.). At the beginning of the simulation possible endorsement tokens

are defined and token values are setup (both done by the modeller). However, in the course of the simulation the values of tokens can be changed by the agent regarding his particular past experience and track of records.

In the first version of the TCT Model presented in this thesis, all agents possess over structurally equal endorsement schemes. Each individual agent's endorsement scheme exhibits individual (distinct in the sense of unique to the agent) values for the number base *b*, and the value e_i of the i^{th} endorsement token but the list of endorsement tokens is equal. The implementation of homogeneous endorsement schemes led to acceptable simulation results, despite being a gross simplification. Homogeneous endorsement schemes tilt towards the same weakness as statistical models by neglecting the heterogeneity of social reality. Different agent types have different functional characteristics and should therefore also have a cognitive structure that corresponds with their agent type. In the case of the TCT Model, the endorsement scheme consisting of endorsement tokens like trust, reliability, reputation and personal relationship should have a diverse range of weightings on certain endorsements. In particular, according to the interviewed consultants, the factors which influence the perception of risk for the client are different to those for the vendor. Clients consider for example trust, reliability and personal relationship as crucial building blocks of a healthy transaction whereas vendors, on the other hand, do care more about the client's reputation. It has become clear during the interviews that clients and vendors do have distinct endorsement cosmoses and care for certain endorsements more than for others.

3.2.5.2 *Typifying Endorsements*

The solution for the aforementioned issue in the previous section was a move to assignment to an agent of a not completely randomized endorsement weights e_i, but weights which are in accordance with the particular agent type. Hence, if it is assumed that the client is most sensitive to continuous deterioration of *Service Level Agreements* (henceforth SLA)[40] and not to occasional SLAs undercuts, the reliable endorsement must be considered more important and therefore receive a higher weight than any other endorsement in this particular agent's endorsement scheme. Consequently, this would allow for a more precise translation of stakeholder information. Figure 3.2-6 depicts such

[40] A service level agreement, frequently abbreviated as SLA, in the outsourcing field is a part of the outsourcing contract with the formal definition of the service level. In practice the term SLA usually refers to the contracted delivery time of the service or service performance.

a typified and weighted endorsement scheme in contrast to (Moss, 2000, 1998) where each agent receives a structurally equal endorsement scheme. An ordering based on interview evidence is imposed but allows for differences in endorsement and base values as long as those differences preserve the empirically indicated orderings.

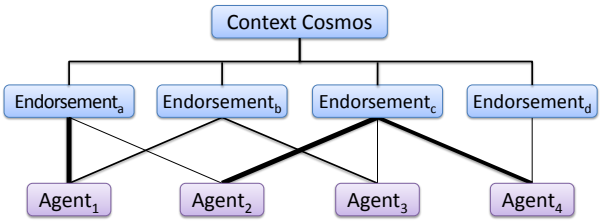


Figure 3.2-6: Heterogeneous endorsement scheme.

In Figure 3.2-6 the thickness of the lines indicates the importance (weighting) of a particular endorsement for a particular agent. Thus, $agent_2$ cares the most about $endorsement_c$ and much less about $endorsement_a$ whereas $agent_1$ cares more about $endorsement_a$ and less about $endorsement_b$ but still more than $agent_2$ about $endorsement_a$. Although the endorsement's weights e_i remain randomly assigned, they are now assigned within a particular numerical range characteristic of an agent type. The order preserving structure is provided. In addition, each agent type may have a different subset of the overall set of endorsement tokens.

In the EBO Model (cf. section 6) the dyad of exchanging partners endorses each other constantly during the whole period of a transaction (cf. section 6.2.1.2). In the case of the client, this models the constant monitoring of the vendor's performance and compliance to clients' requests, and in the case of the vendor it models the monitoring of the payment duties. The application of endorsements as presented in section 3.2.5.1 does not adequately represent the dynamic character of cognitive process at place and does not allow for expression of a mediocre satisfaction with the transaction or a satisfaction grade, which would change with respect to the number of performance measures below/above a certain performance threshold.

The EBO Model went even further and tried to compensate for the underrepresented dynamic character of endorsements in the TCT Model. Originally, an agent's endorsement process is founded on a discrete (i.e. non-continuous) assessment of the endorsee's endorsements: only the most recent endorsement values are considered. Consequentially, an agent's cognition is based on a binary perception of environment. With respect to the fieldwork evidence this issue would have led to undesirable results in

the EBO Model as the static conception of endorsements leads to a misrepresentation of the dynamic endorsements like constant SLAs undercuts/sporadic SLAs undercuts, reliable/unreliable and successful/unsuccessful. Arguably, these endorsements should inherently depend on an agent's historicity. The endorser can only endorse the endorsee regarding his SLAs undercuts continuity if he has a point of reference that lies in the past and that enables him to compare a previous state with the current state, or if he can estimate the (positive or negative) trend of a number of previous states.

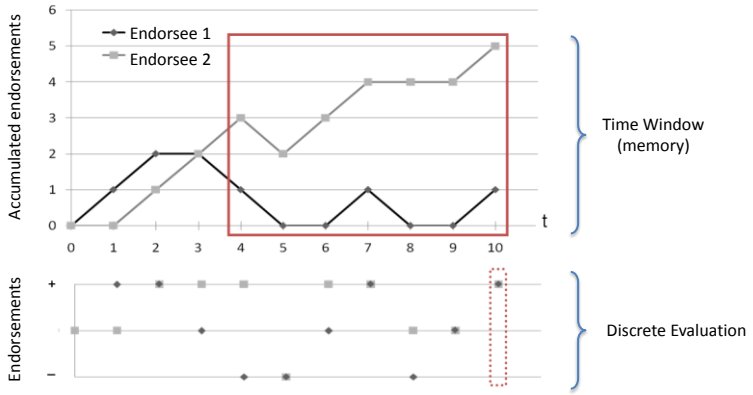


Figure 3.2-7: Discrete versus continuous endorsement evaluation process.

In (Geller *et al.*, 2007) an improved procedure was suggested that allows for a continuous data formalization. Figure 3.2-7 shows the accumulated progression of a particular endorsement for two different agents over time. When choosing between these two the discrete endorsement evaluation process (dashed) relies on ahistoric and binary data collection, as it only samples one point in time. The continuous evaluation process (solid), on the other hand, applies a time window and thus relies on experience and multi-valued data sets. Experience presumes that an agent possesses a "memory" that allows him to collect endorsement data over time as if he would gain knowledge. The time window models an agent's "memory". The size of memory may be chosen randomly from a numerical range in order to allow for variety among different agents. The collection of multi-valued data implies that the endorser does not only increase his knowledge of the endorsee on the basis of dichotomous variables but is building up his knowledge on the basis of accumulated data. For further elaboration of the topic read (Geller *et al.*, 2007; Alam *et al.*, 2009).

3.3 Tools

A separate section is devoted to the description of tools selected for the methodology described in section 3.1. Ropella *et al*. (2002) offers three reasons why software design and/or choice in ABM is important:

- most of the results in ABM are of emergent nature in a system of interacting agents.
- result of ABM are anticipated to be innovative, making implementation errors hard to find.
- often ABM models have nonlinear and multi-thread process control, making trace back simulation processes hardly possible.

There are a wide range of tools and frameworks to support ABM. Some widely used and some limited to small communities. In the author's opinion a simulation framework has to simplify the process of model development, facilitating the implementation of the model, the record of evidence and the collection and processing of results. In this section it will be shown that agent modelling tools like Repast[41], enriched with declarative abilities in particular, can contribute significantly to the quality, creativity and efficiency of social science simulation research efforts. Also, the section provides a clear view of the conceptual idea underlying declarative packages and a view of when and how to use it.

3.3.1 Repast – the Imperative Component

Because a thorough assessment of the effectiveness or reliability of the software conducted by the author on his own was beyond the given timeframe, supporting material from the agent-based community was used. Accordingly, tools' documentations, FAQs, corresponding mailing lists and developers' introductory papers have been reviewed. Also, JASSS papers on evaluation of simulation toolkits and general discussion papers on simulation environments (Tobias and Hofmann, 2004; Mentges, 1999; Gulyás *et al*., 1999) offered a good database for toolkits' reviews. The author's observation of the tendencies in the ABSS community led to the decision to review only Java-based frameworks. The choice of the programming language is important because different languages have different implications in terms of ease of programming, portability, and compatibility. The decision to favour the Java-based toolkits echoes the widely held perception of the ABSS community that Java is becoming accepted as a

[41] Recursive Porous Agent Simulation Toolkit

standard programming language. This is one of the few standards in the community that allows for easier model sharing with other researchers in the field.

All of the shortlisted simulation environments were reviewed with respect to criteria that were chosen following (Castle and Crooks, 2006; Leszczyna, 2004; Tobias and Hofmann, 2004):

1. Availability and acceptance by the ABSS community.
2. Richness of documentation available (i.e. developer's documentation, HOWTOs, tutorials).
3. Support offered (i.e. FAQs, mailing lists) today and future hosting of the software package.
4. Modelling (i.e. agent paradigm constraints, known installation and modelling issues, known advantages or disadvantages).

Finally, the weighted evaluation sheet was used to select the most appropriate simulation toolkit. Of the frameworks considered, Repast appeared to be the most appropriate for the social simulation style described in section 3.1.4, with widest range of examples and better tools and design templates. In the following the assessment of the toolkit with respect to the aforementioned criteria is provided:

1. Repast is released under the BSD license and thus is freely available for download with source code. A recent review and comparison of Java based agent modelling toolkits (Tobias and Hoffman, 2004) showed that Repast is one of the leading free and open source large-scale agent-based modelling and simulation library that is widespread and frequently deployed in the ABSS community. Repast is available as a full implementation in Java that makes interface development to potential declarative packages easier.
2. Repast provides extensive documentation. Besides technical documentation, there is a whole series of "How-to" documents that make it easy to become familiar with the software. In addition, the Repast Web site provides numerous publications by Repast users for download.
3. Repast maintains a support mailing list[42]. A member list allows access to users and developers. Questions are answered promptly, support is informative and helpful. Repast was created by Social Science Research Computing at the University of

[42] http://lists.sourceforge.net/lists/listinfo/repast-interest.

Chicago, USA, and is under constant development and extension. The future of the software is assured for the next five years.

4. Here an abridged list is provided: *(i)* Repast contains a number of tools for visualization and data editing; *(ii)* solution of the stepping problem and dynamic control of the simulation is supported and means for scheduling behaviour of agents in the model are provided, though the integration of extended functionality has to be implemented by the user; *(iii)* support functions for control and recording of simulation series; *(iv)* speed of simulation processing is mainly dependent on the hardware utilized; *(v)* Repast puts very few limitations on agents; *(vi)* Repast supports various sorts of spatial relationships; *(vii)* inbuilt agent and world (model) semantics.

3.3.2 JESS[43] - the Declarative Component

Assuming the deployment of the Java-based simulation toolkit a Java-based declarative package was required that would, if feasible, seamlessly integrate with Repast. This could then be linked to the Repast framework to extend its functionality. Also a licence issue had to be considered since a package had to be freely available for academics in order to facilitate stronger dissemination of the model. Various declarative packages are known for embedding their own languages and entailing a steep learning curve. Therefore, the ease of use and flat learning curve were desirable. From the set of reviewed tools JESS best fulfilled the above requirements .

JESS is a rule engine and scripting environment written entirely in Sun's Java language by Ernest Friedman-Hill at Sandia National Laboratories in Livermore, CA. The fact, that JESS is Java based simplified and speeded up application development with respect to the time necessary to develop the same application by using declarative packages in other programming languages. Despite having a proprietary license, JESS is free of charge if used solely for academic purposes.

JESS treats all computation as a cluster of *if-then-else* statements, in Java or in any other language. Anything computable can be computed that way. JESS works the *if-then-else* statements until no more rules can be executed. The package is non-monotonic in nature, meaning that the data can be added or deleted from the problem set without affecting the results. A rule engine like JESS lets modellers write interrelated logical statements separately, leading to clearer code, and it evaluates them efficiently for large quantities of

[43] For more information on Jess the best resource is the online manual (Friedman-Hill, 2006).

data. Programming with rules works very well when you're coding a problem that doesn't have an algorithmic solution – a fact that was desired by the researcher *a priori* as such data represents precisely the information stakeholders deliver. Also, JESS can work with incomplete information and still reach a result, though maybe not the one that it would reach with all of the possible known facts. The reason for this lies in the nature of a declarative programming language, where there are sets of statements on a database, rules have a set of conditions which are statements with some values left open as variables, and consequents exist which are another set of statements. Therefore this structure makes it easy to edit, add or exchange the underlying logic incorporated into rationale of the agents.

Recapitulating an argument brought forward in section 3.2.4 with respect to rule-based systems being well known in the stakeholders' *metier*, thus not only being used in the lab itself but that also in business, JESS epitomized a tool that was on the upswing in the data warehouse area at the time of research (Alexander, 2004). Thus, the tool fulfilled the expectations for providing a smooth medium allowing involved practitioners to get used to the handling of the tool with ease. Jess is both a rule-based system for executing expert systems written in the Jess language and a rule-based language for specifying expert systems[44] (Friedman-Hill, 2006). The models presented in this thesis make use of the latter option.

As rule-based models can be developed iteratively, simplifying the process of testing and debugging. After some sophistication level it is very tedious to add and test new features to the agent. As a general rule these changes will entail alterations on numerous places in the program. These disadvantages vanish with usage of rule-base systems – a particular rule can be added or removed from the system without any changes in the structure of the program implementation. The advantage of the implementation of rules in JESS is the fact that once agents' reasoning is done, one can simply export rules in a separate file and import them in another model eventually written with a different implementation of agents' environmental constraints. This way the agents' reasoning is of course not completely model and system independent but is to a certain degree portable.

[44] An expert system is a system that can reason about facts about the world using rules, and takes appropriate actions as a result. Sometimes expert systems are also called rule-based systems due to their technical specification via rules and facts.

3.3.3 Procedural Declarativeness

This section introduces a declarative add-on for general purpose modelling frameworks and claims that the usage of this package has potential in making the process of bottom-up analysis and interactions with stakeholders easier. In part, the declarative approach described here arises out of the history of development and application of the SDML[45] language at the Centre for Policy Modelling (Edmonds *et al*.,1996; Moss and Edmonds, 2005). In the course of further development on declarative modelling two approaches were developed. The initial implementation presented here has been strongly influenced by the author's previous use of Repast, and integrates easily with the framework. Section 3.3.2 outlined that Repast is a widely used and supported framework in the ABSS area, and therefore efforts should be directed towards a declarative extension to support this framework, rather than a general extension for multiple frameworks.

A major clue in the implementation of the declarative package is that the rules do not fire as strictly as in the case of a procedural models. Sometimes, the model's output may be sensitive to the order in which the conditions have been coded in the implementation. Arguably a well-designed *if-then-else* choreography might mitigate that issue but in general procedural programming requires more foresight of the future course of actions in the model. Rule-based models use conflict resolution mechanisms to decide which of multiple possible rules is to be fired. In some sense, this works like the minds of the actors that are represented as agents in the model. Interacting agents in the modelled outsourcing world perceive the environment, i.e. the number of potential contractual partners on the market and their preference configurations.

For reasons long rehearsed elsewhere (e.g. Moss, 1998), cognition is best represented declaratively by logic-like rules. At the same time, physical processes most naturally represented procedurally. These two modelling paradigms were achieved by incorporating JESS into a Java programming environment controlled by Repast. This implementation design is depicted in Figure 3.3-1. The overarching model architecture is simple. Everything that has to do with cognition is implemented in JESS, the rest is implemented in Java. In their architecture, Repast serves as a central place for simulation control and time-scaling. The socio-economic stressors stemming from environment,

[45] For further references on this modelling language refer to (Edmonds *et al*., 1996; Moss and Wallis, 1995).

geopolitical incidents and other environmental effects are modelled procedurally in Repast due to the assumption that they do not require reasoning abilities.

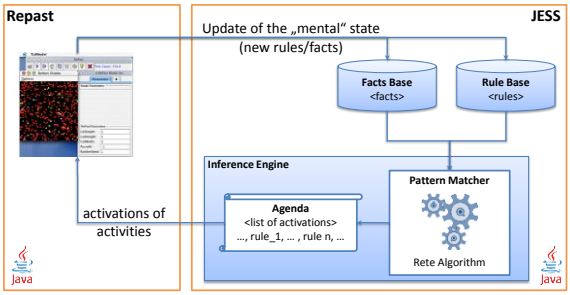


Figure 3.3-1: Image JESS and Repast interaction.

The working memory stores facts about the world and the rule base and the rule base stores the system's rules. The rules and the facts form the JESS part of the simulation. The inference engine is the "black box" that performs reasoning over the facts and rules and uses the *Rete* algorithm. Inside the rule engine, the pattern matcher selects rules that are applicable given the facts in the fact base, and activates these rules - that is, places them on the agenda. Then the execution engine fires the rules on the agenda in a particular order. Agents need to have situational awareness (about themselves and their environment) to be able to act proactively in a sound way – this is reached through the feedback loop from Repast instances to the rule and fact base instances of JESS.

Any computation that does not require agent's cognition is modelled procedurally and is therefore fast. JESS is used for representation of human reasoning solely. Facts and rules a person need to know for reasoning (services offered or needed, contractual partners, records of past experience, etc.) are put in JESS by Repast (see Figure 3.3-1). Upon these data, the inference engine produces an agenda which causes particular rules to fire. The firing of rules may cause either an activity of an agent in the environment or a change of his "mental" state in creating new rules or facts for the very same agent.

Moreover, the order in which we consider issues and the conclusions we draw are contingent on both environmental stimuli and our own internal states. It is much easier to represent this view of cognition as a logic-like process in which statements on a database activate rules that add further clauses to the database. The order in which rules fire can be consistent with a formal logic or by some arbitrary conflict resolution scheme (Moss *et al.*, 1997). Perhaps the biggest advantage of declarative implementations is the ability of agents to use knowledge in ways that the model designer did not foresee. This

architecture uses both declarative and procedural knowledge at different times, taking advantage of their different strengths.

3.4 Data Collection Methodology

The first step in developing any rule-based model is collecting the knowledge the model embodies. The current section outlines how this task was accomplished within the scope of this thesis. Every rule-based model is concerned with some facets of the target system's collected knowledge. This subset of the knowledge builds the domain of the model. The modeller enters the process of collecting information about a domain for processing it in a declarative way – a process called *knowledge engineering* – and becomes a knowledge engineer himself. Inevitably in this role he must learn about the domain in which the target system resides and operates. Without gaining a certain level of expertise the modeller is not able to interpret the input from stakeholders. As a frequent side effect of the knowledge engineering process, the modeller becomes an expert.

The modeller in his new role as a knowledge engineer can use many potential sources of information to penetrate the domain. At large, for the presented research, these sources can be reduced to two: fieldwork interviews and desk research. Considering that one will be studying the temporal behaviour of the system regarding outsourcing dynamics, there is an abstraction of the way components in the observed market system interact and yield some top-level behaviour patterns. To properly simulate, explore and experiment with the ABM paradigm the author had to detail the agent's endorsements, the environmental assumptions and the institutional setting. Special consideration was given to a cognitive endorsement process. According to Geller and Moss (2008a, 2008b) the idea of endorsements serves two aims. First, it differentiates and defines the relevant dimensions agents reason about. Second, it implements agent's cognition in a natural way, being able to use mnemonic tokens found in the evidence informing the model.

To clarify the processes of data collection and their relationships in this thesis during a models' life cycles, refer to the Figure 3.4-1 whilst reading the following explanation. The target system represents an actual social phenomenon – outsourcing dynamics – being researched, from which empirical data should be collected and analysed. In the first phase a set of theory driven mock-up models, based on modellers assumptions harking back on the TCT grounds, was developed. Obviously this process entailed a feedback loop

to incorporate a new knowledge the author gained along the literature review process. Once the first modelling cycle was completed, the modeller opened the first interview round to discuss the plausibility of selected, particularly relevant observations and assumptions with involved stakeholders. Simultaneously, the second modelling cycle had started. This cycle entailed two feedback loops as one can see from the illustration in Figure 3.4-1. The initial interviews as well as the feedback on the first versions of the TCT Model influenced strongly the final concept of the TCT Model. This was a loop process as both the author and the involved stakeholders had to reach a common understanding of what has been analysed and whether hypotheses drawn from this task contain enough realistic assumptions. The stakeholders feedback resulted in the development of another, entirely evidence based, model. Therefore, the third development cycle as well as the second interview round overlap with the previous ones. This means, that still during the discussion of the TCT Model the development of the EBO Model has started. Similar to the development of the TCT Model the EBO Model was accompanied by the constant cross validation of stakeholders from the second and third interview rounds.

3.4.1 Peer Group

The right choice of the subject matter experts[46] is crucial for the participatory approach. They must be clearly defined and integrated in the modelling process to facilitate their understanding, grasp their relationships, and address their issues. While choosing the stakeholder peer group the following two questions were of immanent nature – *Which industry shall be concentrated on?* and *How does one select representative and, above all, non-biased representatives of that industry sector?* The current section tries to provide answers to these questions.

Selection of the stakeholder peer group was made paying particular attention to the aspect of continuous agents' behaviour validation process that will take place during the interview rounds. Among the different validation methods, stakeholder evaluation promises to be the most reliable because stakeholders are sensitive to results that do look "suspicious", that is, the stakeholders are not able to relate to agents or agents' behaviour patterns. In the process of theory formalisation, as in the case of the TCT Model, it was critical for the author to differentiate which information is essential for the model from what is just contextual information. Some information is necessary to

[46] The author defines a domain expert as someone who has a deep knowledge in the relevant problem area of the target system.

understand the social phenomena, but may not be relevant for modelling. The latter obviously comprises much more data than the former, so it is important for modellers to clearly justify their decisions in differentiating these two (Lucas, 2009). Every validation stage of any model entails some strengths and weaknesses as there will be some parts of the model that are well validated and some will be more of an exploratory nature. The issues of validation in this thesis are discussed in section 3.4.2 at length. It can be suggested that the model behaviour is well validated in terms of vendors' and clients' behaviour patterns since the majority of the selected stakeholder peer group – consultants – represents both aforementioned groups. Figure 3.4-1 shows a composition of the peer group in terms of ratios for types of organisations involved and in terms of numbers of interviews conducted with each organisation type. Arguably such detailed knowledge can only be realised through a combination of analysing empirical data and discussing findings with domain experts that are direct participants in the social phenomena (*ibid*).

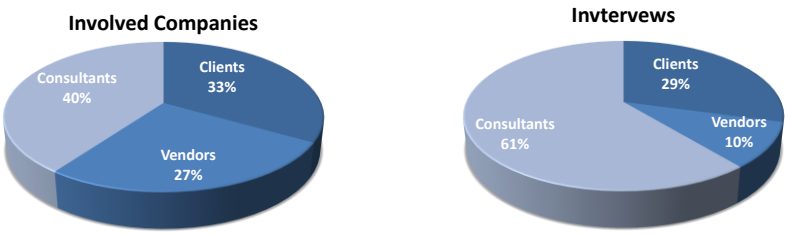


Figure 3.4-1: Composition of the peer group with respect to the type of involved organisations and number of interviews conducted.

In the literature review chapter it was discussed that such a highly debated and controversial topic as outsourcing is best investigated using the example of financial institutions. The financial sector has always represented the most conservative part of the society and of the outsourcing market but has increasingly tried to get a foothold in the outsourcing area recently. Arguably, the debate of core and non-core services within a scope of a financial institution is examined more rigorously than in other industries.

Consultancies have been chosen as the most viable alternative to obtain an informed view on the outsourcing arena. Arguably, consultants are the central point of contact for outsourcing strategies and considerations as they represent the paramount source for knowledge and beset practices dissemination nowadays. Furthermore, consultants provide a great track record of projects in the outsourcing field and can therefore offer an abundance of qualitative data to inform the model building. Common practice in

outsourcing projects is the dissemination of the best of breed practices by consultants taken aboard. This trend increasingly allows for perception of the coordination processes with respect to IT as increasingly commoditised (Poppo and Lacity, 2002). Subject matter experts as described above are exactly the type of stakeholders that were used for qualitative data. The anecdotal evidence incorporated into the model comes from interviews with stakeholders involved in outsourcing projects, either on the client side or on the vendor side or, as in the case of consultants, on both sides simultaneously. Figure 3.4-1 illustrates the composition of the various stakeholders interviewed by the author. It should be remembered that the sample used for qualitative studies was opportunistic.

3.4.2 How Do I Validate My Own Behaviour?

The evidence obtained is best described qualitatively and the rules individuals give for their behaviour are of qualitative nature as well. Therefore, as argued by Moss and Edmonds (2005), validation of software agents as adequate representations of real actors is made smoother by designing agents to perceive events specified by narrative descriptions, maintain the qualitative terms during processing these qualitative perceptions and then act in way that can be characterized qualitatively. A proposed way of maintaining the qualitative link between the language of the actors and the language of the agents is to use modelling tools where perception conditions and actions followed on these conditions can be defined in rules. This was given by the strong adherence to the declarative paradigm.

The information from the initial set of interviews led to the development of strategies to specify the model input and translate the strategy of a company into action rules. A simple stack of white index cards with each potential rule on one side of an individual card proved to be useful (cf. section 8.2.4). The cards have been useful during the interviews because they allowed for on-the-fly-grouping of the reported rules according to various criteria The reverse side of the card was used for notes on issues and comments regarding the corresponding rule (see figure 8.1-2). This stack of cards represented the final product of knowledge engineering and experienced the same evolutionary process as the rules in the corresponding models. The cards themselves proved to be a useful format in communicating information to stakeholders. In the interview the stack of cards could be unfolded on the pin board and, thus, can provide an overview of the whole rule map of the model at a glance. After formalizing the new

knowledge on the index cards during the interview, obvious gaps that require additional information were quickly identifiable. The rules are formalized in pseudocode that is more formal than narrative speech but is still easily comprehensible by involved interviewees. The pseudocode cards are not meant to suggest how the real rules might be coded into the model, but provide guides and a common medium for the interviews.

After the initial conception of the model, the next step has been to validate the patterns that the modeller has previously identified on simulation results. Most of the mailing lists (cf. section 3.2.3) with relevance to agent-based research have experienced some longstanding discussions on the topic of model validation. Thus, only a validation approach chosen for this thesis is outlined. CAVES reports (CAVES, 2006a, 2006b, 2007a, 2007b, 2008a, 2008b) provide a good overview and discussion platform regarding validation of evidence-driven agent-based models with extensive stakeholder interaction.

The author argues that it is impossible to fully validate every aspect of the model but only partially. Model validation is the process of determining that the model behaviour represents the target system to satisfactory levels of confidence and accuracy, which are determined by the intended model application and its application domain. When dealing with complex systems, as it is frequent in ABM, the traditional methods used in model validation are not widely accepted (Brown, 1996). In such cases, a good option for the validation of the conceptual model is to check whether the theoretical foundations and assumptions are reasonable within the context of the objectives of the simulation. This structural validation is sometimes performed on the basis of participatory methods with experts in the modelled domain and stakeholders (López-Paredes *et al.*, 2005).

Validating a computational model is a difficult and tedious task, especially if one aims at the investigation of the micro-macro relationships. But the difficulty and tediousness pays off as validation is tremendously beneficial. A successful validation allows the modeller to have confidence in the analyses of model results. Besides such confidence, validation offers an opportunity to learn the strengths of the model and to understand the boundaries beyond which the model begins to break down (Schreiber and Kathleen, 2004).

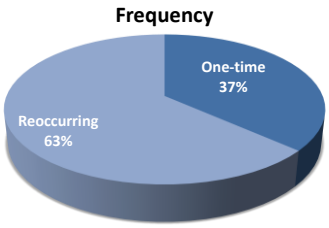


Figure 3.4-2: Composition of field research interviews regarding one-time and reoccurring sessions.

Most of the interviews were of iterative nature. However, the author tried to maintain a certain fraction of sporadic one-time interviews (see Figure 3.4-2). It is argued that one-time interview sessions lower the probability of stakeholder bias – stakeholders, who experienced several iterative interview sessions, might develop a genuine bias towards the model conceptualization and model results respectively.

The agent-based model included behavioural patterns that were aimed to specifically reproduce the behavioural patterns reported by stakeholders. Apart from parameters within the agents' rules the environmental parameters had to be identified and their values defined. ABM is often used to model interactions between entities. These interactions are much harder to measure and are typically sensitive to initial conditions, which makes prediction much more difficult for these systems. Parameter space exploration (cf. sections 5.3.3 and 7.1.2) was part of the model validation process and was incorporated in the interview sessions. Figure 3.4-3 illustrates a typical loop within a stakeholder supported parameter exploration process. After a set of parameters under investigation and some sensible values for these parameter were identified with stakeholders the simulation was run. These results were then reviewed together with stakeholders being involved in the previous parameter identification process.

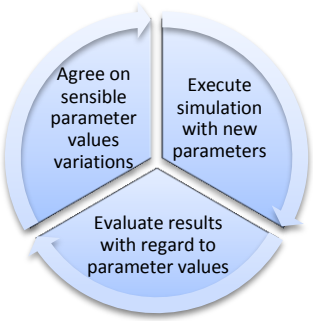


Figure 3.4-3: Model parameter exploration.

Based on the experience in the fieldwork interviews, the author strongly encourages a constant cross validation with stakeholders while conceptualizing the model. Discrepancies between the interview statement and modeller's computational translation

of the interview input posed a frequent encounter. Many misunderstandings could only be clarified in the interview process, as commonly unintentional oversights of important details can happen if modellers do not interact with the relevant stakeholders. Parameter exploration and validation of the models' results happened in a feedback-loop manner together with domain expert leading to changes and addition of relevant organizational features. Thus, by means of constant cross validation with stakeholders and domain experts the author claims to be on the right way for doing good social science in accordance with (Moss and Edmonds, 2005) as previously mentioned in section 3.2.3.

3.4.3 Interviews

As evident from Figure 3.2-3 the mock-up modelling was done during literature review phase. This allowed the author to get familiar with the jargon and fundamental concepts of the domain. With this rough idea of what kind of knowledge the model needs to have the modeller entered the qualitative knowledge engineering part. People are the best source of information about the requirements for a system. Many collaborators have submitted background documents to the author. Despite the best intentions, such documents rarely capture the expectations for a model development process in enough detail to allow the model to be implemented. It is illusory to imagine that a desk research can substitute for interview experience. Often, the modeller can get the missing details only by talking to stakeholders himself. These days it's common to suffer from information overload when you try to research a topic—there are so many conflicting resources available that it's hard to know what information to believe. The stakeholders in the system can tell you which resources they trust and which ones they don't. To mitigate arising issues with conflicting statements during interviews a strategy for resolving conflicts had to be established. Figure 3.4-4 illustrates an interview strategy that was adopted to resolve any arising issues within a span of several interview sessions.

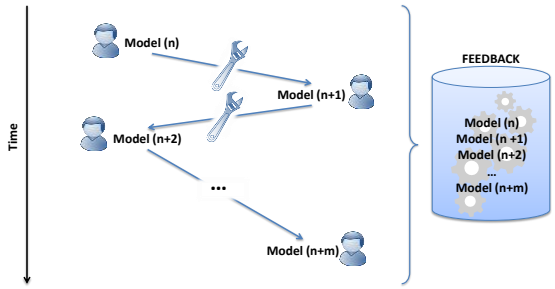


Figure 3.4-4: Interview Roadmap for reoccurring interview sessions.

Both roles, that of stakeholders and modellers, are described in (Downing *et al*., 2000) and suggest, for involvement of stakeholders into the modelling process, to clarify the understandings of stakeholders and ascertain that these understandings or beliefs alternatively are coherent across different stakeholders involved. It is believed to follow this path with the participatory approach as depicted in Figure 3.2-3 and refined in Figure 3.4-4. That participatory approach was designed by the researcher to assure a consistent understanding of the model by the stakeholders peer group at any development stage of the model. The strategy above was also influenced by the creed that development shall not be deferred until knowledge engineering is complete (which will probably never be the case with real-world systems). Therefore each consecutive interview in every interview round was guided by the prototype model with encoded knowledge that was collected in the previous interviews. In case encoding was not possible due to time limitations, the grouped stack of cards, mentioned in the previous section, has been used. To facilitate a coordination of the development process, whenever possible, the author tried to present a prototype of the system to the expert at every interview.

The issues of making quantitative data amendable to the formal techniques of modelling are challenging ones. The mapping of the anecdotal evidence from the field research into the model are discussed at length in section 5.2 and chapter 6. ABM opponents usually reproach ABM with unrealistic assumptions about the structure of conventional social behaviour being studied, a fact which poses extra obstacles to cross-validate models at macro and micro levels (Lucas, 2009). This problem was mitigated by keeping tight links to stakeholders during the model creation and validation phases. For all interview rounds the methodology introduced in (Yin, 2003) was adopted. In order to allow for a flexible approach to interviewing some topics of discussion emerging from simulation results' presentation rather than a fixed list of interview questions was the guiding mechanism during the interview sessions.

From the author's perspective, after some initial difficulties to establish the channels to the companies, the resulting interview setup may be termed as efficient. Any assumption that the author had to include during the process of model development could at least be confirmed as plausible during the fieldwork interview sessions. Thus the process of model development in the thesis at hand was based on quantitative as well as the anecdotal evidence and was conducted hand in hand with the fieldwork.

The author strongly believes that the involvement of stakeholders, to be used as sources for empirically grounded simulations that allows to explore underlying mechanisms on the effect of interaction, can only be facilitated properly if the relationship is non-unilateral. ABSS suffers from congestion with "toy models" which although have an academic purpose but are not valuable to practitioners (Lucas, 2009). Due to the reasons above the author tried to establish a bidirectional flow of knowledge with stakeholders. Thus it was aimed to expose the involved stakeholders to all four steps in the learning process, as identified in (Kolb, 1984: p. 38) (see Figure 3.4-5).

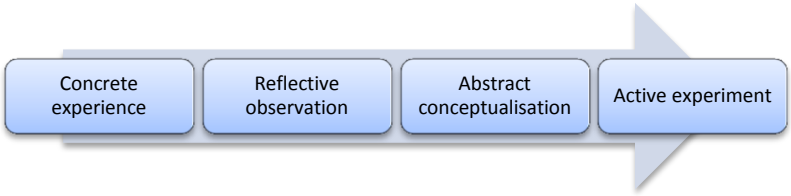


Figure 3.4-5: Learning process according to (Kolb, 1984).

In the course of interviews the researcher-stakeholder relationship experienced an alteration with respect to the institutional affiliation. The researcher become a full time employee of a management consultancy. This "fraternity pledging" spurred the exchange collaboration with stakeholders. The effects of the author's employment are discussed at length in section 8.2.1. The following sections outline activities in each of the interview rounds regarding the data collection process.

3.4.3.1 *First Round – answers leading to more questions*

The first interview round was used by the modeller as well as by the involved stakeholders to get to know each other, find out the needs of the opposing party and discover what resources each side would contribute. At the first interview session the author gave a short presentation about ABSS modelling and its applications to various areas of interest. Consequently a mock-up model and its results were demonstrated. A revealing experience was that even though none of the stakeholders had an initial apprehension of modelling concepts and principals of agent-based modelling, they were able to relate to the model and agents after only a short while. Stakeholders could quickly adopt to rule design procedure as the vocabulary used stemmed from TCT and presented a familiar jargon to them.

Knowledge engineering is an iterative process. Developing a model which is tailored to new issues one cannot make a road map in advance. Instead one feels the way along,

adjusting the course of actions dynamically. Building a mock-up model can point to data requirements and help to determine which data is important and which data can be regarded as subordinate. After the initial interview, the author tried to organize and structure the information gathered. A strong use of mind-map diagrams was made. The deployment of this technique, especially in the first interview round, when the information flow is still unstructured allowed to arrange the elements intuitively according to the importance of the concepts. This way the information was classified into groups and areas with the goal of representing causal and semantic connections between portions of that information.

The TCT Model has been developed through multiple distinct versions. The first version was based on preceding mock-up models and constructed with little input of domain expertise in order to capture the theoretic postulates of TCT. This model represents an attempt to describe a social process that is consistent with both the qualitative data provided by stakeholders and other domain experts and observed characteristics of time series data concerning the outsourcing market. Each successive version of the model has been subject to validation by domain experts. Their validation concerned both the representation of agent behaviour and interaction as well as characteristics of the top-level behaviour output. The stakeholder feedback on preliminary model results has been used as parameter input into further model versions.

Implementing an agent-based model is not equivalent to translating social or economic theories into software. The author suggests that already agent-based simulations themselves are useful to clarify sociological and economic theories. The process of formalisation without ambiguities and vagueness of knowledge and assumptions about social behaviour is *de rigueur* in the knowledge engineering phase. This phase in conjunction with the subsequent cross validation of model outputs builds the process of theory clarification which is the primary objective of the TCT Model. However, the first interview round was shaped more by questions than by answers, since the answers given by stakeholders spurred an exponential growth of questions. In retrospect, it should be said that this process goes hand-in-hand with the aforementioned objective of the TCT since the questions arose not only on the researcher’s side but on both sides of the table.

3.4.3.2 *Second Round – the mistrust of unfathomable*

One of the interviewees baptised the second interview round as a "post-mock-up era". Another interviewee suggested "back to the stack cards" as a more appropriate baptismal name, jokingly alluding to the movie title "back to the future". Both notations echo the title given by the author. Indeed the mock-up models vanished in the first interview round and had been long forgotten and replaced by iterative versions of the TCT Model. The information flow has become more structured which triggered the strong use of stack cards (cf. section 3.4.2) to foster more efficient rule extraction. Yet the concept of stack cards, as efficient as it is, presented to stakeholders an archaic feature in a modern, and not fully trusted, process of ABM.

As mentioned before the main objective of the TCT Model is the reproduction of the individuals' behaviour inspired by TCT and willingly abstract from any thoughts of social components that might matter in the target system. Initially it was intended by the author, after model validation, to gradually "feed" the model with social modules while observing the clustered and volatile behaviour that might emerge as a consequence of actions on the top level. However, after the TCT Model closely replicated the TCT it did not allow for the micro-macro link. The model was short of replicating the resulting distribution of economic activity across different organisational forms emerging bottom-up from processes of interaction between agents, and their adaptation of future decisions according to agents' past experience. After extensive validation the model was condemn as being "far from reality"[47]. Finally, the majority of stakeholders voted for a complete redevelopment of the model from scratch with entirely new assumptions and behaviour rules.

Thus the TCT Model was not able to express the complicated patterns of dependence which have been expressed by the stakeholders. It is arguable, whether the information mining for the EBO Model should be classified as a distinct knowledge engineering process. In the author's opinion the failure of the TCT Model to reflect practitioners' issues is just another milestone in the overarching process of knowledge engineering for the final model. This milestone heralded the new data gathering emphasis in the second interview round. Since the EBO Model is entirely evidence based the rules according to which agents behave are not derived and reified from theory and preceding desk

[47] A comment statement during one of the interview sessions in the second interview round while a final version of the TCT Model – a theory based model – were presented.

research. Rather they are modelled directly from qualitative insight into the target system gained from case-studies and conversations with experts and stakeholders. Only case-studies that give concrete information of the behaviour of target system actors are of direct use to evidence-based modelling. Each successive version of the EBO Model was a subject to validation by domain experts and stakeholders. Their validation incorporated both the representation of agent behaviour and interaction as well as characteristics of the aggregate time series output. This approach differs fundamentally from the usual approaches to statistical research and extends the usual approaches to qualitative research.

3.4.3.3 *Final Round – the Gnosis*

Again, the title above is a baptismal name given by one interviewee for the final interview round. The name echoes stakeholders' reaction to presented EBO Model results. After a tedious process of rules extraction in the second interview round, practitioners were intrigued by the behaviour patterns exhibited by the model. Especially, the relevance of the model contribution to the current issues of practitioners resulted in the so called "gnosis". The fact that stakeholders served not only as primary data resources but were also vital in the model validation process increased the acceptance of results.

The formation of social structures in a population is a complex process. Fundamental to the investigation of social structures are the patterns of relationships. The bottom up validation of the EBO Model happened in large part in the second interview round. The final interviews were dedicated to investigation of the relationship patters that emerged bottom-up – making the micro-macro link the validation centre of gravity of the third interview round. The advantage of the declarative system made the validation smooth. The declarative representation of the micro behaviour could considerably mitigate difficulties in terms of information preparation and presentation as the information is stored in the form closer to natural description used by the very same stakeholders. Coupled with the fact that vast majority of stakeholders in the third interview round was involved into rule design in the second interview round made it easier for them to identify themselves with the model. The results of the validation as well as ample discussion of EBO Model results is presented in chapter 7.

The fieldwork researcher is also an employee of the institute that is specific to the project. The modelled subject and the current occupational area of the researcher are

strongly-coupled. In retrospective the change of researcher's status only intensified the validation process of the EBO Model. Reflection on authors employment on the stakeholder interaction are discussed at length in 8.2.1.

3.5 Conclusion

This chapter is concerned with the methodological problem of how to overcome qualitative and quantitative problems of current outsourcing research while addressing the research objectives introduced in chapter 1. In addition, the research at hand addresses whether and how ABSS can provide a superior alternative to conventional methods of economic analysis. The author argues that the guidance in the choice of the methodology has to be tightly linked to the nature of the problem and the target system under investigation. These are the characteristics of the target phenomena, and not the theoretic paradigm, that determine whether quantitative or qualitative research is applied and whether modelling or statistics is the way forward in addressing the issue.

As mentioned in the literature review, a majority of outsourcing research is based and conducted on the macro level using aggregated data and therefore misses the link between micro and macro levels while investigating a target system. The author doubts whether policy implications for the micro level behaviour stemming from scrutiny on the macro level are reliable and, above all, relevant to practitioners. In order to investigate how interactions of economic agents on the micro level can affect their very own performance and the behaviour on the macro level a tool was needed that will take actors' interactions into account. Already first interview rounds made evident that extraction of model relevant evidence from the past benchmarking studies was not applicable for the reported research. The models based on this data mismatched the stakeholders' observations to a great extent. Therefore, the decision was made to conduct fieldwork studies in order to gain evidence appropriate for modelling. Thus a methodology was required, that would allow for enough flexibility to accommodate new knowledge as it becomes available in the course of the fieldwork.

Considering the requirements stemming from research objectives a method had to be found, that would allow for a participatory approach and at the same time would allow stakeholders to relate to the expressed theoretic constructs that are under investigation. Literature review showed that TCE is incompletely formalized in that such a core concept as asset specificity has no precise definition. Yet, to make it operational for practitioners,

precision is required. Consequently, in order to both support the theory or point out obscurities and eventually suggest alternative metrics an approach was needed that allows for formal description of the theory but on the level of presentation that practitioners and subject matter experts could relate to. The research methodology has to support formalization of theoretic axioms and vague statements of stakeholders.

The method suggested in this research is the combination of agent-based social simulation and empirical research. Reflecting on the scope of requirements outlined above, finally led to the model design involving multiple interacting entities with a decentralised architecture and composed of autonomously acting agents. In the field of economics, MAS provide an alternative to classical economic thinking in which the behaviour of a group of individuals is represented by a homogeneous meta-agent. A further important and more general motive here is a deeper and better understanding of relations between processes on the micro level and the emergence of stylised facts on the aggregated level in the model output. That would create the missing macro-micro level link which is absent in the contemporary outsourcing literature. Thus ABM was chosen to be superior over variety of other modelling paradigms available for social simulation research due to *(i)* ability to encompass emergence and natural description, *(ii)* scalability, and *(iii)* ability to incorporate stakeholders into the modelling process.

Furthermore, it can be argued that, when stakeholders' feedback is involved, fine grain and detailed models would be a more natural choice for modelling than coarse grain models that are able to capture only the aggregate system's behaviour. Rule-based representation stores information in the form that offers apparent resemblance to the form that is used by stakeholders. The most important and desirable ability of stakeholders in the presented research is that the practitioners should be able to recognise and relate to model behaviour that is consistent with their observations or their own behaviour patterns. The closer the models are based on the target system, as it is in the case of fieldwork based models, the easier it should be for the stakeholders to understand or conceptualise them. The rules for the agents were derived partly from the relevant reports and partly from qualitative insight into the modelled target system.

The author highlights the potential of bottom-up models, in particular ABM, to analyse the social intrusion into the traditional economic theory. Conventional problem treatment of the economic apparatus requires the environment to be considered as

homogeneous, which means that the method is only suitable for the class of problems where entities can be represented as such. Considering the issue of social embeddedness of TCE introduced in the literature review, it shall be seriously considered to expand the scrutiny of that theory in the heterogeneous contexts thus enriching the purely econometric observation. Abstracting from the conventional economic assumption of the homogeneous agent with pay-off matrix in his mind and modelling the agents as individuals with a non-game-theoretic approach helps to capture the heterogeneity of the real world. The methodology of evidence-based modelling also satisfies the objective of adding precision to loose theoretic constructs. It combines the rigor of formal logic with the descriptiveness of the agent paradigm for representing social actors and their interactions. Therefore the theory based model described in chapter 5 offers a step towards a formalization of some TCE aspects.

Following the need of a tighter link with stakeholders the exploration and validation of the models' results happened in a feedback-loop manner, together with domain experts using them not only as a primary source of qualitative data but also have been incorporated into the model validation process. It should be remembered that the sample used for qualitative studies was opportunistic. It was shown that such a highly debated and controversial topic as outsourcing is best investigated using the example of financial institutions. The financial sector has always represented the most conservative part of the society and of the outsourcing market but has increasingly tried to get a foothold in the outsourcing area recently. The debate of core and non-core services within a scope of a financial institution is examined more rigorously than in other industries. Consultancies have been chosen as the most viable alternative to obtain an informed view on the investigated system. Arguably, consultants are the central point of contact for outsourcing strategies and considerations as they represent the paramount source for knowledge and beset practices dissemination nowadays.

The modelling and the field work were done by the same party with data engineering involving stakeholder interactions. A constructive and modular approach to model design was adopted. The first research stage consisted of collaborative fieldwork with industry partners: gathering of relevant data, developing the structure and focus of the future model. Internal and published support documents were collected. Subsequently a mock-up declarative agent-based coarse grained model, based on gathered, scarce data, was

developed. Building a mock-up model first was intended to identify data requirements and help to determine which data is important and which can be dismissed. Within the scope of this work two models were developed – a Transaction Cost Theory (TCT) Model (cf. chapter 5) and an Evidence Based Outsourcing (EBO) Model (cf. chapter 6). Exploration and validation of the final models' results happened in a feedback-loop manner together with domain experts leading to changes, alterations and the addition of relevant organisational modules. Based on the experience in the fieldwork interviews, the author strongly encourages a constant cross validation with stakeholders while conceptualizing the model. The participatory approach was designed by the researcher to assure a consistent understanding of the model by the stakeholders peer group at any development stage of the model.

4 Fieldwork Data

"A wise man proportions his belief to the evidence."
David Hume
Scottish Philosopher (1711-1176)

The interviews undertaken during the fieldwork provided ample evidence for realistic modelling of behaviour. The evidence sought and obtained for constraining the model designs and validating model outputs falls into three main categories: evidence about the relevant areas of institutional behaviour, evidence about the structure of contractual relationship networks and contextual evidence such as outsourcing market patterns and trends (i.e. price development, geopolitical events, factors of influence).

For the current research the fieldwork provided an important opportunity to test assumptions built into the models. Thus, the validation process could incorporate stakeholder interaction at an early enough stage to allow for valuable feedback to inform the model development. In the case of the two models presented in the thesis, the stakeholder interaction resulted in a revision of endorsements and elicited knowledge about vendor selection and management strategies.

The following chapters give a summary of the gist of the findings from the field research. Section 4.1 outlines author's requirements on the peer group and discusses possible advantages of comprising consultants as industry experts. Section 4.2 will give an overview about collaborating firms in general, the cases studied, and how they have been selected. Section 4.4 reports on the use of economic theory postulates by practitioners and its implications for the daily business. It describes various supportive tools deployed by practitioners for activities in the outsourcing project. Finally, section 4.5 deals with emergent themes from the field research that have been taken up for the EBO Model.

4.1 Approaching Stakeholders

The collaboration partners were carefully selected as highly experienced and knowledgeable professionals in the global outsourcing field and representatives[48] of the

[48] Selected collaboration partners ought to either possess own subsidiaries in or contractual partners from regions Asia Pacific, EMEA and Americas. The aforementioned geographies encompass the most vivid outsourcing locations of the current economy.

regions Asia Pacific, EMEA[49] and Americas. The choice of organisations was considered very important because it would affect the domain of the project (predominance of vendors versus clients) and would also determine the level of access for carrying out fieldwork and whether or not companies can supply market information for purposes of model validation. Common practice in the outsourcing projects is the dissemination of the best practices by consultants involved in the project allowing for perception of the coordination processes with respect to IT as increasingly commoditised (Poppo and Lacity, 2002).

It was decided to make contact with large consulting companies situated in UK and Germany first and approach the clients with providers through the prior ones. It emerged that it was much easier to get hold of both providers and clients through consultancies already participating in the research rather than approaching these companies directly. During the fieldwork, preceding the model development, numerous strategic and IT consultants (top 10 consultancies) as well as executives in the IT departments either on the provider (fortune 100 IT companies) or financial institution (leading domestic and international financial institutions with worldwide activity range) side involved in various outsourcing projects were approached. All interviewed clients and suppliers alternatively maintained (at the time the research was conducted) a contractual relationship with consulting companies involved into the research. The interview research was conducted with 6 client organisations, 4 suppliers and 5 consulting companies. All respondents were experienced in global outsourcing and expert in business and IT service location attractiveness.

This research setup minimized the peer group of stakeholders that was necessary to obtain equal proportion of clients and vendors respectively. This was important in the face of time limitation given within the scope of the thesis. A lot of time had to be spent in consultation with the stakeholders, to develop close partnerships, to ensure that they understood the nature of the project, and were able to contribute to and benefit from it. From this rationale for the research, a shortlist of companies that would be potential partners in the project was produced. Furthermore, the variance in the service buyers peer group was considerable making the unbiased choice of the peer group difficult. In the banking industry, financial institutions not only vary in asset capitalization and

[49] An abbreviation commonly used as a regional designation for Europe, the Middle East and Africa.

therefore in their power to purchase or internalize IT resources (Ang and Straub, 2002). More importantly, they also differ in the nature of their business, their strategies and their customer bases. Small financial institutions are focusing on retail operations while large ones tend to be regional money centres providing wholesale and international bank services to corporate clients. Thus, financial institutions' size not only measures scale differences but also reflects scope differences (Notebloom, 1993a, 1993b). Consultants allowed for building a common denominator for the peer groups involved. They distribute information, thus minimizing the knowledge differences with respect to outsourcing experience and knowhow.

Initial calls were made and these were followed up by a letter of introduction containing the project overview. There was a very varied level of initial response from the companies. Not all companies that responded and showed initial interest in the project wished to take it any further. In general, the response rate from consultancies was much higher rather than that of providers followed by client organisations.

4.2 Background on the Companies

The fieldwork encompassed professionals from different institutions and areas in the financial sector and consulting business. Whereas the interviewed companies are headquartered in USA, Russia and India, the representatives came from United Kingdom, Germany, Russia, Ukraine, China and India. In the following, due to confidentiality issues, the companies are referred to as VENDOR for interview partners representing outsourcing vendors, CLIENT for interview partners representing clients and CONSULTANT for interview partners coming from consulting houses. Table 4.2-1 provides an overview of institutions that took part in the research.

Firm name	Interviewee location	Headquarter location	Type
CONSULTANT1	UK	USA	Consulting
CONSULTANT2	UK	USA	Consulting
CONSULTANT3	Germany	USA	Consulting
CONSULTANT4	Germany	Germany	Consulting
CONSULTANT5	UK	UK	Consulting
CONSULTANT6	Germany	USA	Consulting
VENDOR1	UK	China	Consulting, IT vendor
VENDOR2	UK	India	IT vendor
VENDOR3	Germany	USA	IT vendor
VENDOR4	Germany	Germany	BPO and IT vendor
CLIENT1	UK	UK	Insurance
CLIENT2	Germany	Germany	Bank

CLIENT3	Ukraine	Ukraine	Bank
CLIENT4	Russia	Ukraine	Bank
CLIENT5	Germany	Germany	Bank, Insurance

Table 4.2-1: Fieldwork collaborators overview.

It can be argued that a broad geographic coverage of the interview panel coupled with a range of functions (consulting, banking, Insurance, BPO and IT providers, etc.) might cause some bias. Indeed, the interview panel does not account for a fully representative or stratified sample and expanding the interview panel can be further research. However, a main contribution of this thesis is the development and proof of the research technique and is not vitiated by any bias in the panel. Also, the author is convinced to have alleviated any possible bias between vendors and clients through extensive use of consultants in the interview panel. Consultants represent both sides of the outsourcing equation as they work for both, clients and providers.

4.3 Data Collection Methodology

The most important issue related to data collection is selecting the most appropriate information or evidence to answer research questions since data in raw form is of fairly limited use. Also, one must begin to think ahead about how the information could be organized, analysed, interpreted and then reported to various audiences. The methodology chapter 3 provided an overview and rationale for the methodology of this research. In addition, the reasons for choosing a specific research method (qualitative over quantitative and interview over questionnaire) were presented. The case study research relied on multiple sources of evidence. Documentary evidence was important as corroboration and augmentation of interview evidence. Available documentation included the online project documentation and any published articles or conference presentations either by or about the projects[50].

Interviews were one of the main techniques used in the case-study phase of the research. Interviews are the most widely used method in social science research. This is because of the flexibility of the technique and the great depth of the outcomes. Interviews will give the opportunity to the researcher to see the research topic from the view point of the participant and to understand how individuals come to have this perspective. This aspect

[50] During the fieldwork the researcher was involved in multiple projects with various consulting teams as a non-active participant of workshops. The researcher participated in workshops on the client site as well as in internal workshops of consultants.

is of paramount importance for the agent-based modellers, who intend to mime the stakeholders cognitive patterns with agents.

The interviews were semi-structured, such that the interviewer had a list of topics that were to be covered, but the interviewer was not forced to strictly adhere to them. The questions were open-ended, giving the interviewees an opportunity to report what they had observed and experienced (see Appendix C). Semi-structured or also called guided interviews is a type of interview that comes between structured and unstructured interviews. The researcher will have a list of themes and questions[51] to be covered and normally data is recorded by note taking or by tape recording. Semi structured interviews use open-ended questions, start with more general questions and most of the questions are created during the interview. The specific interview questions are included at the end of this thesis in Appendix C. Quantitative data was not collected.

Different types of interview set-up, as described in section 3.2.3, have been used: face-to-face (in the initial interview rounds) and group interviews (towards the end of research and during the simulation results presentation and discussion). All interviews were done face to face or in a group setting and only three had to be conducted over the phone. Based on this review, this research focused on using a face to face interview for the in depth data it can provide. The limitation of the semi-structured method is that it is slightly less reliable because of the difficulty of exactly repeating the interview. The use of mock-up models (cf. sections 3.2.3 and 3.4.3) mitigated this issue to a great extent. Interviews of between one and two hours were conducted. Total research was through a mix of interviews, desk research and client and supplier site visits in Europe between March 2007 and April 2010. For confidentiality reasons no transcriptions or recordings were allowed.

In one sense, data analysis occurs throughout the case study research process as the researcher continually interacts with the collected data and their informants. One of the advantages of case study research is its flexibility, allowing the researcher to pursue new lines of enquiry that are suggested by informants' evidence or a piece of documentation (cf. section 3.2.3). In another sense, the major task of analysis occurs once the bulk of the data has been collected and can be inspected, categorized and manipulated. The main

[51] The questions were usually formulated in a follow-up to the involvement into particular project event or activity.

analysis tools used were pattern matching and explanation building. The pattern matching phase involved identifying particular themes in the respondents' responses to questions. It became clear that there were significant clusters of responses around several emerging topics that are described in detail in section 4.5. The analyses of these responses sought to compare and contrast these responses. The explanation building phase revolved around the respondents' answers to the questions about the critical success factors for their projects to date.

4.4 Tools of Practitioners

After analysis of the interviews it was clear that along the lines of academic research of outsourcing, TCT has found its way into practitioners' minds. However, the influence of TCT seems to limit itself to the usage of the terminology without deep understanding of the underlying constructs. This section describes tools in use by practitioners. These tools aim at miming the core features of the TCT – score cards (cf. 4.4.1) and organisational spanning trees (cf. 4.4.2) both seek to determine asset specificity. The practitioners fall back on TCT to identify efficiency implications of varying governance decisions of future contracts and identify asset specific parts of the company. All tools presented in this section are thought to support practitioners along the chain of outsourcing tasks as depicted chronologically in Figure 4.4-1.

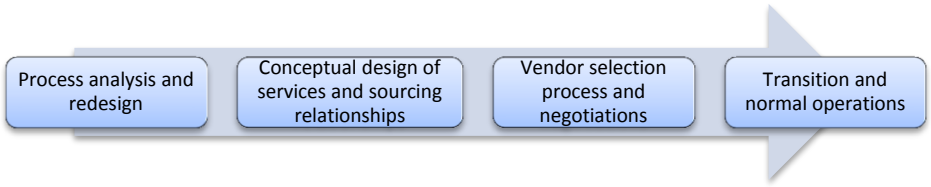


Figure 4.4-1: Chronologic chain of steps in an outsourcing project.

As indicated above, both, organisational spanning trees and score cards, represent the effort in quantifying the theoretical statements of TCT regarding the asset specificity. Spanning trees provide the measurable structure and score cards deliver the measurable units.

4.4.1 Score Cards and Checklists

Before the systematic approaches for vendor selection described in this section can be applied one has to have a clear understanding of one's specific needs and type of the provider that can meet them. Having this information in the back of the mind makes it easier to compile scorecards that are aligned with the company's goals and needs. There are several techniques on the market on how to conduct evaluation activities within an

outsourcing project. All of the techniques use the psychometric Likert scale in one or another way. While Likert scale encounters several disadvantages in the way it quantifies human perceptions[52], the advantage for the modelling process was the ease of mapping the approach into the model (directed graph with weightings on the branches).

To start with, criteria for developing a supplier base are typically derived from the firm's perception of the supplier's ability to fulfil the objectives of quality, quantity, delivery and price. While the supplier's price may be the most critical criterion for profit maximization, other dimensions can equally impact the overall profitability of the firm. Scoring models are typically used to evaluate suppliers for inclusion in the base. In general, this approach ranks each supplier in terms of objectives and then based on a relative weighting of each of the objectives, a total score for each potential supplier is derived. Next, by specifying a threshold score, all suppliers who achieve this threshold are included in the base. Objectives used in developing rankings vary across firms and project aims. For example, Sun Microsystems ranks its suppliers with a "scorecard" based on quality, delivery, technology, and supplier support. However, many stakeholders reported on using more soft factors for evaluation of their potential providers. Senior executive of the corporate strategy department of the CLIENT1 states: "*It* (choice of the evaluation factors) *really depends on how core specific we consider the considered service* (service for outsourcing) *to be. I am even not aware of the exact company that is doing our blackberry network or exchange servers maintenance since it is something out of the box what they do. If, however, we are talking about technical support of our trading units it is a completely different world. There we look for vendors with cultural and company fit and deep understanding of our business*."

While hard issues like offshore vendor's financial strength, experience and expertise, resources, brand etc. can be gauged on a tangible scale, the problem lies in the more obscure soft issues, which can make a big difference. Practitioners propose a vendor selection checklist to evaluate the outsourcing vendor on the basis of hard factors. The parameters on which the vendor must be measured have been carefully chosen and agreed by everybody involved into the decision process. It is imperative to take into account the soft aspect of relationship building facts. Evaluation scores should be weighted to reflect business priorities. The evaluation method and criteria should be

[52] Discussions on shortcomings of the Likert scale approach are beyond the scope of this thesis.

defined and agreed before one contacts potential suppliers to help ensure an objective assessment.

Not all evaluation criteria may be of equal importance. For example, the technical solution and human resources may each be considered key criteria, whereas greater importance may be placed on one rather than the other depending on the transaction. It is therefore natural to consider weighting each of the criteria to reflect the importance given to each. A common approach for weighting the criteria is to assign a weight or percentage to each general category, with the total of all of the weighs equalling 100 per cent. See Appendix B for anonymised scorecards of CLIENT3 and CLIENT5. Similar structure of scorecards has been reported by remaining client participants. Sometimes weights are assigned to subcategories of the general categories in order to allow for more detailed analysis. Again, weights or percentages are assigned to each subcategory, with the total of all the weights equalling 100 per cent.

Appendix B provides example of sample weighted and non-weighted score cards, provider checklist as well as several spider-web diagrams. Furthermore, score cards are used not only for provider selection tasks but also as a management tool for the monitoring purposes. IT score cards can be translated into spider web diagrams (see Appendix B) and allow for a clear presentation of the comparison of target and actual business results.

4.4.2 Spanning Trees

The so called Process Dependency Diagram – spanning tree – is a commonly used alternative to represent organisational units, process flow or the whole structure of the organisation. In combination with the aforementioned score card techniques stakeholders are able to give weightings to each unit/process in the spanning tree and thus tag a number on the specificity of the unit/process. Figure 4.4-2 and Figure 4.4-3 depict a simplified diagram of the IT service landscape for an example enterprise (regarding the functional and IT view)[53].

Beside the quantification of the specificity, a spanning tree diagram is intended to show how, for each process, an execution may depend upon the prior execution of other processes. The diagram in Figure 4.4-2 and Figure 4.4-3 depict the dependencies existing

[53] Due to simplification and confidentiality reasons only a part of the whole tree is depicted.

between the elementary business processes. This concept was mapped into the model with the help of a Firm Skill Universe abstraction (cf. chapter 6.2.2).

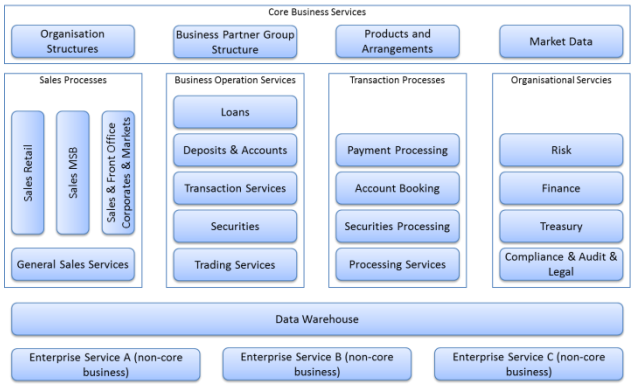


Figure 4.4-2: Simplified dependency model for an enterprise (with regard to functional services).

All interviewed stakeholders undergoing a major sourcing[54] or outsourcing transformation reported on the use of spanning trees of various variations. The level of detail varied strong across different stakeholders and outsourcing projects. As a rule of thumb one can stipulate that the more discrete is the concerned service the more coarse-grained is the process dependency diagram.

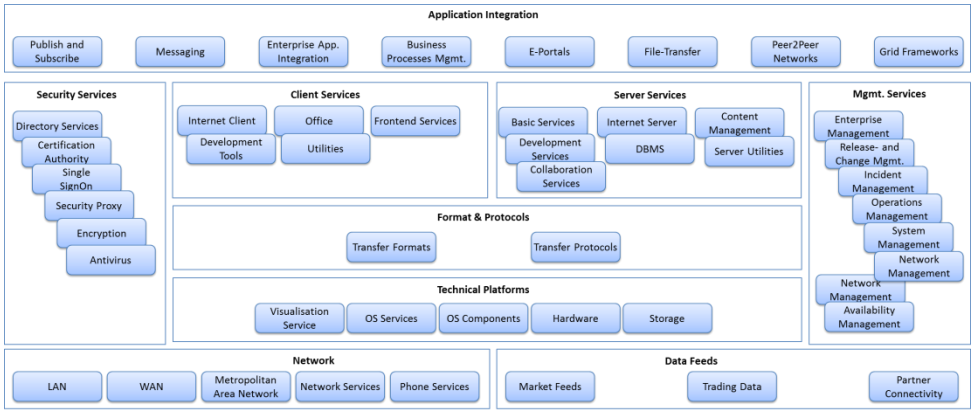


Figure 4.4-3: Simplified dependency model for an enterprise (with regard to IT services).

The main idea of spanning trees is to group the closely meshed process chains into structured discrete activities. The level of detail for a particular process dependency diagram depends on the meaningful encapsulation of the service groups to semi-discrete units. Stronger modularisation of services is necessary to provide meaningful graphs of IT services within an institution. Corporate environments that use products from multiple vendors are much more challenging to manage because the systems may be less interoperable and the management tools are not compatible. The typical result is that

[54] In the context of this thesis the term “sourcing” implies obtaining new services that were not available previously and the term “outsourcing” implies substituting already existing own services through these from the vendor.

mixed environments are managed as discrete IT subsets (e.g. storage, networks and servers) separately. Managing domains separately cannot take into account the interrelationship of the various parts of the overall system.

Services / Location	Location I	Location II	…	Location n
Directory services	x			
Certification authority				x
Single sign on	x			
Security proxy		x		
Encryption	x			
E-Portals	x			x
Feed messaging	x			
Grid frameworks	x			x
Peer2Peer networks	x	x		x
Collaboration services	x			
Internet clients	x			x
Development tools	x			x
Virtualization services	x	x		x
Handheld operations	x	x		
Publishing	x	x		
Regulatory reporting	x			x
Credit risk evaluation	x			
Customer reference data		x		
Billing information	x	x		
Order placement	x	x		x
Treasury transactions		x		x
Back office trading systems	x			x
Depot bank services	x			
Customer rating	x			x
Funds administration tools		x		

Figure 4.4-4: Relating processes to the consumer locations.

After processes have been identified and modularized in the process of building a process dependency diagram the location mapping can be made. In this process all services identified are mapped into the table with the list of locations of processes' delivery. Figure 4.4-4 depicts such a table. While the dependency diagram allows for conceptual clarity the location mapping table allows for physical inventory of the corporate IT landscape. This activity is of particular importance for corporations with multiple computer centres (in particular with non-discrete service delivery environments). The process dependency diagrams allow for logical mapping and relation of services and location mapping tables allow for physical mapping of assets. Sometimes dependencies that remained uncovered by process dependency diagrams can be revealed by location mapping tables (i.e. a single unit that is spatially scattered over multiple locations).

Knowing the structure and scattering of own IT landscape is helpful but does not express the level of service delivery. Here the concept of service level agreements (henceforth SLA) and key performance indicators (henceforth KPI) comes at help. Next section

explains how both constructs are used by practitioners to determine needed service levels.

4.4.3 SLAs and KPIs

The *Service Level Agreement* is a formal negotiated agreement between two parties that sits underneath the contract of appointment. It is an agreement between a client and its service provider that records the common understanding about services and responsibilities. *Key Performance Indicators* are metrics used to quantify the performance of the supplier and monitor adherence to the Service Level Agreement. KPIs when set correctly give an early indication of when the supplier is struggling to reach the agreed level of service. Generally, IT outsourcing vendors are very good at defining SLA measures and KPIs to track the performance of their services (e.g., time to respond to a call, uptime, etc.). However, it has to be assured by the client organisation that the KPI and SLA measures suggested by the provider mirror the actual needs of the organisation. An overview of the interaction of various contract components can be found in Figure 4.4-5.

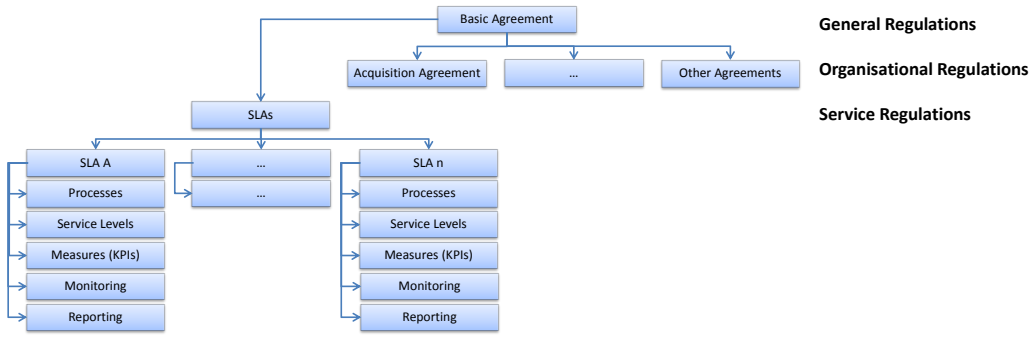


Figure 4.4-5: Components of the outsourcing contract.

Since cost of setting up and administering the contract has to be less than headline saving from using external contractor, service level agreements provide an efficient and straightforward way of monitoring the provider. SLAs are structured in a rule-like way and therefore are suitable for 1:1 translation into the rule arsenal of agents. Common SLAs developed together with stakeholders were translated into JESS rules that agents used to govern their contractual relationships in the EBO Model. Table 4.4-1 exemplifies an excerpt of typical statement clauses from an SLA for Desktop Services. As evident from the archetype of presented clauses they allow for smooth transition in multiple *if-then-else* statements suitable for use with JESS (cf. section 3.3.2).

Generic outsourcing contracts contain service level agreements which describe in a meticulous way the service itself, how it is going to be monitored and penalties in case of

non-performance. A rule of thumb is that the more service level agreements are incorporated into the contract (600 for mega-contracts) the more elaborate and cast iron this contract becomes. This means in case of an escalation, a contract with more detailed service agreements will offer a better protection. One should bear in mind that the more elaborate a contract is the more expensive is it to set-up. Also, it does not represent a one-off investment since the defined KPIs have to be renegotiated after a certain account of time due to technological changes and innovations. After a certain period customers have to carry out benchmarking tests in order to re-evaluate their performance levels for post contractual management.

Service Availability
Desktop Service is required as basis for access to further specific services. Required availability for the Desktop Service services is 98.5 % uptime (scheduled maintenance times are not counted). The 98.5 % availability metric will be measured upon a rolling 3-month period.
Reliability
The service is guaranteed not to break more than three times per year. A break is defined as the loss of any kind of accessibility to or of Desktop Services.
IT Service Continuity
In the case of a major catastrophe with hardware loss, desktop computers and infrastructure services shall be restored within a time window of 12 hours.

Table 4.4-1: Excerpt from an SLA document for Desktop Services at CLIENT5.

SLAs and KPIs start making sense if they capture realistic specifications. These are obtained either through own extensive experience or benchmarks against the industry standards. Next section outlines the process of benchmarking as conducted by involved stakeholder organisations.

4.4.4 Benchmarking

Comparing IT services against the industry standards and best practice in other organisations (if available) helps to identify where performance improvements can be achieved and which services represents outsourcing candidates. Such sort of benchmarks is normally conducted by consultants who possess a wider industry overview than their clients due to repeated engagements with multiple clients. The involvement of consultants in the benchmarking task enhances the standardisation trends in the industry (cf. section 4.5.2). Figure 4.4-6 shows a sample benchmark of a firm's IT costs against the

market average values[55]. The average market values are obtainable from various research organisations (i.e. Gartner) or consulting companies alternatively.

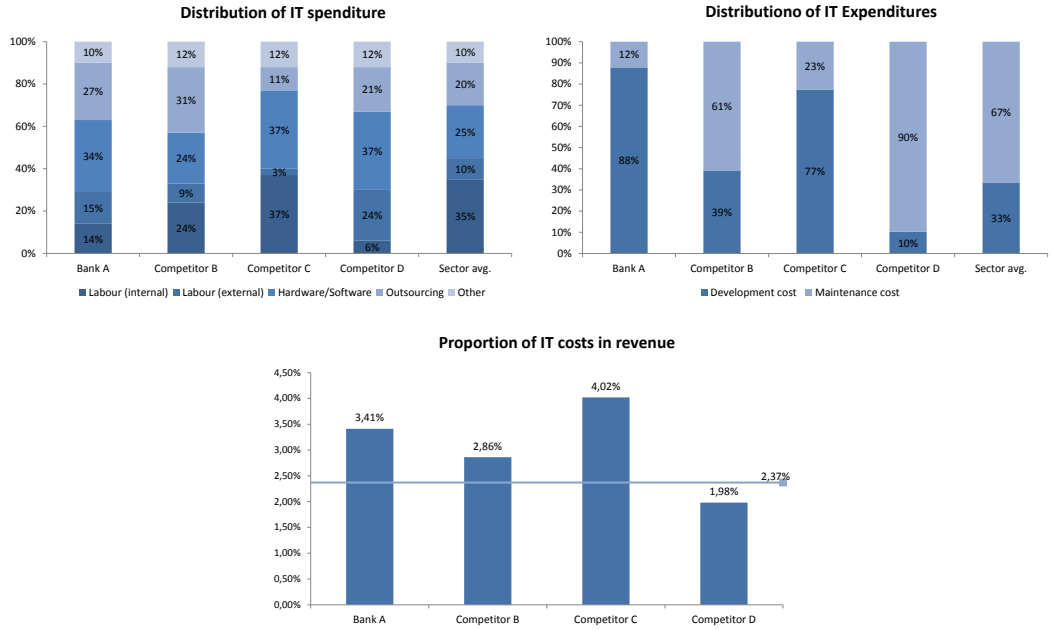


Figure 4.4-6: Excerpt from a benchmark of CLIENT2 against market.

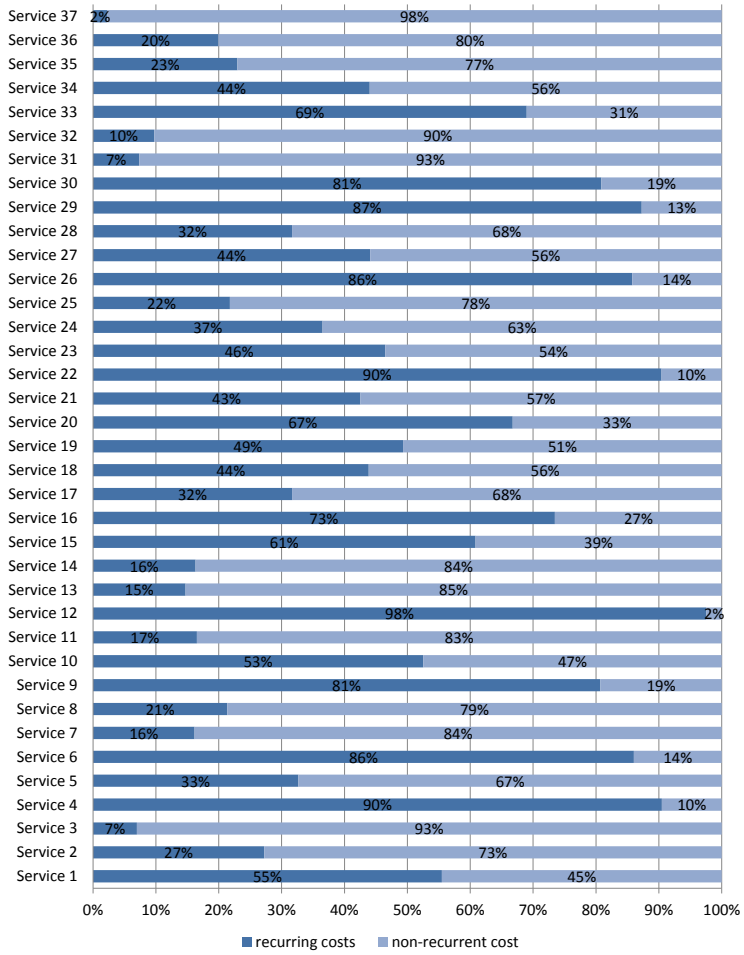


Figure 4.4-7: Decomposition of IT service costs for CLIENT5.

[55] Due to confidentiality reasons real values have been altered.

Benchmarking against the market has a positive side effect even in the case where it does not come to outsourcing decisions in the end effect. IT in-house operations are regarded as separate cost-units and, as such, are facing real competition in nearly every area and can no longer assume they will retain their monopoly status with the organisation. As a result of benchmarks, in-house operations are increasingly adopting the techniques of the market. According to CONSULTANT4 this technique on "intimidation" proved to be an effective tool with internal IT operations: "*without extensive optimisation measures we usually achieve instantaneous savings of up to 25%-30%. If one considers that such savings can be achieved without an extra effort but through a little of "threatening" the savings appear gigantic*."

Internal benchmarks is another version of internal inventory activities. Figure 4.4-7 depicts an analysis of the cost structure for selected IT services of CLIENT5[56]. The decomposition of services' costs in one-off and recurring payments provides a basis for outsourcing considerations. CLIENT4 explains: "*Services with high proportion of recurring costs are candidates for in-house development but outsourcing maintenance tasks. Mostly these are company specific services or internal processes. They* (processes) *involve internal experts only at a time of set-up and become "no-brainers" in the maintenance. On contrary, services with high one-off investment – say roll out of new operating systems or replacement of infrastructure hardware – shall be considered for projects with an outsourcing provider.*" The pattern of sorting services into one-off or continuous investment categories is company specific. This was confirmed trough multifaceted feedback of stakeholders on the topic.

4.5 Emergent Themes from the Fieldwork

Typically, there are a number of contributing factors, large and small, that cumulatively result in a project being abandoned or failing to meet its intended goals and objectives. While outsourcing being not a new organizational surgeon tool, the success of any outsourcing endeavour, however, still has a flair of Russian roulette. This chapter reports on practitioners' concerns about insecurity of outsourcing decisions.

A number of themes have emerged from the fieldwork. In order to contextualize the findings from the fieldwork and to take a forward look at possible implications for the simulation models, the major trends and pressures operating in the global outsourcing

[56] Due to confidentiality reasons real values have been altered.

arena are identified and explained. The stakeholders raised a number of questions relating to the research objectives, both at inception of the project, and during the evaluation phase. The main questions to be addressed are described in the following. This section covers only topics that represented focal interest of involved practitioners and have been reflected in the TCT (cf. chapter 5) and EBO (cf. chapter 6) Models.

4.5.1 Dependencies

Based on the interview responses the author found out that the most popular course of action at the end of a contract will continue to be contract renewal with the incumbent supplier. A corporate strategy officer from CLIENT2 exemplifies "*HP is running our Microsoft Exchange Servers and sorts out the necessary hardware. They do it good and they do it for ages now. The knowhow they have of our mailing system is far better than that of any of our internal IT infrastructure employees. The costs are low and the service is acceptable. Why shall I switch to another provider and undergo the arduous process of change only because someone gets scared of overdependence on HP. Mailing system is the most standard thing I can imagine. It is pathetic, to believe that any provider managing your mail system has power over you.*" The field work suggests that a quarter will be re-tendered and awarded to new suppliers, and only a tenth are taken back in-house. This evidence is supported by similar findings in (Willcocks *et. al*., 2009).

Furthermore the fieldwork showed that the contract will be renewed due to some dependency issues in the vast majority of cases. Academic literature offers here a wide variety of explanations (cf. section 2.1.4). The reports from fieldwork echo these outsourcing risks in a vague manner but do not provide a clear position of involved stakeholders. None of interviewed industry experts could provide an explicit explanation on the following questions:

- *Why would somebody lose core activities if these are not getting outsourced in the first place?*
- *How does the "leveraging" by suppliers look like and why does it happen undetected so often if it is so evident?*
- *If it is a truism that offshoring bears additional risks that need to be considered why are these then reported as the most frequent failure cause of offshoring endeavours?*

The list of a few, fairly ironically formulated, example questions prepared by the researcher provides a general idea where the discussions on the topic of dependency

issue went. Involved stakeholders cited prominent keywords resembling similarity to risks of outsourcing already mentioned in section 2.1.4 but were not able to explain the reasons why would these risks lead to dependencies. The general sentiment, however, entailed a generic fear of dependence.

4.5.2 Standardization

In most cases outsourcing is never a first solution but an iterative step in the process of IT optimisation. Thus before any outsourcing considerations can be made the IT of a company has to be standardized. The ulterior motive of this plan of action is many-sided. First, the process of IT standardisation eliminates redundancies and delivers a streamlined structure. Some cost savings can be gained already at this step. Second, a standardized structure of IT is easier to manage, maintain and find distinct outsourcing partners for. Poppo and Licity (2002) found that the involvement of external consultants has the effect of best practices dissemination and "templateing" of mega-deal contracts. Although each organization that participated in the study regarded their practices as secret for competitive reasons, practices were nearly identical across mega-contracts.

The growth of the IT services sector rests upon the trend of its products and services standardisation. It is the central and paramount factor of success. Starting with the 70s the early concept of costumed software was abandoned and the keyword of vendor independent software came to the fore. Early 90s sealed off the era of custom software and heralded the beginning of standard software era. An interviewed security officer from CLEINT2 remembers: "*early 90s was a mess* (...) *we had perfectly streamlined IT landscapes and all of a sudden we had to interact with other institutions who, most of the time, had a completely different IT landscape. Us or them separately functioned great but us and them together did not function at all. However, as with every new technology, after a while people started to see the benefits of standardized software with standard interfaces allowing them to connect banking systems from distinct institutions.*" This approach of a universal concept as a solution for a generalized problem soon beard fruits of success. In multiple customization steps of system integration consulting company could adjust the procurable software to special needs of a particular customer.

But it is not only the software that has been affected by the trend. An operations manager from CLIENT5 stipulates: "*before, it was taking weeks to agree with the provider on delivered services* (...) *suddenly we could get all what we needed, software, hardware,*

maintenance services and alike, much faster but in a canned way – one did not have much choice. However the cost savings were enormous." Thus, by applying standardized solutions to their issues, customers automatically unify and harmonise their IT processes while establishing a basis for outsourcing their operations to an external IT services provider. Standardisation helps to resolve the imminent issue with legacy systems in the banking sector as according to an information officer from VENDOR3, lack of structure is the handicap of majority of financial institutions: "*Many of the problems in the financial sector regarding the IT have their root cause in the lack of modularity of underpinning services and structures wildly prospered over the years.* (...) *One of our current clients deploys an IMS Database that is roughly 30 years old and the only reason why he* (the client) *cannot replace that product is the interconnectedness of that database. It is simply impossible to gauge the aftermath of affected systems completely.*"

An operations manager from CLIENT1 suggests a binary distinction of outsourcing contracts: "*I'd divide them* (sourcing contracts) *into two categories – either they are off the shelf or costumed solutions.* (...) *The later ones are hardly affordable and for the prior ones applies – if it* (outsourced services) *doesn't get standardized, it doesn't get outsourced."* Finally, by simplifying the IT infrastructure, companies utilize the opportunity to streamline the day-to-day management of their technology which results in significant cost reductions. Well known manufacturer of standard software, who also offer system integration and consulting services with regard to their own-brand software, are companies like SAP, Oracle and Microsoft. The trend of standardisation let the system integration and consulting companies mushroom. The biggest players on that market regarding financial institutions are companies like IBM, SBS, CSC Ploenzke, T-Systems, BT, Lufthansa Systems, Steria Mummert and Accenture.

The whole dynamic of standardisation and outsourcing has a flair of an automotive construct. Both, outsourcing and standardisation of IT landscape minimize operational cost and additionally build a positive correlation. A firm that wants to enter the outsourcing market, be it as a vendor or customer, is required to streamline the internal IT through standardisation efforts. At the same time while putting efforts in standardisation an easier entry into the outsourcing market is created.

A senior manager from CONSULTANT4 advises his clients: "*The buyers need to ensure selected providers have certification and pedigree relative to the process compliance*." In

this context COBIT[57], ITIL[58] and ISO/ICE 20.000[59] interact closely with each other. Requiring that any vendor coming on site supports open standards guarantees compatibility during interactions with each other. Strict standard adherence would eliminate issues with proprietary structures, and thus facilitate compatibility of systems from multiple vendors and with multiple types of systems from a single vendor. This quality is of paramount importance in the multisourcing environment (cf. section 4.5.7). Furthermore, open standards adherence should reduce concerns over lock-in to the same level as concerns about portability.

4.5.3 Relationship management

The negative experience of recent years is making a lot of waves in the outsourcing filed. This can be evidenced by the attention given to relationship management by the Outsourcing Institute lately. It is not a secret that wages in the low wage countries are not that low anymore and are levelling between each other. Thus, clients realized that providers have strong technical capabilities and similar pricing. Therefore, the really distinctive property of the provider is the ability to add value through governance and relationship management. In this context, it is pivotal to understand the impact of the interplay between opportunism and cooperation. Offshore outsourcing brings together companies, managers and employees with differences not only in law, politics and business practices, but also in cultures and languages. As more functions are outsourced, integrating and managing a portfolio of service providers is becoming more difficult and is causing significant service disruptions in many organisations.

Relationship management is not about monitoring the SLAs and distributing penalties. A senior manager from CONSULTANT4 reports: "*It is always a fruitful task to tell our clients attempting to go offshore the story of GM's introduction of its Chevy Nova to the Latin American market in the late 80s.* (...) *Due to the choice of the model name which has an unfortunate translation in Spanish the whole marketing offensive flopped in the early birth. A great story to get our clients' attention to the soft side of the outsourcing contract where culture cannot be neglected.*" Furthermore, a manager from CONSULTANT3 adds: "*Majority of our clients is simply not aware of how many issues they will have to resolve*

[57] Control Objectives for Information and Related Technology, a set of best-practices for IT management.
[58] Information Technology Infrastructure Library, widely accepted approach to IT service management.
[59] International Organization for Standardization, the first international standard for IT service management.

by pure communication with the vendor representatives and that cultural sensitivity is worth more than any formal framework compiled by highly paid lawyers."

Consolidating the interview results regarding the relationship management topic made evident that cultural issues seem to be the most commonly overlooked and misunderstood barriers to successful outsourcing. Table 4.5-1 compares perceptions of interviewed clients and vendors with respect to their goals, approaches to achieve these goals, issues arising during outsourcing deals and most expected outcomes due to these issues.

	Customer	Provider
Goal	Minimise costs	Maximise profit
Approach	Price reduction via playing competitors against each other and use of escape clauses in the contractual framework	Supplementary agreements through change requests, further services and volume increase
Issue	Anticipated business case does not realise due to vendor's tactical approach. Switching costs and provider dependence aggravate the issue	Submitted offers in the contract negotiation phase are below break-even point due to price competition pressure
Result	Legal implications, escalation management, change and out-of-scope requests	

Table 4.5-1: Clients' vs. vendors ' perceptions.

Dany Ertel, the founder of the Outsourcing Institute, says that in the Outsourcing 2.0 era factors like culture, chemistry, and communication issues have become the new critical success factors for many offshore and nearshore engagements[60]. It is expensive and time consuming to switch between outsourcing service provides. A failure to develop a truly collaborative relationship greatly increases the risk of unsatisfactory service levels, frequent disputes and increases contract management costs.

4.5.4 Merger and Consolidation

The current trend of alliances and acquisition will continue to grow. Since offshoring is now an integral component of most outsourcing deals the big western players are scaling up dramatically in locations such as India and China. They add thousands of people among their offshore resources. As a result, companies looking to offshore can now consider western based providers along with the local providers that are native to a particular country.

[60] Refer to section 2.1.2 for explanation of various forms of outsourcing.

Indian companies are now competing with large Western companies for service delivery out of India, which makes the breakthrough on the western outsourcing market for these companies nearly impossible. There is an obvious indication of a potential shortage of talent in India that could become dramatic in the near future. Indeed, the industry now faces threatening talent wars – buying graduates just to let the competitor die of "starvation" represents a common business practice. Attrition rates are high and heavy pressure will be felt on the supply side of talent for the next couple of years as the big players continue to scale up in India. Business risks are greater if the outsourced service is provided by a supplier with strong competitors since he can become a target of a hostile takeover by such companies.

However, this trend proceeds unnoticed from majority of service buyers, reports a strategy analyst from CONSULTANT2: "*Our customers are insomuch busy with forcing the provider to do what they want that they* (clients) *forget to think about sustainability. Nobody analyses whether the survivability of the vendor with forced conditions is ensured or whether the vendor is in a good financial condition a priori. It is no wonder to see many smaller vendors disappear – they are, so to say, negotiated to the extinction by their very own clients.*" CONSULTANT2 advises clients to take into consideration whether the provider is getting a critical mass on services in order to realise the economies of scale. In other words, providers without that critical mass are not capable of surviving long enough in the face of market pressure by delivering services at the full cost without a sufficient profit margin.

Consolidating the interview results, the following reasons for *Mergers and Acquisitions*[61] (henceforth M&A) activities from vendors' perspective become apparent:

- Broadening the geographic base of the company – by merging with a firm in the different country is the easiest way to penetrate the foreign market without tremendous investments.
- Merger for growth – mergers provide a faster way to growth in contrary to internal expansion. Thus, besides the new capacity, the company acquires further consumer demand.

[61] Aspect of corporate strategy involving purchase, sale and financing of companies and organizations. M&A transactions range from large scale contracts to small contracts.

- Merger for economies of scale – it emanates from the field work that there are only little, if any, cost savings from mergers with respect to IT industry. Although the economies of experience are non-negligible.
- Mergers for monopoly power – according to the traditional theory of the firm, smaller competition results in a less elastic demand thus enabling higher percentage above marginal cost. Merger can be seen as a means to reduce the completion in this case.

Companies like IBM Global Services, Tata, EDS[62], HP and Perot Systems are exemplifications of the monopolisation policy on the IT horizon. These companies are anxious to increase their market shares through acquisitions of smaller rivals. In that context fieldwork identified several acquisition types that are typical for recent M&A activities: expansion of the customer pool, breakthrough on the new market and increase of the market share through size. From one standpoint clients can benefit from concomitant features of the aforementioned process as M&A side effects like economies of scale and experiences are carried forward to them. From another standpoint the providers' drive for scale can have a poisoning consequence for the competition as smaller vendors struggle to survive in the market.

Sourcing from foreign vendors may yield substantial benefits, but is riskier than alternatives with usage of locally based vendors. Hence, many client organisations are wary of non-domestic IT services. Language barriers, cultural barriers, and fear over losing intellectual property remain significant obstacles for many companies in North America and Western Europe. While this trend makes domestic politicians happy, it causes worries amongst non-domestic providers. Non-domestic providers are well aware of the culprit caused by these barriers and are actively seeking ways to address them. One of the ways of addressing the aforementioned problem is either an acquisition of or a merger with a foreign rival. Leading offshore services providers, such as IT consulting giant Wipo or Tata Consulting, are opening large offices and making acquisitions in America and Europe – the locales of their leading customers – as earning profits from work performed purely offshore has become more challenging, and offshore firms become more global and mature in nature (Boby *et al*., 2007).

[62] In the present thesis EDS is still listed as an autonomous company despite being acquired by HP in early August 2008 (HP news release: http://www.hp.com/cgi-bin/pf-new.cgi?IN=referrer). However, at the time the corresponding fieldwork was conducted the deal had not taken place.

In recognition of recent shifts in the global economy many global outsourcing executives have determined a more "risk averse" approach toward their global outsourcing portfolio. It is believed to be a prudent and necessary means to ensure supplier stability, less volatility in certain markets and enhanced skill-set options *vis-à-vis* regional workforces. This trend causes some considerable turmoil between vendors that affects the overall reorganisation processes on the outsourcing landscape. Competition for outsourcing contracts became difficult in the face of current economic downturn, with a huge expansion in the number of suppliers fuelled by the outsourcing boom of early 90s, so some significant consolidations are on the horizon. Interviewed industry experts are expecting more M&A activity in the IT suppler sector in the near future – a trend that non-domestic vendors can benefit from. Recent rumours of a merger between information technology heavyweights Infosys Technologies and Capgemini Group, reflect a current market sentiment and pushed the stock price for both companies up. In spite of these prognoses it is enlightening to investigate the merger behaviour of the EBO Model's artificial society under influence of different factors.

The trend is for increasing globalization of the market as more regions seek to cash in on the offshoring boom. This development goes hand in hand with the requirement of clients for service delivery by the same vendor independent of the geography. What is more, as was mentioned in the previous section, the financial meltdown has made large organisations even more risk averse than they were beforehand. That means that many organisations are looking to mitigate the risk involved with outsourcing by using multiple locations. In (Willcocks *et al*., 2009) this tactic is compared to a "global craps game". For ample discussion on various reasons to choose an internationally active providers consult (*ibid*).

4.5.5 International vs. Domestic

Philippines provide currently 124 contact centres for companies such as Dell, AOL, JP Morgan, Siemens, HSBC, Shell, Citybank and many others (*ibid*). The trend of standardisation (cf. section 4.5.2) makes outsourcing process appear nearly commoditised – an illusion many clients fall for. With a standard set of services, standardised infrastructure and well established interfaces there is no space for mistakes left, one could think. However, as various track records of interviewed stakeholders show there is more behind it rather than having a common set of tools and agreeing on a

functional specification document. An executive from VENDOR3 summarises this statement as follows: "*The so frequently neglected soft factors can throw a spanner in any, even so meticulously worked out, outsourcing plans*."

"*The shrinking barriers of the globe are proving to simultaneously be an opportunity and a challenge*", states senior executive of CLIENT2. Despite the initial optimism of early 90s, many client organisations are wary of China's and India's IT services as language and cultural barriers, legislation uncertainty and fears of losing intellectual property remain significant threats for many western companies. An operations manager from CLIENT2, which itself is in the middle of the escalation process with both of his non-domestic suppliers, says: "*In an offshore outsourcing project it is of paramount importance to put more emphasis on the question: Where and by whom will the specific service be most effectively and efficiently performed? instead of following business as usual and concentrating on the hourly pay of an offshore worker*." Interviewed stakeholders complained that this very fundamental question if frequently overlooked and is more than just a mere concern over the cost of labour hours.

If western companies are so reluctant to enter a contractual relationship with a non-domestic provider why is this sector still booming and gaining on momentum? An information officer from CLIENT4 answers this question with the following sentiment: "*If one ever dares to bring rationale of offshore projects into question, one is confronted by the lucrative cost structure of non-domestic providers which allows for cost reductions of 40-60%.* (...) *It is the economic thought-terminating cliché. However it does not hold anymore since even our Indian or Chinese IT vendors revised these values* (...) *we are talking now about 15-20% at most and even that after an initial ramp-up time.*" Surely, such margins and labour cost arbitrage cannot be considered as the ultimate argument for countries like Germany with nominal VAT rate of 19% which makes an achievement even of a breakeven a challenge. Thus, the reason for the frenzy of activity around offshore vendors has to have additional driving factors below the surface.

Another claim, frequently put forward by the interviewed stakeholders, is the qualification level of the workforce at the destination countries. According to the corporate strategy officer from CLIENT4 "*It is fair to note, that while white-collar employees from countries like Russia, India, China and Eastern Europe are cheaper they are also highly qualified. The academics fraction in the labour pool at disposal is very*

high." Indeed, foreign providers frequently exhibit a higher standard of quality levels rather than their western counterparts and exhibit a variety of certifications (i.e. COBIT, ITIL and ISO/ICE 20.000).

The final controversial argument for the offshore move is the political and socioeconomic pressure. Indeed, offshoring was coined as the "axis of evil" by the labour force activists but it is a *sine qua non* for any listed company. A procurement officer from VENDOR3 reports: "*Every time we made or considered an offshore move, one could open two newspapers of the same publication date and see us featuring the proverbial axis of evil at one page and representing an interesting company for investors with a smart expansion strategy at another."* Same applies for clients according to legal officer from CLEINT5: "*We are pressured by our investors to possess a proverbial "Indian Story" in our portfolio to keep them* (investors) *aboard and look appealing enough for further investors.* (...) *In the executive board the term B2B stays not for business to business anymore but for 'back to Bangalore'. Acquiring all services from the domestic market evens to suicidal behaviour with regard to our shareholders*." At the same time western companies are reluctant to enter into contractual relationships with non-domestic providers due to various concerns. Considering stakeholders feedback it can be asserted that offshoring projects represent a politically charged decisions that tend to influence the corporate policy in a great manner.

Sourcing from firms in totally different cultures may yield substantial benefits, but it also requires different competencies in the outsourcing organization. Kotabe and Murray (2004) state that outsourcing from foreign vendors requires some specific skills and is riskier than alternatives with usage of locally based vendors. This does not suit all customer profiles. As an example one can point out traditional mutual insurance companies whose tolerance for risk is low and need for control is high. The aforementioned sentiment creates an unfavourable atmosphere for non-domestic providers. Offshore vendors lack company specific understanding and the problem of high turnover among offshore IT professionals leads to abysmal service levels. IT attrition rates average from 25% to 30% in India, according to a 2002 study of NASSCOM, McKinsey and Hewitt Associates (McKinsey, 2002). CIOs may need to start the arduous knowledge transfer process over again with new offshore workers never reaching the acceptable level of knowledge transfer.

Planned initiatives by president Obama and increased government spending on infrastructure projects also could lead to more domestic outsourcing, particularly for construction, real estate and technology (Srivastava, 2009). Outsourcing destinations such as India and China will be challenged by the "closer-to-home" locations. Outsourcing to a domestic vendor is easier due to a common *modus operandi*. Therefore, one has to expect fewer surprises at the negotiation table and the consequent transfer of knowledge is easier.

4.5.6 Overspecification

Due to increasing number of project failures, companies that aim at outsourcing try to build more rigid rules and guidelines to govern their outsourcing relationships. In limiting the scope of providers' freedom they limit the ability of a provider to react to economic changes or use alternative cost-effective service delivery methods.

A self-explanatory issue, one would say, but according to a senior consultant from CONSULTANT3 it is an important problem that did not attract enough attention in the past and is about to escalate with a steady growing outsourcing market: "*One has to know 'what' one wants and the 'how' shall be left to the provider. A simple rule but so far I encountered the issue of over-specification on every project I have been involved with. The clients are afraid to loosen the reins and tighten them instead.*"

The client's control centred view of the service delivery processes conflicts with their aspiration to seek an outsourcing supply of best in breed IT services with added value. By restricting the provider one takes his ability to innovate. Thus one is deemed to be left with the archaic technology and mediocre services at the end of the contract runtime. A manager from CONSULTANT2 comments: "*One of my recent clients sued his providers for monetary compensation due to the use of antediluvian technology in the process delivery. In the course of the dispute settlement it emerged that the initial contract signed by both parties actually prohibited the vendor to deploy other technologies rather these agreed on in that 5 years old contract.*"

4.5.7 Paradoxes of Multisourcing

Invariably, all interviewed clients organizations employ an array of partners, service providers and internal resources to obtain necessary IT services. Single outsourcing involves contracting with an external supplier to provide services that were traditionally carried out by the customer in-house. Multi-sourcing (also known as multi-vendor

partnering), on the other hand, is where a customer receives services from a number of suppliers, normally on the basis that each is a specialist in a particular area such as end user computing, managed network services, and hosting and storage. As experience with traditional outsourcing initiatives has developed and new supplier models have emerged, customer organisations are refining their outsourcing strategies and beginning to combine best-of-breed solutions from multiple suppliers.

Nowadays it belongs to the realm of truism according to management literature not to outsource all IT functions to one supplier. Over-dependence on one service provider can make costs and risks of moving to another supplier unacceptably high. A vendor management officers from CLIENT4 summarises as follows: "*It is all about not to put your eggs all in one basket and is no different than a stock portfolio strategy – diversification is the clue in turbulent markets. All our competitors are involved in some things in India, some more things in South America, and a few things on the domestic market. It's a matter of a mix, and your ideal mix is going to vary depending on your company and temperament, risk tolerance and needs.*" Albeit, the long awaited multisourcing panacea seems to awake converse opinions among practitioners as the title of the recent Forrester's Services & Sourcing Forum 2009 makes evident "Multisourcing: Sourcing Nirvana Or Highway To Governance Hell".

Through the paradigm of multisourcing, customers are beginning to combine best of breed solutions from multiple suppliers. While this approach helps to avoid the risk of over-dependence on suppliers it, simultaneously, increases the complexity of managing supplier relationships. A Senior Executive from CLIENT4 reports: "*When we signed our first sourcing contracts it was enough to have a one outsourcing officer who has managed our pool of suppliers. Nowadays, we have the whole department which is taking care of our sourcing contracts. Frequently, I have the feeling that the task of this department consists not in exploring how to exploit the developing sourcing market to achieve strategic business advantage but in how to get through the contract runtime without escalation issues.* (...) *this way* (by applying multisourcing) *we definitely achieve the technological superiority but gain an overhead on managerial tasks as a by-product."*

As the extent of outsourced scope increases, the complexity of managing the outsourcing efforts and their impact upon each other also increases. Organisations can cultivate strong relationships with a select number of outsourcing suppliers and therefore seek to

avoid engaging with a large number of suppliers. Controlling the number of suppliers provides an opportunity to simplify management efforts, reduce hidden costs, and shape the portfolio of suppliers to provide future options. But the question on the ideal number of outsourcing relationships remains open.

It is crucial in a multi-sourcing context (especially where services that are interrelated or co-dependent are divided between different suppliers) for services to be defined clearly and comprehensively. A key risk with multi-sourcing is the potential for gaps to remain between the various tasks allocated to different suppliers. Often these oversights are not evident until a problem arises. Multisourcing paradigm was intended to bring the relief from the dependency issues that single outsourcing is afflicted with. However, a strong consolidation wave amongst the providers in the background, caused by recent economic downturn, bears unforeseen surprises with respect to hidden market structures. Thus it is well possible to have various providers for multiple services and still be dependent on a single “puppeteer vendor” that is not transparent from the first sight and is active in the background.

There is also often the potential in a multi-sourcing arrangement for the services of one supplier to be adversely affected by the activities of another. Thus the clear boundaries and well defined interplay of different services within one company becomes a crucial factor for success. As for IT services, some areas can be more complex to outsource than others. As a general rule of thumb, the more discrete the part is, the easier it is to outsource and the less governing interference it demands at later stages. Comparing the various kinds of services available, there are clear differences between them with regard to the complexity of the outsourcing, ongoing management and benefits achievable.

There are significant differences between unisourcing and multisourcing. The most compelling difference between the two approaches is that they require different internal management structures. Multisourcing will require a broader internal management equipped to manage several vendors at a time. In addition, there are liability issues. There are also cost benefits and risks associated with the two approaches. Bundling services together may allow the vendor to quote a better overall price for the services. However, if the vendor has to build a necessary infrastructure it may be more cost effective for the customer to contract directly with the subcontracting organization. The contract should also contain mechanisms to encourage suppliers to cooperate in resolving any disputes.

Management of multiple vendors frequently entails practical difficulties that can easily outweigh the commercial benefits.

4.5.8 Knowledge loss

As indicated above, many customers choose to adopt a multi-sourcing approach in the hope of avoiding being "wedded" to a single supplier. However, in adopting the multi-sourcing approach, customers often overlook one of the most basic ways in which that can occur – through technology or knowledge dependency. This type of dependency can occur with any form of outsourcing, unless intellectual property issues are planned for and dealt with properly. Suppliers, *de facto*, often attempt to achieve a "lock-in" by structuring their contracts so as to retain control of intellectual property supplied under the contract, preventing its use by competitors. A sales officers from VENDOR1 gives an account from his track record "*there is nothing illegal in what we do. Same as our clients safeguard themselves with draconian prosecution actions, we safeguard ourselves with knowledge transfer* (...) *It is commonplace for us to compile outsourcing contracts with transfer clauses. In my opinion, it is a win-win situation. Clients get their services with competitive pricing and we increase our knowledge base* (...) *If everybody follows the rules of the game there will be no nasty moves and nobody will ever ask where the knowledge resides* ."

Such knowledge relocation bears dangers if one of the parties decides to act in an opportunistic way. It can give the supplier the power to demand fees for the use of those systems or information by other vendors, making competing proposals to provide services to the customer uneconomic or impossible.

4.5.9 Misperception of moderate cost increase

Another interesting discovery was the revelation of real costs for most of the outsourcing deals. Interestingly, these results were revealing for some of the stakeholders coming from the clients fraction. Apparently the whole trick of the lucrative outsourcing deal for the vendor is to make the client believe there is only a moderate increase of costs. Entering an outsourcing deal a client assumes *ex ante* some increase of costs and therefore urges for renegotiation of the contract in regular periods. However this renegotiation drive is not able to prevent opportunistic behaviour on the part of the vendor. In conjunction with the knowledge loss issue (cf. section 4.5.7) clients lose the sense for exact pricing patterns on the market as they are not in the position to estimate

these costs accurately anymore. Nonetheless, clients assume some moderate increase of the maintenance costs. The satisfaction or dissatisfaction with the contract is reduced to the consideration of the cost increase over the runtime of the contract. The plain truth is however far away from that naïve thinking on the clients' side. Most of the outsourcing deals are constructed in the manner depicted in Figure 4.5-1.

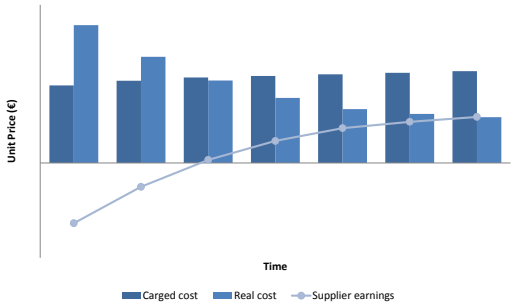


Figure 4.5-1: General pricing development in outsourcing contract on hardware maintenance.

A senior sales officer from VENDOR4 recapitulates: "*it is a calculation that can only work out with time. In the first phase we put lucrative bait on the market. It does not have anything in common with luring anybody in a trap. Due to strong competition we are forced to work below the break-even point at the start of the contractual period.*" Once customer is interested, there is a negotiation phase where the thresholds for the various costs increases are manifested. After a while these costs are renegotiated and corrected upwards (and seldom downwards). The upwards correction can be always justified with various change requests and out-of-scope activities. Figure 4.5-1 makes it evident that the real costs for the maintenance of the same hardware will naturally decrease. Vendors usually try to arrange contracts without compulsory renewal of hardware by presenting these options as extremely costly. As a result, one encounters a state of alleged mutual benefit – a vendor who is cashing up dramatically and a client who, illusorily, believes it has entered a lucrative deal.

For instance, financial institutions in Germany have an additional 19% costs conditional upon taxation for services acquired from the outside. In contrary, tax is inapplicable for services adduced onsite. Tough the client can claim the tax back as input tax set against the VAT due as output tax on sales. However, for a certain period of time these costs represent a temporal investment that stresses the balance sheets. Therefore, vendors have to pretend to be at least 25% below the production cost of the customer to become lucrative. Traditionally, vendors have offered clients the benefit of significant discounts in the early years of the relationship in exchange for higher rates towards the end of the

term. However, this approach is increasingly untenable in today's economy. Service providers offer client organizations significant discounts of 20% to 25% below existing market rates in the initial year of the contract term, along with purchases of client assets at book value (cf. section 4.5.8 on knowledge loss issue). These savings were then offset by rates of up to 30% higher toward the end of the term. This "back-end loaded" approach to outsourcing contracts poses a variety of challenges, most notably that of assessing the "fairness" of pricing at any given point in the contract term. Whatever their drawbacks, early discounts have provided clients the benefit of a short-term cash infusion and boost to financial performance. Service providers, meanwhile, have leveraged the discounts as an incentive to secure long-term agreements and reaped higher margins towards the end of the contract term.

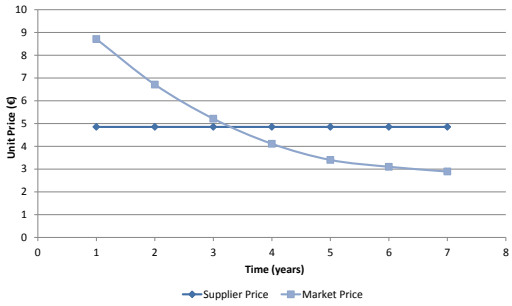


Figure 4.5-2: Fixed price bid for the contract runtime.

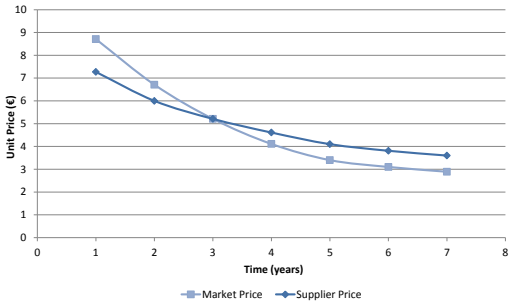


Figure 4.5-3: Flexible price bid with close market alignment.

Figure 4.5-2 indicates what can happen when a vendor offers a fixed price bid for fixed scope. When the first benchmarking window opens, corporate memory of the discounts from the early years of the contract may have been lost. Figure 4.5-3 depicts a leading practice for vendor bids. Here vendors produce a contract that delivers services at market price throughout the life of the contract, i.e., where market and vendor price are more closely aligned. The opportunity still exists for a slightly lower than market price initially, which then tracks closely to the market.

A strategy analyst from CONSULTANT4 stresses the issue as follows: "*after a year or so, the honeymoon period is over. Cost reductions and efficiency enhancement turn out to be minimal at best. The vendor struggles to meet the obscure business objectives and aggressive performance targets while focusing on his own profit margins.*"

4.5.10 Dynamics of Asset Specificity

Interviews lead one to suspect that the notion of asset specificity is used without substantial definition of the term and moreover, remarkably, without fixed meaning. None of the interviewees was able to provide a clear definition of the term and the

definitions provided were not consistent with each other. Interestingly, some stakeholders reported that the notion of asset specificity with respect to IT services has changed over time. A project manager from CLIENT5 recapitulates: "*some of our services which have been classified as core specific couple of years ago appear now on score cards for outsourcing evaluations*." Further, an officer from a trading analytics department at CLIENT1 has made a reverse experience: "*last year* (2008) *we have experienced a case where some services for credit cards evaluation have been taken back in-house due to wrong prior assessment of these services as noncore.* (…) *vendor performance played no role in this decision. It was decided by the executive board that upon a new internal reclassification these services have moved up an internal value chain*."

Figure 4.5-4 represents the structure of a typical service in a financial institution as sketched by stakeholders during the interviews. Mostly the service consists of more than one sub-service. These sub-services are highly standardised and can be outsourced smoothly. The pervasive problem is to identify which of these sub-services is really specific. In that regard, the interviewed stakeholders appealed to the experience and business impact of a service under consideration.

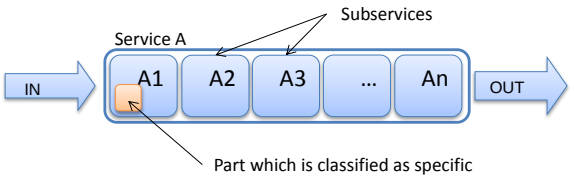


Figure 4.5-4: Generalised service structure as depicted by interviewed stakeholders.

A senior sales representative from VENDOR1 provides the following explanation for the dynamics of asset specificity: "*clients generally tend to unfold a more aggressive sourcing behaviour after having undergone several successful sourcing deals. Same customers get back to us in the contract renegotiations and ask us for further services they refused to outsource before.* (…) *Recently discovered area of outsourcing, which was deemed as untouchable before, are the R&D* (Research and Development) *services. We get increasingly more requests on development of credit risks models and default swaps. This was simply unimaginable in the past.*" This behaviour raises all kinds of questions on the consequences of such outsourcing and will not be considered within the present thesis. Modularity of services structure seems to have penetrated the monolith thinking of financial sector. A senior sales representative from VENDOR1 carries on: "*on the example of a particular client of ours one can observe the paradigm shift over time – some credit*

risk assessment models have been considered as part of the investment strategy by that client. Then he realized that developing such models is just another IT task where a programmer receives formal specifications and simply implements these. It can be done by the internal or external staff and is not part of a core service."

To reduce cost and gain competitive advantage, organizations should source for services and products strategically by internalizing components critical to the product or service with which they have distinctive competency and outsourcing peripheral business activities. In IT services, transaction specific assets include fixed assets such a specialized and dedicated equipment, operating procedures, and software systems tailored for the use of a specific organization. Idiosyncratic professional skills and specialized know-how embedded in human assets can be regarded as transaction specific too. Figure 4.5-5 depicts an asset classification diagram as deployed by CLIENT2 in outsourcing workshops. The classification of the service is made subjectively in a survey manner.

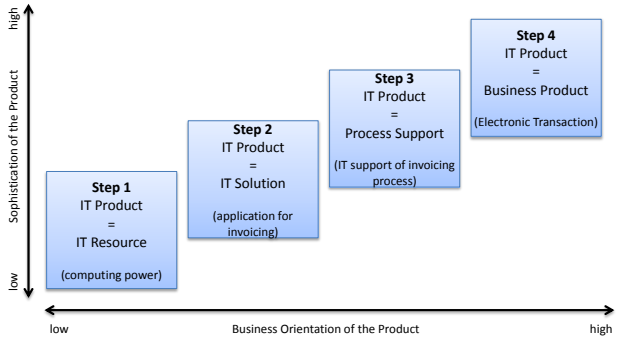


Figure 4.5-5: Simplified asset specificity classification diagram as deployed by CLIENT2.

The literature review revealed that Quinn is one of the most cited authors in the academic outsourcing literature regarding the outsourcing of non-core activities. Interviews showed that his views also found their way in the practitioners' circles. His views can be found in numerous publications of Outsourcing Institute and have been cited by interviewed practitioners on multiple occasions. The main idea of Quinn is that any non-core activities or activities one cannot perform optimally shall be outsourced. Without going into detail of how right or wrong this statement could be (the literature on criticism of Quinn's statement is ample) it shall be remarked that Quinn assumes a dichotomous distinction between core and non-core assets of a firm. In contemporary organizations services are strongly interconnected and practitioners find that the distinction between these two categories is often hard to draw. An operations manager from CLIENT4 confirms: "*Each consultancy that we had in our house brought its own*

evaluation apparatus to determine what is core and what is less core. I have the feeling that in most of the cases my gut feeling would do equally good as their tools. I wished there would be a silver bullet for this issue, so far it remains a highly subjective task." Figure 4.5-6 was sketched by the strategy consultant from CONSULTANT3 as an attempt to explain the service buyer performance with respect to outsourcing degree depending on specificity of services being outsourced.

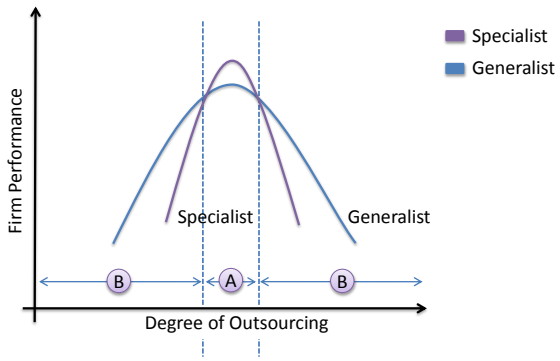


Figure 4.5-6: Correlation between firm performance and degree of outsourcing.

A more specialised firm will produce a higher performance optimum rather than a generalist firm (interval A in Figure 4.5-6). The root cause lies in the alignment of the assets in the specialised firm – the assets are better geared towards the activities that can only be undertaken in-house. It is assumed that any vendor will never be able to achieve same effectiveness in performing an activity of a specialist firm . Yet at the same time the specialized firm will experience a steeper fall if the degree of outsourcing goes beyond the optimal level (interval B in Figure 4.5-6). The hidden agenda of behaviour is the assumed misalignment of the firm – by outsourcing too many services some core specific processes get outsourced too, which is reflected in the overall performance of the company. Further away from the optimum the point is reached where the generalist firm actually outperforms the specialist firm. This analysis produces an important conclusion in the context of firms' outsourcing strategies. Firms have been advised to concentrate on core competencies. The analysis of the graph in Figure 4.5-6 reveals two main characteristic of the aforementioned classification into specialist and generalist company profiles – firms that specialize are able to increase their performance potential. At the same time, being more specialised also increases a firms' vulnerability to mistakes as the slot of acceptable firm performance is narrow. Figure 4.5-6 sketched by CONSULTANT3 mirrors the opinion of academic literature on the issue (Kotabe and Mol, 2004, 2009; Mol, 2007).

4.5.11 Myth of Enemy

In most outsourcing negotiations a vendor is setup as an enemy and the contract is there to safeguard oneself from any opportunistic behaviour on the part of the vendor. Williamson's framework only supports this view of transaction relationship (cf. section 2.2.2). Actually it is arguable whether the whole framework is feasible if one takes out the assumed opportunistic drive of the transaction partners. TCT sees the vendor as somebody who has to be forced into doing what the client thinks is the best (cf. section 2.2.3).

However, this type of negotiations guided by procurement departments cannot sustain with increasing weighting of the relationship management issues (cf. section 4.5.3). Therefore a different tenor for negotiations has to be set nowadays. Vendors do not go away after setting up a waterproof contract. In an outsourcing contract one is setting up a relationship which lasts for several years. It is therefore very important that in a negotiation one does not establish an enemy-like relationship. Many stakeholders, as well on the service buyer as service provider side, mentioned that a well setup contract does not necessary leads to a good social vendor-client relationship but in contrary a good social relationship *a priory* results, as a matter of fact, in a well-established contract.

Despite the theoretic indications, the reality exhibits an adverse picture. A senior consultant from COUNSULTANT6 states: "*Operational concerns become the dominating factor in the relationship with very little attention given to the care of the shared vision that we agreed on at the outset. There was this clear view on objectives and future directions but it got blurred over time. It is hard to get the train back on the rails ones it is off track. It becomes a self-fulfilling prophecy game – if I am convinced that my relationship partner is trying to take me for a ride than I will see his every single action as an offence and react accordingly. Consequently, I cannot expect him to act in a friendly manner.*" This is, by far not an isolated statement of that kind. Many of the interviewed stakeholders complained about the enemy-like picture of their opponent at the negotiation table. A sales representative of VENDOR1 adds: "*We all have a vision and a picture of a rosy future until we get back to the negotiation table. Once there, we switch to the safeguard modus. Instead of cooperative atmosphere it is all down to the procurement people*." An equally pessimistic reflection was encountered on the client's side. A procurement officer from CLIENT4 attests: "*It is difficult to get sufficient time and*

attention from the provider's managers. We get all the care one can imagine until the signature is set on the contract. Then the iron curtain immediately falls and the call centre is the single point of contact one is left with." This foe centred view of providers conflicts with clients aspiration to seek an outsourcing supply of best of breed IT services with added value. Once the contract is signed, there is a danger that the balance of power swings too sharply in the supplier's favour.

An eventual failure of the outsourcing relationship is menacing if the financial and legal considerations have been the predominant factors in the supplier selection process instead of investigating the provider's ability to form a successful relationship with the customer organization. A senior manager from CONSULTANT4 summarizes: "*We call it an exposé effect. Like an advertised property that looks breath-taking on the reprint of the real estate agent's leaflet, the vendor might bring all prerequisites – substantial project track record, necessary certifications, best financial offer and attractive business plan – and look great on paper.* (...) *But, by far, it* (formal requirements) *has not proved a recipe for successful coexistence of contractual parties.*"

4.6 Conclusion

The interviews undertaken during the fieldwork provided ample evidence for realistic modelling of behaviour. Also, for the current research the fieldwork provided an important opportunity to test assumptions built into the models. Thus, the validation process could incorporate stakeholder interaction at an early enough stage to allow for valuable feedback to inform the model development. In the case of the two models presented in the thesis, the stakeholder interaction resulted in a revision of endorsements and elicited knowledge about vendor selection and management strategies.

In retrospective, it was much easier to get hold of both providers and clients through consultancies already participating in the research rather than approaching these companies directly. The fieldwork incorporated interviews with 6 client, 4 supplier and 5 consulting companies. All respondents were experienced in global outsourcing and experts in business and IT service location attractiveness.

The extensive use of consultancies in the fieldwork setup minimized the peer group of stakeholders that was necessary to obtain equal proportion of clients and vendors

respectively. In general, the response rate from consultancies was much higher rather than that of providers followed by client organisations. The author argues that a broad geographic coverage of the interview panel coupled with a range of functions does not account for a fully representative or stratified sample but did not cause any bias. A main contribution of this thesis is the development and proof of the research technique and is not vitiated by any bias in the panel.

After analysis of the interviews it was clear that along the lines of academic research of outsourcing, TCT has found its way into practitioners' minds. However, the influence of TCT seems to limit itself to the usage of the terminology without deep understanding of the underlying constructs. The tools described in this chapter aim to support practitioners along the chain of outsourcing tasks and mime the core features of the TCT – score cards (measurable units) and organisational spanning trees (measurable structure) both seek to determine asset specificity.

The stakeholders raised a number of questions relating to the research objectives, both at inception of the project, and during the evaluation phase. The assembly bellow covers only topics that represented focal interest of involved practitioners and have been reflected in the TCT (cf. chapter 5) and EBO (cf. chapter 6) models:

- Dependencies

  Interview responses indicated that the most popular course of action at the end of a contract will continue to be contract renewal with the incumbent supplier. The interviewed stakeholders suggested that a quarter will be re-tendered and awarded to new suppliers, and only a tenth are taken back in-house. In vast majority of cases the renewed contract with the incumbent supplier of these services will be prolonged due to some dependency issues. Involved stakeholders cited prominent keywords resembling similarity to risks well described in the management and academic outsourcing literature but were not able to explain the reasons why would these risks lead to dependencies.

- Standardisation

  A firm that wants to enter the outsourcing market, be it as a vendor or a customer, is required to streamline the internal IT through standardisation efforts. The trend of standardisation is, however, misleading since it makes outsourcing process appear nearly commoditised – an illusion that costs dearly many clients. With a standard set

of services, standardised infrastructure and well established interfaces it is hard to imagine that problems can arise. As various track records of interviewed stakeholders show, having a common set of tools and agreeing on a functional specification document does not provide safeguards against outsourcing failures.

- Relationship management

  As more functions are outsourced, integrating and managing a portfolio of service providers is becoming more difficult and is causing significant service disruptions in many organisations. As part of strategic outsourcing vendor stratification and increased focus on vendor-relationship management is essential. After having undergone a rapid paradigmatic change from unisourcing to multisourcing firms are confronted with often unexpected demand for new management techniques and specialized skills among the client-side management teams. A failure to develop a truly collaborative relationship greatly increases the risk of unsatisfactory service levels, frequent disputes and increased contract management costs. The need and awareness of clients for change in established management techniques is constantly growing but companies are still struggling to address these requirements adequately.

- Merger and consolidation

  Feedback from the fieldwork indicated that the current trend of alliances and acquisition among suppliers will continue to grow. Offshoring, now being an integral component of most outsourcing deals, forces big western players to scale up dramatically in most vivid offshore locations. As a result, companies looking to offshore can now consider western based providers along with the local providers that are native to a particular country. By implication that means that non-domestic vendors are now competing with large domestic companies for service delivery out of non-domestic regions, which makes the breakthrough for these companies nearly impossible. Outsourcing from foreign vendors may yield substantial benefits, but is riskier than alternatives with usage of locally based vendors. Hence, many client organisations are wary of non-domestic IT services. Interviewed stakeholders confirmed the trend for increasing globalization of the market as more regions seek to cash in on the offshoring boom. Furthermore, fieldwork indicated following vendors' M&A drivers in the outsourcing market: *(i)* extending the geographic footprint of the company, *(ii)* growth of consumer demand, *(iii)* economies of scale, and *(iv)* increase of the monopoly power.

- International vs. domestic

  As indicated above, many client organisations are wary of non-domestic IT services as language and cultural barriers, legislation uncertainty and fears of losing intellectual property remain significant threats for many western companies. Despite the reluctance of western companies to enter a contractual relationship with a non-domestic provider the offshore sector is still booming and gaining on momentum. A claim for going offshore, besides cost-cutting measures, which was frequently put forward by the interviewed stakeholders, is the qualification level of the workforce at the destination countries. Furthermore, political and socioeconomic pressure serves another controversial argument for the offshore move. Despite offshoring being frequently referred to as the "axis of evil" by the press, it is a *sine qua non* for any listed company.

- Overspecification

  This trend arose from the clients' strive for safeguards. Due to increasing numbers of project failures, companies that aim at outsourcing try to build more rigid rules and guidelines to govern their outsourcing relationships. In limiting the scope of providers' freedom they limit the ability of a provider to react to economic changes or use alternative cost-effective service delivery methods. This slow "suffocation" of the vendor weakens his financial stability and makes him vulnerable for hostile takeovers.

- Paradoxes of multisourcing

  Through the paradigm of multisourcing, customers are beginning to combine best of breed solutions from multiple suppliers. While this approach helps to avoid the risk of over-dependence on suppliers it, simultaneously, increases the complexity of managing supplier relationships. As the extent of outsourced scope increases, the complexity of managing the outsourcing efforts and their impact upon each other also increases. Besides the additional management overheard there is also often the potential in a multi-sourcing arrangement for the services of one supplier to be adversely affected by the activities of another. There are significant differences between unisourcing and multisourcing. The most compelling difference between the two approaches is that they require different internal management structures. However, as experience with traditional outsourcing initiatives has developed and new supplier models have emerged, customer organisations are refining their outsourcing strategies and beginning to combine best-of-breed solutions from

multiple suppliers while still using obsolete management toolset. This is a serious argument since, according to stakeholders, multisourcing tends to encourage more aggressive outsourcing strategy compared with unisourcing.

- Knowledge loss

  This type of dependency is imminent in any form of outsourcing arrangement and appropriate measures have to be planned for and dealt with properly. Suppliers, *de facto*, often attempt to achieve a "lock-in" by structuring their contracts so as to retain control of intellectual property supplied under the contract, preventing its use by competitors.

- Misperception of moderate cost increase

  The evidence regarding the cost development was revealing for some of the client-stakeholders. Vendors delude clients in believing there is only a moderate increase of costs. Entering an outsourcing deal a client assumes *ex ante* some increase of costs and therefore urges for renegotiation of the contract in regular periods. However, these measures are not able to prevent opportunistic behaviour on the part of vendors.

- Dynamics of asset specificity

  The fieldwork revealed that the notion of asset specificity was used by interviewed stakeholders without substantial definition of the term and moreover, remarkably, without fixed meaning. None of the interviewees was able to provide a clear definition of the term and the definitions provided were not consistent with each other.

- Myth of enemy

  Knowing that providers will become an integral part of the service delivery, firms should set up a mutual relationship tenor for negotiation. Instead, adhering to the standard mentality of procurement activity, negotiation is usually set up around driving cost down. In most outsourcing negotiations a vendor is seen as an enemy who has to be pursued into doing what the customer thinks is the best. Outsourcing contracts are different from other contracts in a sense that by signing an outsourcing deal one sets up a relationship which lasts for several years. Starting off such relationship with a prejudice of that kind does not promise success.

5 First Model – TCT[63]

"It is the mark of an instructed mind to rest satisfied with the degree of precision to which the nature of the subject admits and not to seek exactness when only an approximation of the truth is possible."
Aristotle
Ancient Greek Philosopher, Scientist and Physician (384 BC-322 BC)

This chapter presents the first of two declarative agent-based models developed in the course of the research. The current model was developed in the way suggested in section 3.4, meaning that the model has undergone several alterations during the iterative development in order to accommodate the input coming from the evidence gathering process. The purpose of the model is to formalize theoretical stances of TCT, described in literature review chapter 2, thus adding precision to the theory.

First, the overall picture of the model is provided by describing the model dynamics along general lines with references to particular components of the TCT Model in section 5.1. This is followed by an extensive description of the model's key components in sections 5.2. Consequently, social structures that emerged from the interaction and information exchange between individuals in the market are investigated from the micro- and the macro perspectives in section 5.3. Next, the outcomes of the stakeholder validation process and their consequence for the further development of the model are discussed in section 5.4. Finally, the implications of the validation results for the next, evidence based, model are outlined in section 5.5 and concluded with a brief overview in section 5.6.

5.1 Overview of the Model and the Aims of Simulation

The model introduced in this chapter has several objectives. First, it attempts to devise precise statements about measurability of asset specificity (cf. section 2.2.2). Second, it examines the assumptions that agent-based methodology provides a helpful toolkit for critical observation of TCT.

[63] Some parts of this chapter are based on (Werth and Moss, 2007b, 2007c, 2008, 2009)

Outsourcing research uses the term of asset specificity only as guidance without precise definition or quantification of the notion. The ambiguity and the measurement issue is well known by scholars (cf. section 2.2.3.1). The TCT Model attempts to assign to asset specificity a tangible value while letting the protagonists of the simulation act according to TCT postulates. The model is a pure representation of the extreme selfishness notion incorporated in Williamson's theory and purposely abstracts from any social interaction that might matter in the target system (cf. section 2.2.3.2). In order to include a direct representation of relevant relations from the transaction cost theory into the model the original theory had to be altered in a way that made it possible to map in an agent based model. Since Williamson's framework belongs to the realm of equilibrium theories and can be regarded as a snapshot in time, it did not allow for translation of the processes.

After such a model is validated, it is intended to "feed" the model with social modules gradually while observing the clustered and/or volatile behaviour that might emerge as a consequence of actions. The theory-grounded data is supplemented by qualitative descriptions decision making process provided by subject matter experts. In order to emphasise social response to economic stressors and represent adaptive behaviour of agents a whole set of rules was developed upon which agents will draw their decisions and react to changes in environment. The resulting distribution of economic activity across different organisational forms emerges *bottom-up* from processes of interacting agents, and their adaptation of future decisions according to agents' past experience. Hence, the model presents the first step towards formalization of ill-defined TCT aspects. Terms which were ambiguously used in the theory with no exact mapping to the outsourcing context will ought to prove their validity on the test bench of a modelling toolkit. The next section provides a detailed description of the simulation model.

5.2 Model

For the credible exploration of concepts to be operationalized by TCT, one needs to set up a model of the environment which incorporates assumptions made by and necessary for TCT. Contrary to conventional economic models, TCT Model does not apply the stereotype of homogeneous agent. Instead the model consists of two types of potentially interconnected agents that represent firms. The simulated outsourcing market is

populated by agents who proactively seek for partners in order to obtain/provide services needed/offered by these partners. The interaction of these agents is at focus and the two types of firms are called – clients (firms who want to obtain services) and vendors (firms who offer services). The different agent types are described in section 5.2.1 at length.

Following the implied economic pressure[64], agents are impelled to interact with each other in order to survive in the volatile competition. In order for the rules to fire, the environment has to exhibit certain stimuli and conditions *a priori*. The description of the agents' environment, which is modelled as a so-called production space, can be found in section 5.2.3. As specified by the TCT (cf. section 2.2.2), clients have a binary choice of the organizational form at their disposal for the service delivery model – market (outsourcing) or hierarchy (keeping services in-house). Williamson's framework suggests a hybrid form too. The focus of interest among involved industry experts lied clearly on the outsourcing dynamics. Therefore, TCT Model incorporates both organisational structures in a simplified manner. Agents are confronted with a binary choice of either outsourcing a service or keeping the service delivery in-house. The model does not allow for hybrid structures. This assumption is supported by fieldwork evidence. The data suggests that hybrid structures represent an archaic construct which is hardly used in the IT sector. Customers intend to adhere a strict separation between internal and extern service provision. A senior product manager from CLIENT5 underlines the sentiment of the market: "*When I've first started to service my product in the 80s CIOs still had difficulties to let the service go and rely purely on the external service provider. Thus, any hybrid contract was thought to be a back-up solution in case an external provider will fail. In the meantime it is standard to outsource the whole service and save on internal IT staff* (...) *What is specific stays and what is off-the-shelf goes completely."*

The primary task of the client is to find an appropriate partner vendor and subcontract to him. Before the subcontracting can take place the client-agent has to build some differential preferences over available alternatives. First, clients evaluate vendors in their

[64] An emergent economic pressure to provide a constant incentive for clients to seek for outsourcing deals is assumed upfront. In that way a narrow market is modeled with only vendors and clients who are interested in a relationship.

operating range (several service characteristics the vendor is offering, price for the service, performance of the service etc.). Depending on the evaluation of the vendors' portfolios a client will either offer a contract or not. Second, vendors evaluate all received requests based on several vendor-specific preferences with regard to clients followed by establishment of the partnership. Only the most appropriate client will receive an offer, whereas other applicants will be rejected. This matching process is described in the chapter 5.2.5 and the institution of the contract is represented in chapter 5.2.2. During a transaction each of the two partners may opt out of the contract prematurely or stay committed until the natural end of the transaction. The dynamics of the client-vendor relationship depend on the opportunistic elements in the behaviour of both parties involved. In the case of a premature end of the transaction, sanctions are imposed on the defecting party. The characterization of the contractual partners' interplay is reported in chapters 5.2.4 and 5.2.6.

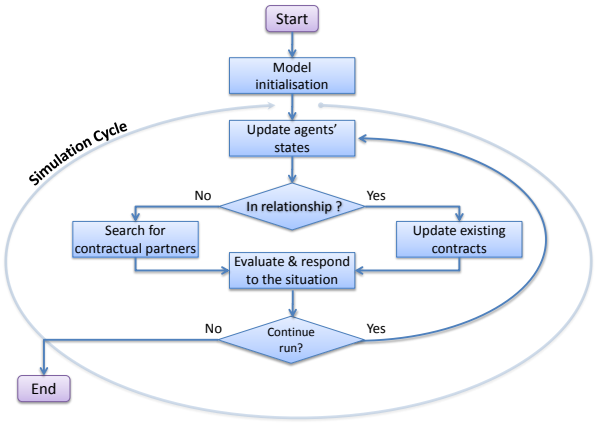


Figure 5.2-1: Flow chart showing the model's process sequence of the simulation step.

Figure 5.2-1 offers a dynamic notion of the model capturing building blocks of processes incorporated into TCT Model. The flow chart showcases in a generalized form the main agenda run through by an agent during a single simulation cycle. That is, the processes depicted are repeated each cycle and run in parallel. The UML diagram is generic and can be used for all agent types deployed in TCT Model. One should bear in mind that while the sequence of building blocks is equal for all agent types the consisting sub-processes of every building blocks differ substantially for the two agent types.

5.2.1 Agents

The actors in the outsourcing process are modelled as autonomous and heterogeneous agents that can respond to changes in the environment they are located in. Hence, interactions play a pivotal part in the process of emergence of social structures. The set of rules used to describe each agent type's reasoning behaviour is inspired both, by Williamson's TCT framework and by evidence stemming from interviews with stakeholders. In the following the origins of evidence used are indicated.

As mentioned above there are two types of protagonists in the model – suppliers and customers. The supplier-agents provide services to their customers. This agent type is set to aim at running the minimal service levels required by the customers and withstand technological innovation over the contract's runtime as long as only possible. This is sound with both, Williamson's notion of opportunism and evidence from involved industry experts. According to fieldwork data it is a frequent occurrence that providers try to "*scratch the service of minimal service delivery*"[65] in order to avoid additional investments and maximize the profit margin.

The technological innovation is defined in TCT Model upon the Lancastrian Production Space (cf. section 5.2.3) as relocation towards the client's position on the coordinate pane. Arguably, the locomotion towards the client does not necessarily represent a notion of innovation. However, in the context of the TCT Model it is assumed that any movement on the production space can be considered as technological innovation since this action involves modification of service characteristics.

The customer-agents seek to find the best match for their outsourcing needs. Once customers entered a contractual relationship with a vendor they will switch the supplier only as the choice of last resort due to the assumption of high switching costs. This proposition is in line with the constraints posed by the TCT (cf. section 2.2.2). After tagging a supplier as trustworthy, the client is expected to act in a trustworthy manner. It is not entirely clear from the theory when a supplier is to be classified as trustworthy. An assumption made at this stage was based on the Williamson's notion of opportunism.

[65] Statement of a vendor management officer from CLIENT4.

Thus a supplier can be tagged as trustworthy if the last contract with this supplier met customer's expectations. While being in the contractual relationship customer agents are constantly trying to measure supplier's performance and to motivate the supplier to improve performance while reducing unit costs over time. Here an extensive use of the endorsement concept was made (cf. section 5.2.6).

There are two sets of rules in the model: *general rules* – which describe local actions of individuals independent of their capacity to interact with each other, and *topological rules* – which describe the possibility of interactions through connections between individuals. Under topological rules one has to imagine any behavioural rule agents might use during the transactional period, i.e. renegotiation of the contract, evaluation of the partner's performance, monitoring, breach of the contract. Hence, rules agents use in the contractual partner search phase are called general rules, i.e. vendor selection, vendor evaluation (while not yet subcontracted), contract establishment.

A client is assumed to have a constant drive for subcontracting a third-party vendor for transferring some in-house services to this vendor. This assumption comes only partly from the economic theory where agents seek for new alternatives of profit maximisation but is mostly attributed to the stakeholders' focus of interest. The assumption can be justified with fieldwork data suggesting that most of financial organisations streamlined themselves in the recent years to the extent where these companies cannot function in an autarkic way anymore. The concentration of the financial core functionalities caused massive reduction of IT staff. These companies do not have all the skills and scale for in-house delivery of needed IT services anymore.

The aforementioned behaviour is achieved by endowing vendor-agents with slightly more attractive pricing of services rather than client-agents. In support of this assumption it can be argued that, there may well be vendors with less attractive pricing on the outsourcing market but since a narrow market is modelled, only these vendors are taken into consideration that fit the aforementioned criteria. Whereas Williamson does not provide evidence here, fieldwork suggests that vast majority of vendors can offer competitive pricing due to experienced economies of scale and experience (cf. section 4.5.9). In the

context of TCT Model this assumption was necessary to keep a constant impulse for agents to interact. Since one of the objectives of the model is to investigate the notion of asset specificity in the transactional setting, agents had to be equipped with the aspiration to enter into transaction relationships. Accordingly, a vendor is assumed to rely on clients' orders to survive in the face of competition. This is realized by vendor's ambition to work at full capacity, meaning that a vendor-agent will not refuse a consideration of the contractual offer if he still has capacity to accommodate another client.Vendor-agents can build relationships with clients in a non-exclusive way. Scenarios are possible where a vendor collaborates with multiple client-agents. Each vendor-agent has a capacity quota that limits the number of clients he can be involved in the contract with. At the beginning of the simulation run the quota is initialized as an arbitrary number for every vendor-agent separately. Thus any vendor-agent can simultaneously be involved in an outsourcing relationship with several client-agents. Clients, however, can be involved in the outsourcing relationship with one vendor only. In the absence of an appropriate vendor a client would keep the service delivery in-house while still scanning the market for suitable service providers. Since TCT in its original formulation (Coase, 1937) does observe each relationship on its own it was assumed, for better match to the theoretical framework, to provide clients with this limitation. These collaboration relationships of agents are of a non-permanent nature, thus they can be built up and broken respectively in accordance with agents' perceptions of the current situation.

TCT offers a snapshot view of the transaction and doesn't allow for transitions. Thus any change of the vendor's or client's properties (production cost, capacity and clients pool) has to proceed during the contract free span. In case of a vendor who is involved in multiple outsourcing relationships a partner client will come to know vendor's new production costs only after his relationship with this same vendor finished.

5.2.2 Contracts

As already mentioned in the literature review chapter, Williamson classifies the transaction type upon two dimensions – the frequency of occurrence and the degree of asset specificity (cf. section 2.2.2). Consequently his framework for categorizing the most efficient mechanism of governance is based on these two dimensions. In his framework

Williamson categorises the most efficient governance mechanisms as either classical contract, neo-classical contract or relational contract. In the case of outsourcing it is sensible to translate the aforementioned governance mechanisms in total outsourcing (outsourcing of all services to the supplier), selective outsourcing (keeping the most specific assets in-house while outsourcing others), and keeping services in-house. In the case of outsourcing Williamson suggests a classical contract, neo-classical contract or relational contract. The presented model, however, does not provide this distinction. Instead, like Coarse in his seminal work (*ibid*), the model considers the market and the firm as two alternative mechanisms that could be facilitated to conduct a transaction between parties. Therefore each client has a binary choice to insource (keep services in-house) or to outsource (obtain services from the vendor).

The fieldwork evidence suggested to incorporate an annual contract renegotiation. The reason for doing so is the business uncertainty and technological changes. A senior consultant from CONSULTANT2 stated: "*There is no such thing as short negotiation periods. The next day one has signed the contract the subcontracted provider is already working with half the production costs he mentioned at the negotiation table. There is an easy rule of thumb - the more one talks about cost structures the cheaper they become.*" Accordingly, the renegotiation process is triggered by the client-agent. This, so called, process of adaptation is described amply in the chapter 5.2.6. A premature breach of the contract triggered on the part of a vendor or a client is a possible outcome of this process in case of the dissatisfaction with the current relationship by any of the parties involved. The premature cancellation of the relationship is, however, a last resort, and is preceded by numerous warnings and requests from both sides.

Both types of agents are less favourable towards premature contract cancellation as a solution if a contract is near the end of its runtime. It is considered best to wait until the natural end of the transaction. In this situation it is a cheaper alternative rather than facing compensatory damage and legislative measures. Once entered into an outsourcing relationship, there is an idle time until another one can be initiated by a vendor-agent. This time delay between relationships accounts for one-off payments connected with

entering an outsourcing relationship (communication infrastructure, knowledge transfer, etc.). Same applies for both agent types in case of a premature contract termination. It is assumed that premature contract termination leaves both parties unable to achieve a smooth transition to a new business partner, thus an initial investment is necessary.

5.2.3 (Production) Space

Central to the Williamson's transaction cost framework is the notion of asset specificity. Specificity in its own turn leads to product differentiation and mutual/unilateral dependencies. One way to model it is to use the *n*-dimensional *Product Characteristics Space* (henceforth PCS) (Lancaster, 1966) as was done, in the only agent based model on TCT found during the literature review, by Klos (2000). In Lancaster's proposed approach consumers and products are placed on an *n*-dimensional PCS, the location of a product represents a characteristics portfolio it offers and the location of the consumer represents his "ideal product". Klos locates products as well as consumers as points in a multidimensional PCS. Through the product differentiation and agent-specific variable Klos determines the returns for the producers.

In order to replicate the TCT behaviour of concerning actors the medium where agents are located has to allow for preference matching and adaptation with respect to opportunism, bounded rationality and asset specificity. These conceptions can all be defined upon the aforementioned production space with the slight modification of the latter.

This approach was adopted for the model at hand in an altered way and needs to be described in some detail as it is crucial for the understanding of assumptions in the model at the later stage – both, product differentiation and asset specificity are defined in this space. This Lancastrian PCS approach was adopted for TCT Model in such an altered way that instead of products and consumers, the space has been populated with agents representing vendors and consumers. Both, product differentiation and asset specificity are defined upon this space. Vendors and clients are located in the production space. Location of the vendor-agent represents the service he offers and the location of the client-agent represents the in-house service he would like to outsource.

The evidence from stakeholder interviews suggested five most frequently outsourced IT functions: *production*, *operations*, *application development*, *desktop services* and *local support*. Therefore, a 5-dimensional product space was chosen for the TCT Model. Location on the grid is not exclusive. It is well possible for more than one agent – vendor and/or client – to be located at the same spot in the space indicating, for example a perfect match between the services needed by a client and services offered by a provider.

Services are identified by an *n*-dimensional vector of salient characteristics in the PCS (Lancaster, 1966). As pointed out above, industry experts suggested five services with high outsourcing probability. Taking this evidence and technical limitations of the system where the simulation was going to be performed (cf. section 8.3.5) into account the model exhibits a 5-dimensional vector. Clients face a variety of vendors each offering a different set of characteristics. Once a client-agent is allocated, his service characteristics (coordinates in the PCS) are fixed. Behind this assumption is the belief that it is highly unlikely for a client, who is representing a financial corporation, to change its in-house IT services rapidly. However, this is what is expected from IT services providers. As an IT operations manager said: *"*(…) *it is incredible how old are some of the banking legacy systems and software applications we have to deal with on the day to day basis. Some of the production systems are more than 20 years old and they are still in service* (…)." Vendor-agents, by contrast, are freely movable on the PCS thus adjusting their services to the demand of the market. It is assumed that vendors incur costs while moving in the PCS. Therefore, vendor-agents have a limited radius of reach before they have to recuperate from the effort made while moving in the space. It proved efficient to adopt the multiple characteristics representation as it facilitates and supports inclusion in the model of many of the intrinsic qualities of vendor-client interaction.

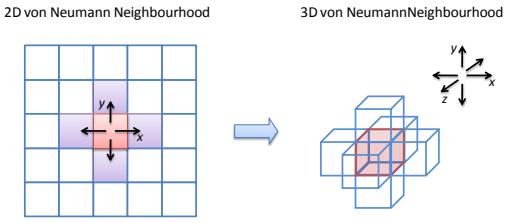


Figure 5.2-2: Extension of the von Neumann neighbourhood from 2D to 3D space.

In the same way as in a 2D plane a cell's neighbourhood extends a r = 1 neighbourhood into either a *von Neumann* or *Moore neighbourhood* set, in a 3D space a cell's neighbourhood extends this idea through the z-plane (see Figure 5.2-2). In the case of PCS as implemented in the TCT Model the thinking has to be extended for the further two axes. While tracing his neighbourhood the agent "taps" into each adjacent cell of the five dimensions to scan the location. The use of Moore neighbourhood was abolished due to constraints regarding the computational issues[66]. Instead the von Neumann neighbourhood was implemented. In retrospective, the simplification of the sphere in Figure 5.2-3 to the Moore neighbourhood could be justified with field work evidence. According to involved industry experts the paradigm of multisourcing (cf. section 4.5.7) clients are prescribed to knit for outsourced services separately and refrain from use of mega-contracts encompassing multiple services. Translating this evidence into TCT Model would mean that any cells in the PCS sphere outside the Moore neighbourhood can be reached only via relocation on more than one dimension. Regarding the implementation of the PCS any relocation in a dimension means alteration of the corresponding service. Thus, a relocation on more than one dimension would contradict fieldwork evidence.

Figure 5.2-3 illustrates the altered PCS as used in TCT Model. The sphere around the C_1 agent represents his "visible"[67] space. It shows a sample client-agent C_1 with his corresponding acceptance range (the sphere around the client).Two vendors, V_4 and V_3, are currently in client C_1's "visible" space. The acceptance range of the client can be thought of as an area around the client that can be queried by him for presence of other agents. Thus, this area can be also called "visible". The acceptance range of an agent is defined as an area accessible from agent's current position via one step in any direction. The arrows from client C_1 to vendors V_4 and V_3 are the distance vectors, which represent the cost of "transportation" C_1 has to incur in order to obtain either V_4's or V_3's service.

[66] The calculation of distance in a 5-dimensional space with Pythagoras' theorem involved inefficient calculation routines (rounding of the distance in order to match a particular cell) which slowed down the simulation considerably.

[67] While talking about one agent's acceptance range the term visible will be used in order to reflect how many other agents would satisfy his demands with respect to characteristics.

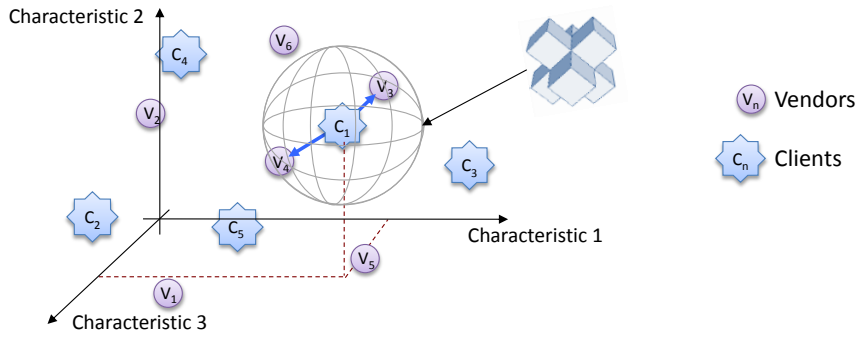


Figure 5.2-3: Simplified 3D production space.

The acceptance range of an agent has to be imagined as a sphere around the agent with a radius *r*, where *r* is a random number drawn from the range [0,5% of the axis length]. The acceptance range represents the service levels that are still accepted by the client. Thus, a client with the zero acceptance range accepts only the "perfect match" of an offered service with the one that is needed. Whereas a client with the non-zero acceptance range is willing to accept service levels which do not match his "ideal product" exactly. Therefore, if a vendor is located outside the sphere of a particular client-agent, it does not satisfy the requirements of that client and the vendor will not be considered as a possible relationship partner.

The acceptance range is also used for the representation of the concept of bounded rationality. Williamson, in his introductory work on transaction cost theory (Williamson, 1975), encompassed bounded rationality (cf. section 2.2.2) as limited access to information which is translated in jargon as information impactedness. For ABM research, this implies that researchers should design systems that do not attribute unrealistic levels of ability to agents (Taylor, 2003). Therefore, allowing agents in TCT Model to perceive the "outer world" though the limited "eyes" of acceptance range, the concept of bounded rationality is modelled.

5.2.4 Opportunism[68]

From Figure 5.2-1 it is evident that a simulation cycle routine of an agent in a transaction relationship differs substantially from that of an agent outside of a relationship. A client without any contractual ties systematically re-evaluates his acceptance range in every

[68] The sort of opportunism described in this section deals with opportunistic behaviors, which may occur during a transaction between two agents.

time step of the simulation. In accordance with behaviour assumptions described in section 5.2.1 he is doing so due to his aspiration for cost reduction. If a client has spent a substantial time without being able to find a transaction partner (vendor) he might want to widen his acceptance range. While being not that rigid about the accepted service levels the client-agent hopes to find vendors, who will satisfy his new service levels. Thus, using the jargon established in the previous section 5.2.3, any vendors that fall into agent's increased acceptance sphere become "visible" for that client. Arguably, the aforementioned process causes some level of standardisation of services in the narrow outsourcing market that is modelled and is sound with evidence from the fieldwork (cf. section 4.5.2).

The dynamic adjustment of a client's acceptance range entails a selfish nuance. In case there is an increase in "visible" agents in the "visible" range of a client, he might consider narrowing his acceptance range. This action will take place independently of whether the agent is currently in a relationship with any particular vendor or not. The hidden agenda of this demeanour is the notion of standardization. As the number of available vendors, who are able to satisfy the outsourcing needs of a client, slowly grows the client starts perceiving his service needs as standardized. The more vendors appear in the client's acceptance range, the stronger is his belief that his service is less specific. There is always a possibility that by narrowing his acceptance range a client-agent will exclude his current contractual partner and eventually abort a relationship prematurely if the vendor will refuse to adjust his services. In this context, service adjustment means for the vendor to move closer to the client on the PCS until he will penetrate the acceptance range of the contracted client again[69]. The client-agent will not terminate the relationship instantaneously but after some grace period. The more vendors become "visible" to the client, the more likely he is to terminate any ongoing relationship.

[69] Vendors, by purpose, are not capable of assessing whether they are visible for any client or not. Thus, a vendor-agent evaluates his "visibility" for the contracted client by means of the number of adjustment requests from the client. These differ from usual adjustment requests broadcasted by the client while being in the contractual relationship.

The choreography above transforms the symmetric transaction dependence between vendors and clients into a unilateral dependence on the part of the vendor – switching costs for the client decrease whereas vendor's switching costs in its turn might increase. The switching costs as such remain the same but the idle time – the time without any contractual partners – for service providers increases. The area around the client is oversaturated and the probability for establishing contractual ties quickly diminishes.

Furthermore, a client expects his relationship partner to systematically adjust his characteristic portfolio in order to achieve economies of scale and experience. The client will send out regular requests for characteristics adjustment. By complying, the vendor starts to transform his assets in a way specific to the demands of the client. An interviewed consultant from CONSULTANT2 expressed that sentiment as follows: "(…) *there is no such thing as the perfect match* (between any outsourcing partners)*. Thus, clients chose the today's best of breed and expect him* (the provider) *to adjust gradually to their demands over time. What they fail to take into account is that a vendor will not have had enough being fed from one hand only and will look for other income sources to avoid dependence*."

Analogously, the vendors are assumed to be entirely opportunistic too. On that account the vendor would comply with the request as long as his actions do not place him at a disadvantage by, for example, creating a threat of losing potential customers or getting too specialized on the needs of the contracted client. In other words, the vendor-agent will gradually move towards the client-agent in the PCS until he starts losing other clients, which were "visible" in his range before. The loss of clients in the vendor's "visible" range is interpreted by the vendor as becoming too specialized and not being able anymore to cover the same broad range of clientele needs as before. Vendor's possible reaction to this reasoning is either refusal of compliance to client's requests regarding the characteristics adjustments or breaking up the transaction with the client. The latter choice depends on the number of contract requests from other clients.

5.2.5 Preferences and Matching

The evidence from interviews with industry experts suggested that the choice of partners is initiated by clients. Vendors invest a great deal into advertising campaigns in order to increase the awareness of clients about their existence but the final decision to contact a vendor lies in clients' field of activity. It is assumed that if vendors become "visible" in the clients acceptance range, this amounts to the vendor advertising himself. The client would send an arbitrary number[70] of requests to the best matched vendors. In choosing a partner, clients benchmark vendors' price structure against the costs of own production and with those of other competitors. The choice of the contractual partner is then determined by evaluation of vendors' characteristics match (i.e. vendor with shortest distance to the client), best price offered and various other preferences discussed in section 5.2.6.

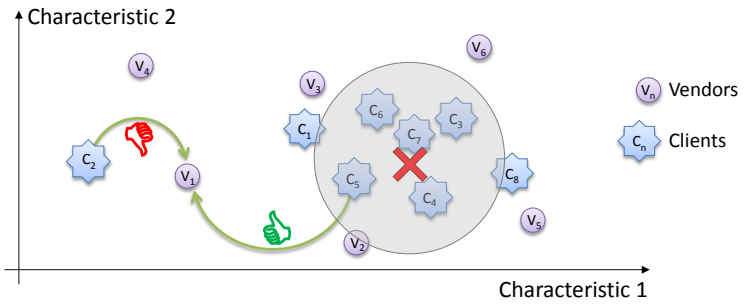


Figure 5.2-4: Simplified 2D-production space.

The vendor in his turn, due to his selfish attitude and behaviour, would evaluate all incoming requests regarding possible contracts and go for the one which comes from the client located in the greatest conglomeration of other clients. This case's hidden agenda is to portray the vendor's drive to remain attractive to as many clients as possible. The vendor is expected to adjust his characteristics in compliance with his contractual partners to decrease the distance in the PCS. Knowing *a priori* that he will unavoidably need to move towards the contracted client, the vendor aims upfront to select a contractual partner who is located in the conglomeration of other clients. Thus, by moving closer to the business partner in this setting, the vendor wins potential clients in case his current client will opt out of the transaction. The requested relocation on the PCS

[70] The maximum number of request a client-agent can process is initialized for each single agent at the beginning of the simulation.

is accepted by the vendor only if he thinks that by the intended actions he is not losing any potential clients. The vendor will also go for the client with the highest costs of own production since these clients leave a big margin for the net profit.

Figure 5.2-4 shows an example of the matching process for the vendor-agent V_1 simplified for the 2D space. All clients in the figure are assumed to be in the "visible" range of the vendor V1, darkened area in the circle around the cross is the preference area for the vendor V1 where he is likely to accept a request from. For simplicity it is assumed that all agents depicted in Figure 5.2-4 are "visible" to each other. Despite the request from the client C_2, the vendor will turn down that client's offer if there are any requests from clients allocated in the darkened area around the cross. In accordance with the vendor's assumption these clients present a more lucrative bait. The client-agents are stationary agents and do not change their service characteristics (cf. section 5.2.3). Therefore, the shaded area with its surplus on clients allows for a faster switch of business partners in case of a relationship termination rather than the area around C_1 which exhibits an evident shortage of potential clients. Thus, any vendor will rather try to match his service portfolio to the contractual partners based in such conglomerates as shown in the Figure 5.2-4. In case a client-agent could not find any suitable vendor, even after altering his acceptance range, he will be matched to himself, thus preferring in-house production over outsourcing.

5.2.6 Endorsements

Based on the conducted interviews and secondary data from literature and media, an endorsement scheme for each agent type was developed. Several questions played a pivotal role in this process: *Which properties shall a transaction partner possess ex ante?, How shall the behaviour of the corresponding party be monitored?* and *When is the threshold reached to opt out of the transaction prematurely?* The analysis of the data available was done under the aspect of these questions.

According to the TCT principles, the specificity of an investment (an asset) determines the risk in the transaction relationship. In the dyad of exchange parties this risk can be considered as perceived risk. However, the interview partners mentioned several other

important influences on perceived risk: trust, reliability, reputation, personal relationship and size of the contracting partner to name a few. Whereas the distinctiveness of some of these terms might be arguable, they were clearly important to all interviewees and so were adopted for the model.

The personal relationship was classified as an indirect attribute contributing to the overall contractual picture, or in words of a vendor management officer from CLIENT4: "(…) *having a good contract doesn't insure us a good personal relationship with the vendor but by starting with a good personal relationship we can reap good contracts*." The evidence from interviews suggests that reputation, trustworthiness and reliability ought to play a pivotal role in the perceived risk and thus in the resulting estimates of the expected transaction costs. The later three factors were linked to the risk through the individual propensity of the transaction partner to act in an opportunistic way.

Trust, reliability and loyalty are implemented computationally by means of endorsements (see Table 5.2-1). Endorsements are used to capture the agents' process of reasoning about preferences and the consecutive establishment of preferential ordering.

Static	Dynamic
big-size/small-size, discount-policy/no-discount-policy	reliable/unreliable, good-personal-relationship/bad-personal relationship, trustworthy/untrustworthy, good-reputation/bad-reputation

Table 5.2-1: Endorsement scheme of a agent in the TCT Model.

Whereas the size and the contractual policy are anchored as static properties, which are not changing throughout the simulation, tags like reliability, trustworthiness and reputation are subject to a particular agent's experiences, thus might change dynamically. It was reported during the interviews that from all the endorsements implemented in the TCT model size and contractual policy were the most stable ones. However, with progressing research the opinion of stakeholders with respect to static and dynamic classification changed. Thus, an endorsement with respect to the size of the vendor is already classified as a dynamic endorsement in the EBO Model (cf. section 6.2.1.2).

Each agent in the TCT Model is assigned its (numerically) individual endorsement scheme by giving each of the endorsements listed in table 5-1 a different weight for each agent. This means that while one agent cares most about reliability, another agent might consider size and good reputation as more crucial factors. Therefore, both agent types base their decision on whether to interact with the business partner upon the existence and weights of particular endorsements. If there are several contestants, which fit the desired profile, the candidate with the highest preference match – i.e. the highest E_{stat} – is chosen (cf. chapter 3.2.5).

In summary, endorsements in the TCT Model do not only provide means to overcome statistical data scarcity, but in fact help to implement an evidence-based reasoning scheme and therefore make a virtue of necessity. Finally, endorsements form the decisions on which both agent types – clients and vendors – base their behaviour. The model's dynamics and structural outcome are a direct result of the implemented endorsement scheme.

5.2.7 Adaptation

Interviewed industry experts suggested that occasionally providers alter their portfolio of services in case they could not gain a customer base they intended to. It might be an offer of a new services or elaboration of a service that is already contained in the portfolio. This evidence was mapped into the model as follows – vendors, who did not get any requests, will relocate randomly one step in any direction in the production space. This is an attempt to alter services' characteristics in order to look more appealing to clients that might not have considered this vendor otherwise. Thus moving in any direction along the axis might bring the vendor in the acceptance range of one or more additional clients.

According to evidence from the fieldwork clients exhibit a more conservative behaviour regarding their portfolio of services. It is a rare occasion that a client would alter an existing non-core service. If alteration of a service is required than this service is getting sourced. A product manager from CLIENT1 reports: "*We simply do not have enough personnel we could spare on adaptation of services that are not our core business. It is cheaper for us to use internal staff for tasks that require tacit knowledge and outsource*

no-brainers to external providers." In order to be sound with the evidence above, clients are assumed to be stationary and alter their acceptance range only. They will never relocate in the production space during the whole simulation, as it is unlikely that clients will adjust their IT services only to get a better match to potential vendors. In case a client could not find an appropriate vendor match in the time step (be it due to the refusal of the vendor or lack of vendors in his acceptance range), he will change his preferences with respect to what is an acceptable service level agreement to him. Thus he may adjust the width of his acceptance range as discussed previously in the chapter 5.2.4. One should bear in mind the fact that the further the client goes in his search for an appropriate vendor, the less attractive the relationship appears to him and the more likely he is to break the relationship prematurely in spite of better alternatives. This attitude can, however, change in case a contracted vendor systematically complies with client's requests adjusts his services accordingly.

In case of the contractual relationship the client's acceptance range will either stay the same – e.g. if the client is not forcing the vendor to become more cost or production efficient – or decrease gradually – e.g. if the client expects vendor's compliance to the agreed customizations for the particular transaction. Figure 5.2-5 showcases the consideration process of a vendor-agent outside and within a transaction respectively regarding the agent's adaptation strategy. As becomes evident from the flowchart, a vendor-agent is extremely systematic in his choice for the better alternative. According to the theoretical postulate of TCT there is no room left for social factors. The choice of probability with respect to the contract length accounts for the penalty calculus on the side of the vendor. The longer the remaining contract term the higher is the penalty for a premature termination. Vendors do not leave anything to the arbitrariness of life.

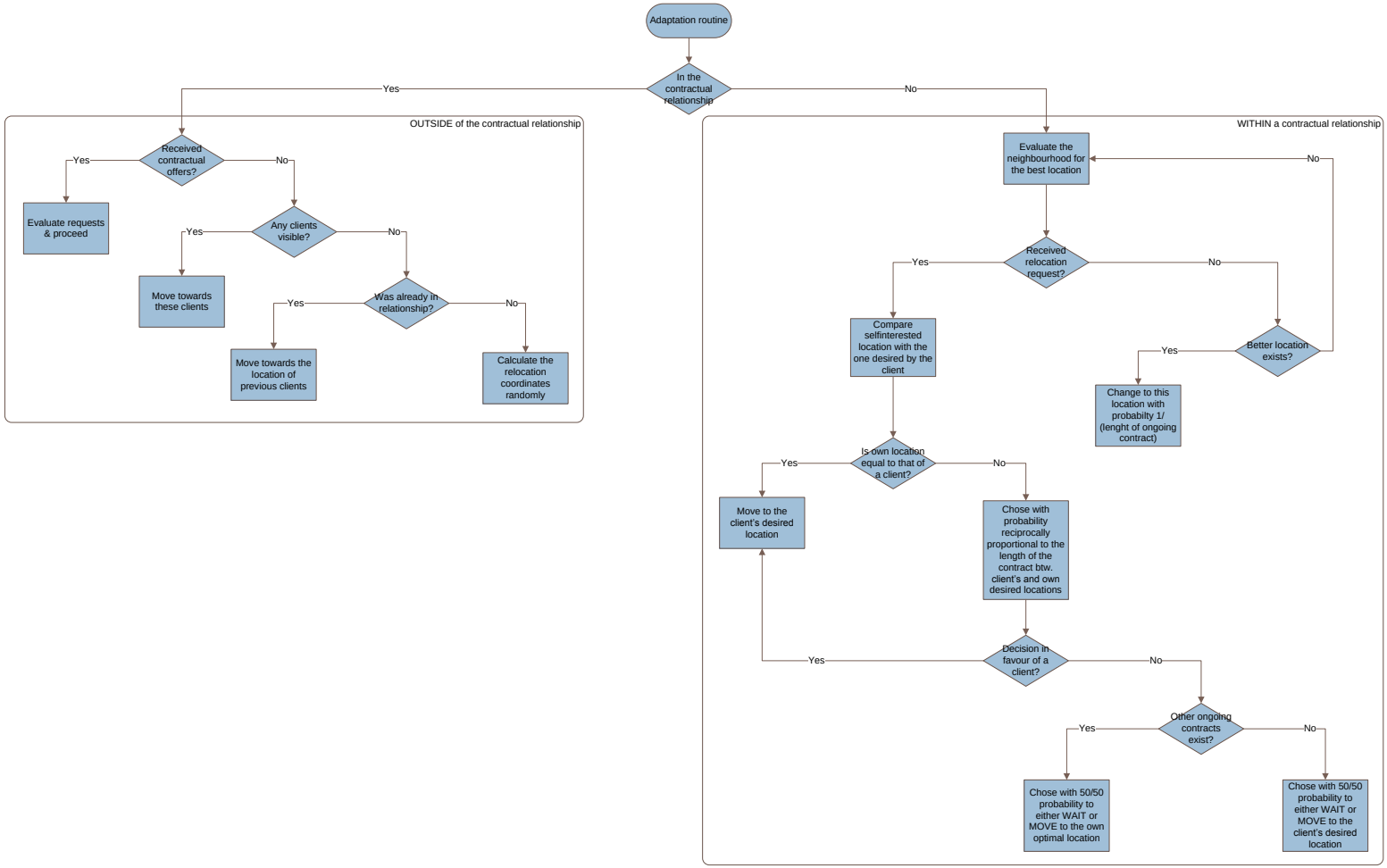


Figure 5.2-5: Consideration process of the vendor with respect to the adjustment of the service portfolio within and outside of the contractual relationship.

5.3 Results

Two categories of results are presented – excerpts from a random agent's life (micro perspective) and the rule activation's statistics of a single simulation run (macro perspective). The macro perspective results incorporate a discussion of model behaviour on the representative run and a series of parameter explorations (dimensionality, number of agents and client/vendor proportion were explored).

Before the results of the model (macro perspective) are going to be discussed it is worth examining an excerpt out of a random agent's life (micro perspective). This verbal output illuminates in a practical way the behaviour rules of the agents described in the preceding section and might serve helpful in understanding model's results.

5.3.1 Micro Perspective

For clarity purposes and due to the space constraints an abridged version of the excerpt is provided in Appendix A (see excerpt 1). The excerpt can be seen as a story line of the agent during his "life" and allows for inspection of agents cognitive processes on the micro level of observation. The excerpt concentrates on a particular stage in *vendor-7*'s life regarding the process of received requests evaluation conducted by that vendor-agent.

The verbal output illustrates perfectly the selfish nature incorporated into the vendor-agent, when he repeatedly refuses complying with client's demands to adjust his service levels and finally breaks the relationship. Vendor terminates the relationship because he thinks that further adjustment of his services will be disadvantageous for him. According to vendor's calculations, his next service adjustment action will cause the loss of possible customers *client-2* and *client-38*. Since *vendor-7* is losing both clients from his acceptance range, he is considering his new services portfolio as not attractive to these clients.

The data in Table 5.3-1 provides a complete statistical analysis of *vendor-7*'s "life" during the simulation. The verbal model output of a simulation run was filtered for the output with reference to contractual actions and considerations of *vendor-7*. The table depicts

the agent's actions during the whole simulation run of 300 time steps[71]. The names of the rules are self-explanatory. It is evident from the table that the rules *refuse-adjustment-for-client-due-2-own-disadvantage* and *reject-request-due-2-disadvantaged-location-of-client* have the highest usage rate. Both rules portray the selfish basis of the vendor-agent's adaptive calculus. These rules are activated as a result of the cognitive process of alternative consideration in case vendor is afraid his further compliance with client's request will cause his current state to deteriorate.

Rules	Number of activations
init-acceptance-range / init-service-location	1
adjust-service-due-2-client-demands	12
adjust-service-due-2-no-requests	27
reject-request-due-2-disadvantaged-location-of-client	74
accept-request	11
reject-request-due-2-no-capacity	14
refuse-adjustment-for-client-due-2-own-disadvantage	33
terminate-transaction-prematurely	7

Table 5.3-1: Set of rules fired for the "vendor-7" during the simulation run of 300 time steps.

An analysis of the model's verbal output is a good opportunity to view the model dynamics from the perspective of a particular client. However, to obtain a bird's eye perspective one has to abstract from a single agent and concentrate on the aggregate behaviour. This is done in the next section where a cumulated behaviour of agents is investigated. This evaluation of results should shed light on the overall activity and dynamics within the model.

5.3.2 Representative Run

In this chapter a representative run is discussed. The run was conducted over 41224 simulation steps[72] with 1000 vendors and 500 clients. It was agreed with participating stakeholders that TCT Model shall contain twice as many vendors as clients in order to reflect experts' market observations. The parameter exploration section 5.3.3.2 explores further constellations of agents.

[71] The time step does not carry a semantic meaning for the model. It is only used as a notion for the time component.

[72] Maximum number of steps that were possible due to technical limitations. After 41224 ticks the model quit with a "java.lang.OutOfMemoryError: Java heap space" error. Due to clarity reasons the charts depicted in this section are shortened to 3000 steps.

In the rule-based system the number of activations can be used as an indicator for activity of the system. In Figure 5.3-1 the cumulative number of rule activations for the client- and vendor-agents is plotted. Additionally, the number of ongoing transactions at each time step of the simulation is laid in the same chart. Since a transactional tie between agents in the TCT Model stands for a contractual relationship these are referred to as contracts in the following. Figure 5.3-1 helps to juxtapose both data streams and gives clues regarding the model dynamics over the whole simulation run.

Generally speaking, the pattern of activations in Figure 5.3-1 suggests that the model is in constant flux, thus agents are applying either topological or/and general reasoning rules[73]. Furthermore, the graph indicates that despite the system is in the continuous dynamic, the rule activations pattern exhibits the tendency to lose gradually on activity towards the end of the simulation run. Both, the number of rule activations for the clients as the number of ongoing transactions in the system decreases dramatically at the beginning and slows down in the later stages of the simulation. At the same time, the number of rule activations for vendors preserves an equal level of activity. In general it can be said, that agents behaviour becomes routine and nothing much needs to change – no extensive recalculations of endorsement values or evaluation of transaction partners.

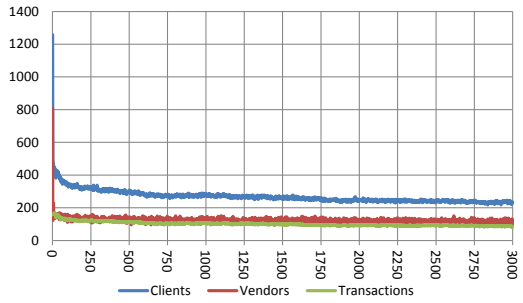


Figure 5.3-1: Number of rule activations for all agent types and transactions. Upper line – clients' rules, middle line – transactions, lower line – vendors' rules.

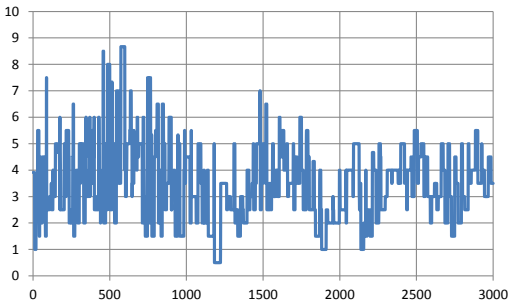


Figure 5.3-2: Average number of vendors being "visible" to the client-agent.

At the start of the simulation, a large number of rule activations are observable in Figure 5.3-1. This is partly attributed to the artefact of the model (setup rules which fire at the beginning of the simulation) but also to the high degree of interaction between vendors

[73] The difference between the topological and reasoning rules as well as rules itself is described in-depth in (Werth and Moss, 2007b).

and customers at the very beginning of the simulation. The simulation starts with no predefined relationship ties. This absence of predefined links between clients and vendors accounts for the high number of activations – abruptly a high number of clients starts to seek for contractors. The curve drops soon after the initial phase since the use of agents' memory economizes on re-evaluations at later stage of the simulation.

One possible explanation for the observed behaviour can be concluded if the Figure 5.3-2 is examined. The figure depicts the average number of vendor-agents who are "visible" to the client-agent. The average was built by adding vendors in the "visible" range (cf. section 5.2.3) of all client-agents in the model and dividing it by the number of clients. It is obvious that the average number of "visible" vendor-agents exhibits some fluctuations but remains semi-constant over the whole simulation run. Therefore, in the general case, the client-agent will never lack for alternative transaction partners. However, due to the *ex-ante* negative experiences with these vendor-agents, the client-agent will not consider them as viable alternatives for future partnerships. Therefore the client-agent will remain in his current contract despite dissatisfaction with it – lock-in setting is created.

Correspondingly, in Figure 5.3-3 the number of client-agents who ended up in the lock-in is presented. A client-agent is thought to be in the lock-in if he is not satisfied with the transaction he is currently involved in but cannot drop out of the ongoing transaction (be it due to the lack of alternative vendors or personal preferences of the client-agent). An increasing amount of agents in the lock in influences the overall rule-activation pattern in a great manner. Client-agents trapped in the lock-in tend not to seek for further providers and refrain further outsourcing attempts unless the current lock-in is resolved. Thus, the longer a client-agent remains in a lock-in situation the less activity this agent exhibits in terms of rule activations.

The selfish nature of the TCT forces agents to break up their relationship as soon as they see a better alternative to their current transaction partner. Consequently, there is much activity to observe at the earlier stages of the simulation – in the so called mating stage – where agents are seeking the perfect match. Subsequently, the number of possible alternatives (vendor-agents without a negative experience track record) for client-agents

decreases rapidly and so his activity. This interplay brings an overall sedation in the system and explains the pattern observed in Figure 5.3-1.

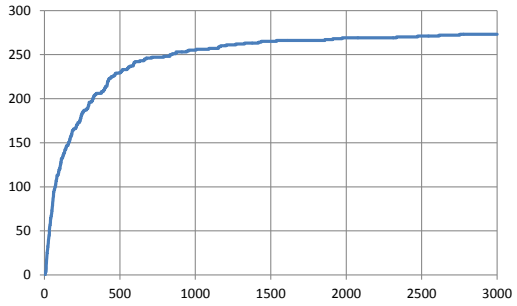


Figure 5.3-3: Number of clients who ended up in the lock-in situation.

Another peculiarity of Figure 5.3-1 is the nearly constant and slightly lower level of rule activations on the side of vendor-agents while decreasing but still higher client-agents' activity. This behaviour can be explained by considering the different agent roles in the process of contract establishment. A client-agent is playing an active part in that process – clients contact potential vendors, initiate transactions and conduct regular evaluations of potential providers in their acceptance range. At the same time vendor-agents are also constantly evaluating their environment for better services portfolio adjustments. However, the evaluation of vendor-agents is less frequent rather than that of clients' scans of the environment for outsourcing partners and additional evaluations of ongoing contracts. Thus, the reactive behaviour of vendor-agents explains a slight difference in the level of rule activations regarding client-agents visible in Figure 5.3-1.

Following the aggregate level analysis of the current section stakeholders expressed interest in further exploration of the simulation behaviour with varying parameter settings. The key parameters of the model are explored in the subsequent sections.

5.3.3 Parameter Exploration

In the forefront of parameter exploration two objectives had high topicality – *Will either dimensionality or vendor/client ratio effect the model results?* and *Will the system exhibit dynamic equilibrium behaviour?* Each of the results from the parameter exploration is an aggregated result from multiple runs with various parameters settings (20 simulation runs at 3000 steps each).

In the following three parameter scenarios are examined. First, the results form dimensionality explorations are presented in section 5.3.3.1. It is investigated whether the dimensionality component influences the simulation results. Next, in section 5.3.3.2 the results of the simulation runs are discussed where the ratio of both agent types in the model varied. Finally, section 5.3.3.3 discusses the system equilibrium issue by means of simulation runs with perturbations[74].

5.3.3.1 *Dimensionality*

Due to technical limitations only PCSs with less than six dimensions could be tested. Simulation runs in spaces of higher dimensionality could not achieve the necessary number of steps. The simulation runs were conducted in the 5D, 4D, 3D and 2D production spaces respectively. Figure 5.3-4 and Figure 5.3-5 depict rule activations in PCSs with different dimensionality for client- and vendors agents respectively. The author and stakeholders expected to find a higher rule activation levels in the runs with low dimensionality of PCS. The argument was that with the constant number of agents and dimensionality being the only variable the probability of agents' encounters increases. The increased probability will lead to higher interaction degree in the system and higher rule activations subsequently.

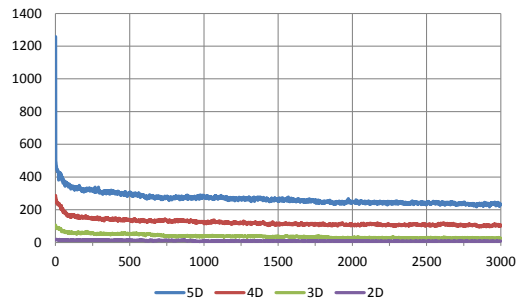


Figure 5.3-4: Number of rule activations for clients.

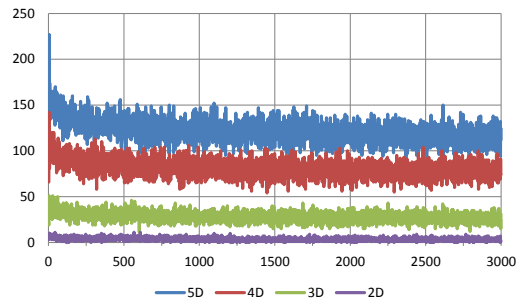


Figure 5.3-5: Number of rule activations for vendors.

The results were eye-opening. Contrary to the aforementioned expectations that the 2D setup will be the one with the highest dynamic, the 5D setup exhibited the highest flux. Intrinsically, the system activity abated with the decrease in dimensionality. Therefore the activity abated reciprocally proportional to the probability of agents being allocated close

[74] Technique used by Hales (Hales *et al.*, 2004; Hales and Arteconi, 2006) to explore robustness of systems. Hales also makes use of the term "churning" for perturbation activities.

to each other in the production space. Further analysis of the verbal simulation output revealed that while the fraction of the topologic rules decreased, the fraction of the general rules, by contrast, increased with decreasing dimensionality. This follows straight from the agents' intention to find the perfect match for their service delivery. Since vendors are not subcontracted they start altering their services portfolio more intensively in an attempt to increase their attractiveness to clients. Clients in their turn try to compensate for the lack in appropriate providers by constantly readjusting their acceptance range.

The contractual situation is examined by means of the data regarding the lock-in and premature termination of transactions. Figure 5.3-6 depicts the lock-in numbers in systems with different dimensionality. Analogous, Figure 5.3-7 deals with premature termination of contractual ties in the system.

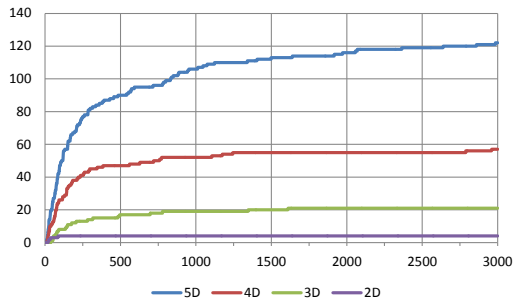


Figure 5.3-6: Number of lock-in encounters for different dimensionalities.

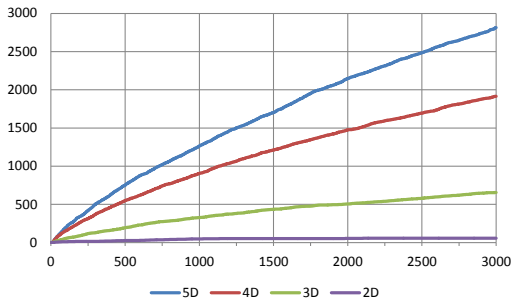


Figure 5.3-7: Number of premature relationship terminations for different dimensionalities.

According to the expectations of the author the 5D PCS exhibited the higher lock-in degree. The analysis of the verbal simulation output confirmed the assumption that the decreased probability for agents encounter in the 5D space leads clients to remain in their current contractual relationships even if providers are not compliant with their requests.

Surprising for the author was the increase in rate of premature contract termination with growing dimensionality. Following the assumption of low agents' encounters in the 5D space, proposed by the author, the level of premature termination was expected to be low. In order to understand the discrepancy between author's expectations and actual outcome of the simulation the verbal model output was examined.

The analysis of the output indicated a problem with original expectations. While proposing the argument of less terminations in PCSs of higher dimensionality the scarcity of resources had not been taken into account. In the environment where potential business partner are scarce, every relocation on the PCS can entail a loss of "visible" clients. Therefore, vendor-agents are less compliant with clients' requests. This leads to a higher degree of premature contract termination and a more in-house service delivery. Thus, a vendor-agent behaviour which was thought to preserve the pool of potential clients harms that agent in the long run. This example is a good illustration how the simulation model, thus the ABSS, changed the expectations on the side of the researcher and involved stakeholders.

5.3.3.2 *Agent Type Ration*

In the initial phase of interview rounds (cf. section 3.4) industry experts suggested a simulation setup with a higher proportion of vendor- rather than client-agents. After a presentation of first preliminary results an interest arose on the stakeholders' side to investigate how TCT Model would react on a different setup. The current section examines the implications of the client-vendor ratio on the simulation behaviour. Multiple runs (20 simulation runs per setup variation) were conducted with following constellations:

1. Number of clients > vendors (2/3 client-agents vs. 1/3 vendor-agents)
2. Number of clients = vendors (equal number of agents of each type)
3. Number of clients < vendors (1/3 client-agents vs. 2/3 vendor-agents)

Figure 5.3-8 and Figure 5.3-9 depict the rule activations for each agent type in the aforementioned ratio configurations. The figures show that out of all the constellations the one with equal numbers of agents of each type exhibits the most dynamic behaviour of the client-agents and produces a more volatile overall picture. The configuration with fewer vendor-agents exhibit a behaviour that is more settled. This picture is different from that of the vendor rule actions. In case of vendors, it is the constellation with a higher proportion of clients that produces a higher degree of activations followed by the constellation with equal ratio of agent types.

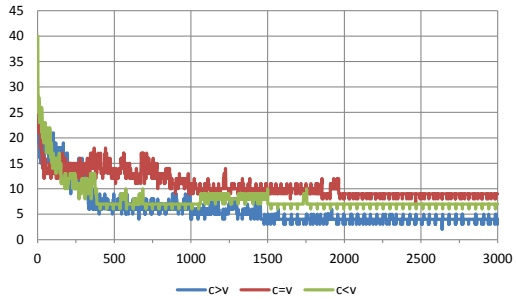


Figure 5.3-8: Number of rule activations for client-agents in setups with different vendor-client ratios.

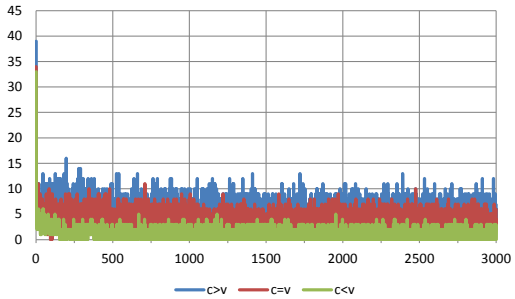


Figure 5.3-9: Number of rule activations for vendors in setups with different vendor-client ratios.

Again, the analysis of the verbal simulation output helps to understand the intrinsic reasons for the observed data patterns. In case of the vendor the rule activations rate is inversely related to the number of vendor-agents in the system. Vice versa the rate of rule activations increases with the growing number of clients in the system. Thus the decline of vendors' activity is attributed to the abating number of requests from client-agents. In case of the client the lowest activation rate is found in the constellation with the higher proportion of client-agents in the system. Fewer vendors lead to fewer transactions in the system and therefore to the overall abating activity. From the remaining two constellations the one with equal number of agents offered a more fruitful basis for interactions. The verbal output echoes this statement as this constellation produced a higher amount of interactive content. The abating number of transactions leads to the decreasing level of lock-in in the system as evident from Figure 5.3-10.

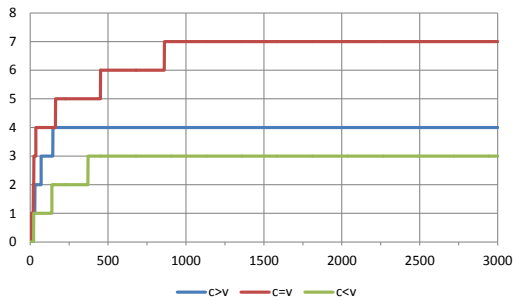


Figure 5.3-10: Number of lock-in in setups with different vendor-client ratios.

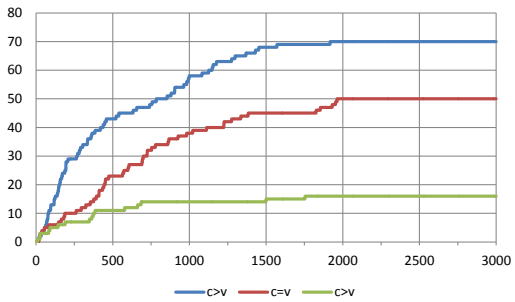


Figure 5.3-11: Number of premature terminations in setups with different vendor-client ratios.

Figure 5.3-11, together with the verbal output of the simulation, provides the explanation for different levels of premature contract terminations, taking place in the system. Similar to the selfish behaviour of vendors in the 5D space, that caused an increase of premature terminations, here the increase of premature termination can be attributed to the

selfishness of the client-agent. In the environment with the surplus of potential service providers, clients are more reluctant to terminate the transaction prematurely. Thus, in the environment with increasing numbers of vendor-agents, a refusal of compliance by vendors on the repeated requests clients' requests leads to a higher probability of premature contract termination.

Overall, all three constellations exhibit the same behaviour patterns with differences in the system activity intensity. This is also true for the simulation runs with varying dimensionality. Therefore, next section deals with the issue of stable system behaviour.

5.3.3.3 *Perturbation*

After exploring the key parameters of the simulation this section examines the robustness of model's behaviour. In order to find out whether the system resides in or converges to dynamic equilibrium a series (20 simulation runs) of perturbation runs were conducted. The perturbation run lasted for 40,000 time steps and after 15,000 time steps the number of clients and vendors was doubled – new agents were injected into the system and randomly distributed over the production space (new agents were injected into the system without any predefined contractual ties). All values presented in subsequent graphs represent averages over 20 simulation runs.

As one can clearly see in Figure 5.3-12 to Figure 5.3-15 there is a big jump in all the graphs after a new batch of agents is injected into the system. The overall intensity of activations increases in value. Nevertheless, the typical shape of the curves remains the same. This behaviour is best represented in the Figure 5.3-12. After a massive increase in agent's rule activations a rash decline of activity is observed. The new configuration produces same long and stable periods of rule activations. The chart in Figure 5.3-13 shows, as expected, that the average number of "visible" vendors for the client increases. A possible explanation for this behaviour is the fact that the size of the production space was not increased and there the probability of two agent encounters increases. The density of agents in the PCS increased which is an important element of the model.

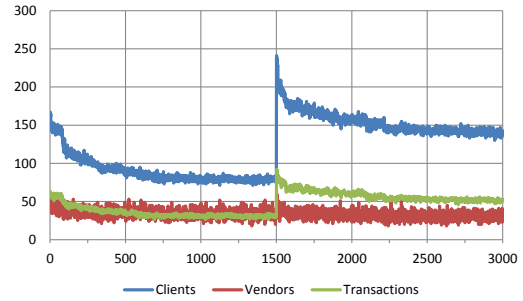


Figure 5.3-12: Number of rule activations in a perturbation run.

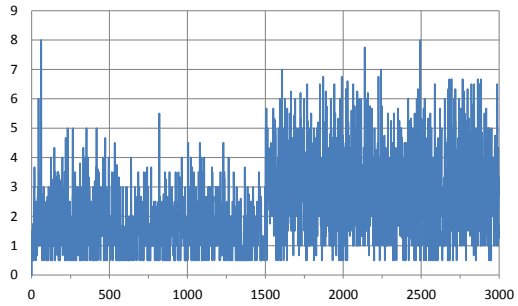


Figure 5.3-13: Average number of vendors "visible" by clients in a perturbation run.

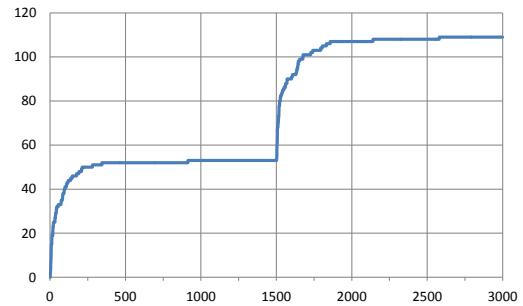


Figure 5.3-14: Number of premature terminations in a perturbation run.

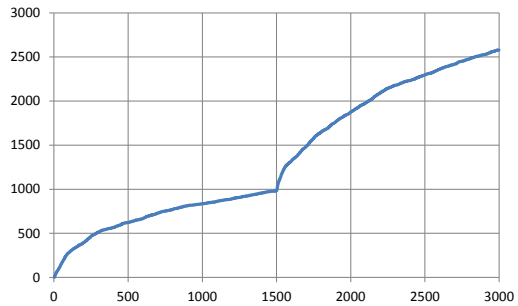


Figure 5.3-15: Number of lock-in encounters in a perturbation run.

Figure 5.3-14 and Figure 5.3-15 show that after the system reaches a dynamic equilibrium state, despite the injection of additional agents, it tends to return to this equilibrium like state. This finding, together with the other results from parameter exploration and the results from a representative run described above were presented to the audience of domain experts. The next section reports on the stakeholder validation and implications of the stakeholders' feedback on the further course of model development.

5.4 Stakeholder Validation

Before the conceptualization of the EBO Model (see chapter 6) a cross-validation round with stakeholders was conducted. The motive for this is the reinforcement of the feedback loop in the design process of the model. The TCT Model is a formalization of the economic theory with evidence based elements in it. Since the implemented theory is controversial in the academic world but, nevertheless, widely used by practitioners, the results of stakeholder's feedback were expected to be enlightening. Through the process of cross-validation there was evidence of shortcomings of the theory. These are valuable contributions for the next research round and also for the awareness of stakeholders. This section reports the gist of the validation process with industry collaborators.

In the following sections, the results of the model validation in cooperation with domain experts are reported. The stakeholders were presented with the model setup, a representative run and the results of the parameter exploration. The issue of detail is pragmatic. The level of detail chosen should enlighten the relationships of interest and hide unwanted detail and was previously discussed in earlier interviews.

5.4.1 (Production) Space

The n-dimensional PCS (Lancaster, 1966), similar to the approach taken by Klos in (Kloss and Nooteboom, 2001), was used in an attempt to represent the core TCT concept of "asset specificity". The Lancastrian PCS approach was adopted for the TCT Model in such an altered way that instead of products and consumers, the space has now been populated with agents representing vendors and consumers. This way, one could define product differentiation and asset specificity on the same space. Thus, the location of the vendor-agents represents the service he offers and the location of the client-agent represents the in-house service he would like to outsource.

Thus, with the help of this apparatus one can define the specificity of own services by the number of agents who can provide the same service. The degree of specificity evaluation is then a subjective function of the corresponding agent. This interpretation of asset specificity was welcomed by the stakeholders since it reflects the way companies evaluate standardisation of their IT services – if someone else on the market can provide the needed service without extensive alterations of the existing service delivery workflow in place then the service is considered to be standard. A senior operations manager from CLIENT3 summarises: "*If we want to reduce IT operations costs, the first thing we do is to compare internal operations with the market. We basically benchmark ourselves with external providers. This way we also get the feeling how easy is it to obtain some of our services from third party providers. If there are only some specialized boutique providers offering a particular service than it is best to keep the service in-house and do not risk the outsourcing step.*"

Another virtue of PCS is the possibility to express the concept of bounded rationality through the acceptance range of each agent. This construct was in line with the essence

of bounded rationality – that agents' computational and information processing capacities are limited (Moss *et al.*, 1994) – and correspond with the experiences of stakeholders – that depending on the size of the company, it will not be possible to survey all appropriate vendors on the market. A statement from a sales representative from VENDOR2 mirrors the aforesaid: "*Out of sight, out of mind is a proverb that I tell to my every new employee. Unfortunately our clients tend to limit themselves to the companies that are on everyone's lips. Thus, if we do not keep ourselves afloat with various PR and sponsoring activities we just vanish from RfP lists within a blink of an eye.*"

Furthermore, Lancaster's approach will allow for interface to extend the results of the TCT Model to consumer theory. Investigating outsourcing theories under the aspect of consumer theory is a promising, though uncommon for outsourcing community, approach.

5.4.2 Objectivity

One of the major insights gained during the discussion with stakeholders was the, by theory, prescribed usage of the objectivity notion. This issue has however a longstanding history of debate both in economic and outsourcing communities. In the current TCT Model which was meant to replicate foundations of Williamson's TCT framework there is one production space for all agents independent of their kind. This assumption was made by the modeller because, as stated earlier, Williamson prescribes objectivity of measurement. Therefore everybody in the current model has to be able to measure costs, performance etc. in the same way.

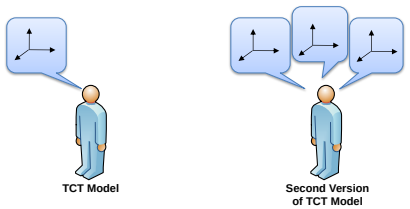


Figure 5.4-1: Current vs. proposed implementation of PCS in the model.

Due to the fact that the only publicly accessible information about the agents needed for the decision of participating a transaction is the services portfolio an agent offers, a method to objectify this information was needed. One way to model it is to use the n-

dimensional product characteristics space. In the model both vendors and clients are located in the production space. Location of the vendor-agents represents the service he offers and the location of the client-agent represents his in-house service he would like to outsource. Therefore all client-agents see the portfolio of some particular vendor-agent in the same way. This is somewhat counterintuitive form the first glance and was proved repeatedly during the stakeholder interviews. Hence a suggestion for the second version of TCT Model would be to implement a separate product space for each single agent which would give and account of the fact that each client sees some particular vendor through his own measurement "glasses". Figure 5.4-1 reflects the current implementation state of the model and gives an impression of how it can be extended.

5.4.3 Opportunism

Williamson's framework is interwoven with the notion of opportunism. This is the drive of every agent since TCT does not allow for mutual thoughts. Both agent types, client and vendor, re-evaluate their situation at every simulation step and are prepared to terminate the ongoing partnership in the case that an improvement of the agent's current situation is possible. The ulterior motive for this agent's behaviour is the notion of opportunism.

However, this behaviour caused disagreement amongst most of the stakeholders interviewed. One does not disclaim the existence of opportunism on the executive floors of every corporation. Admittedly, the aforementioned opportunistic behaviour should not be such a pivotal part of an outsourcing partnership. According to the domain expert from CONSULTANT1, in most outsourcing negotiations a vendor is set up as an enemy, that has to be forced into doing what the buyer of service thinks is best. Negotiation is usually set up around driving cost down, which is normal for the procurement activity. Notwithstanding, outsourcing contracts are very different from normal procurement. It is a question of setting up a relationship which lasts for several years and cannot be treated as a one-off deal. Furthermore, a procurement CEO at VENDOR3 underlines: "*If we have a good social relationship with our sourcing partner, most of the time, it embodies in a good professional partnership. However, a dysfunctional social relationship holds lots of surprises which can rub off negatively on the professional level.*"

5.4.4 Preference and Matching

The fact that any outsourcing partnership is initiated by the client was endorsed and reflected stakeholders experience. Thus, stakeholders pushed for a wider awareness level of clients about the existence of possible vendors. Correspondingly, proportions of the service providers which should be known to a client, with respect to the overall outsourcing market, were specified.

A disagreement was evoked by limited facets of the partnership search routine. In the current model a client would choose his contractual partner on the basis of the best match to his characteristics (i.e. vendor with shortest distance to the client on the PCS). In case a client cannot find any suitable vendor, even after altering his acceptance range, he will be matched to himself, thus preferring in-house production over outsourcing. The whole range of consideration aspects in the outsourcing process is discussed in further detail in section 5.5.

Experience of the vendor proved to be a crucial factor for the client during a transaction partner selection process. Clients tend to pay higher prices for the vendors that enjoy a good reputation. A public relations officer from CLIENT1 reports: "*You see, the decision to outsource becomes more of a political rather economic one. Our investors expect us to do some outsourcing as a proof of us being streamlined to our core business. But at the same time they do not want to see providers they never heard of. Inevitably, this forces us to pay premium prices for vendors with high brand recognition.*" Thus, no or bad publicity represents one of the major fears of vendors. TCT Model lacks these constructs and assumptions.

5.4.5 Adaptation

Some vendors, who did not get any requests, will relocate randomly one step in any direction in the production space. This is an attempt to alter services' characteristics in order to look more appealing to the clients, which might not have considered this vendor otherwise. The customers, on the contrary, are assumed to be stationary and alter their acceptance range with respect to what is an acceptable service level agreement to them.

The domain experts suggested to consider cases where one would encounter joined outsourcing i.e. situations where several small banks would adopt a common services portfolio in order to deliver enough scale for the vendor. Standardisation is not only an objective of the clients. The domain experts have mentioned that outsourcing companies try to standardise their portfolio of products in order to grow whilst keeping costs under control.

The willingness of the agents to terminate their ongoing relationships was questioned by stakeholders. Despite being in line with the TCT, termination was said to be an uncommon tactic in the experience of stakeholders. It was pointed out that due to legislative restrictions, most of the contracts will terminate in the natural way. Indeed, some disaster scenarios are possible where an ongoing relationship can be terminated prematurely. The domain experts specified probabilities for such an event to take place.

5.4.6 Representative Run

The results from a representative run over 10.000 simulation steps with 1000 vendors and 500 clients were presented to the audience of domain experts. Domain experts were confronted with a possible explanation for the observed behaviour – lock-in and abating overall activity of the system. The lock-in was attributed to the *ex-ante* negative experiences with some vendor-agents, which shrinks the pool of available alternative service providers. The client-agent would not consider vendor-agents with negative prior experiences as a viable alternative for future transactions. Therefore the client-agent will remain in his current transaction despite being deeply dissatisfied.

Furthermore the declining level of system activity was explained with the selfish nature of agents. The TCT prescribes the agents to break up the relationship as soon as they see a better alternative rather than their current transaction partner. Consequently, there is a high level of activity to observe during the earlier stages of the simulation – in the so called mating stage – where everybody is aspired to find the perfect match. Subsequently, the amount of possible alternatives (vendor-agents without a negative experience track record) for the client-agents gradually decreases and so his activity. This brings the overall sedation in the system.

Experts reported that Figure 5.3-1 exhibits, approximately, the state of the outsourcing market since the economic downturn of the early 2000 when outsourcing leapt to the fore as a cost-saving quick fix when budgets came under squeeze. There was a lot of turmoil on the outsourcing market since everybody was outsourcing compulsively. Since then the market exhibits some activity but can be regarded as being in a more or less semi-stable state. However, the constant decrease of transactions and activity could not have been verified by all interviewed domain experts.

The explanation of the model behaviour regarding the lock-in issue was widely accepted by the stakeholders. However, it was pointed out that, most of the time, these are not the negative *ex ante* experiences which deter banks from switching providers and remain in the lock-in but the "patron" effect. It is cheaper and less risky to subcontract to someone you know for a long time instead of opting for a newcomer with an uncertain outcome.

5.4.7 Dynamic Equilibrium

In the forefront of results discussion with domain experts an objective of the equilibrium behaviour of the TCT Model had high topicality. During parameter exploration an issue of the stable behaviour of the model was examined. In order to find out whether the system resides and/or converges into a dynamic equilibrium, a perturbation run was conducted.

This behaviour was confirmed by domain experts. Undoubtedly, any market can exhibit volatile and unforeseen behaviour. However, outsourcing market of the investigated target system – big financial institutions – featured equilibrium-like behaviour since it was introduced by IBM a few decades ago. In the face of the current turmoil in the banking industry, experts showed a great deal of interest in the factors which can bring such a system to be out of balance. This task remains to be answered by the future research.

5.4.8 Power

Whereas Williamson's framework entitles both parties of the transaction for opportunistic behaviour and withdrawing out of the transaction, the reality looks different. In the outsourcing relationship between financial institutions and information services providers there is an unequal power proportions. It is always the financial institution who is having a power to withdraw out of the deal. Vendor, in contrary, does

not stand a chance to opt out, irrespective of vendor's size. Vendor's financial penalties and negative publicity ensure clients that the vendor stays in the contract until released.

A comment of a sales officer from VENDOR2 illustrates the market sentiment regarding the aforementioned issue: "*Of course we can opt out or terminate the contract and believe me, irrespective of the client, there are very often situations where we would like to do so. However, the publicity is ruthless – it is always the provider who failed to deliver or behaved in bogus ways. Once a rumour is set your whole portfolio of long established clients will fall like dominos. It is safer to take the blame and sweep it silently under the rug rather than insist on your rights and go public.*"

5.5 Implication for Further Research

The next logical step in the elaboration of the presented TCT Model was intended to be the gradual enrichment of the agents with rules for social interaction on top of already implemented rules stemming from the selfish roots of TCT. The feedback from the process of cross-validation should augment the development of the next model stage. The extensive cross-validation with stakeholders, however, showed that augmenting the existing model that is grounded in TCT dogmas will fail on capturing different facets of the outsourcing market. Thus, a development of a new and entirely evidence based model was decided. The EBO Model should be based entirely upon the evidence from the stakeholders and should not be constrained by any economic or behavioural theory (cf. chapter 6).

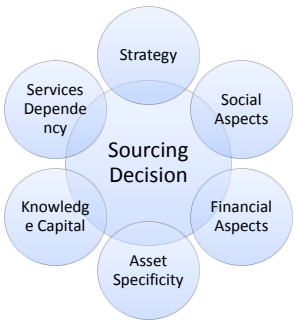


Figure 5.5-1: Facets of the outsourcing decision as identified by domain experts.

Building the TCT Model and confronting stakeholders with it was intended in order to point out data requirements, and help to determine which data is important and which can be dismissed. Additional interviews were conducted in order to fill gaps, which

became evident through the analysis of the TCT Model. In the course of the cross-validation with stakeholders several issues arose, which are reported in detail in the following sections. Overall, six facets of the outsourcing process were identified by the domain experts. Figure 5.5-1 illustrates these different aspects of the outsourcing decision.

5.5.1 Co-dependence of Services

While outsourcing is a not a new phenomenon by any stretch of imagination, for much of its history it has been primarily focused on discrete services (Cohen and Young, 2006). However, IT has evolved and cannot be regarded as an assemblage of discrete services. These services both support and depend on each other. The notion that services are autonomous and thus decisions around these services can be made autonomous is absolutely wrong.

As an increasing amount of services are getting outsourced, coordinating a portfolio of service providers is becoming tedious, thus causing significant service disruptions in numerous organizations. Therefore, stakeholders urged for more intertwined outsourcing relationships. Scenarios where a vendor *A* can deliver a service for a client *X* only in collaboration with a vendor *B* needs to be incorporated into the model.

The representation of the firm's skills universe (FSU), as was done by Taylor in (Taylor and Morone, 2007), provides a possible way of dealing with the whole services agglomeration of the company. According to the experience of stakeholders and theories of Prahald (Prahald and Hamel, 1990), one would assume roots of the graph as core services thus all other services depending and predicating on these core services. Therefore, a dislocation of the service to the third party vendor can be expressed as an extraction of the corresponding node with its links from the FSU_{client}.

5.5.2 Sourcing Partnership

During the validation process the awareness emerged that with respect to relationships one should define the following bank profiles – the risky ones and the risk averse ones – with the consequence of reflecting diverse outsourcing strategies. It is regarded as risky to streamlining a corporation to its essential elements with only one outsourcing partner.

A distribution of the service failure probabilities on multiple contracts is a safer option. Therefore, the agents with high risk aversion would preferably enter into the multisourcing[75] (cf. section 2.1.2) relationships rather than relying on a single vendor.

It was also pointed out that simple relationships such as those implemented in the TCT Model are an extreme oversimplification. A more interconnected construction of partnerships with multiple outsourcing partners, have to be implemented in the new model. In words of a CFO from VENDOR2: "*It is not enough if we* (clients) *have a good relationship with our vendors. Since they* (vendors) *can deliver services we need only by working hand in hand with each other* (other vendors) *it is pivotal for them* (vendors) *to have a good cooperation too*." Thus a network topology of the contractual relationships will reflect the circumstances.

Furthermore, experts have specified three types of the outsourcing deals: effectiveness, acquisition of new services and transformation and change. Each of the contract types has different setups, pre-requirements and outcomes.

Another artefact of the outsourcing market is the capacity and scale savings of the vendor. One should not automatically assume that the service provider would be able to deliver economies of scale and so deliver the services clients used to have at the discounted price. The only way the service providers can deliver an unprecedented level of service at a discounted price is through increasing scale and standardized products. Thus, the client has to create and govern the scale in a move towards a more standardised service portfolio.

5.5.3 Social Aspect of the Partnership

The view of technology in general as a tool which is considered to be independent of the social context in which it is developed and used, is widely spread in the information systems literature (Willmott and Bridgman, 2006). The majority of domain experts agreed on the importance that information technology cannot and should not be regarded separately from the social context it is situated in. However, a precise statement with

[75] A new operational model that envisages provisioning of business services from multiple sources inside and outside the corporation to obtain the best business outcomes.

respect to this topic could not be achieved. Therefore, stakeholders were urged to investigate this issue with respect to the volatility of the equilibrium state of the system. It was reported about the projects which have failed due to social resistance of the company employees. The further discussion on this topic led to the strategy and change issue.

5.5.4 Strategy & Change

The main shortcoming of the TCT Model is the absence of strategic consideration possibilities. Williamson's framework does not allow for making any business strategy considerations. Also, TCT does not allow for translation of processes since it takes a snapshot view of the corporation.

Absence of representation of business and outsourcing strategy was the biggest deficiency of the TCT Model criticized by stakeholders. According to their experience the misalignment of business and outsourcing strategy scuppers the majority of outsourcing projects. First, aligning the outsourcing strategy with the business strategy of the company is pivotal for the achievement of the set goals. "*If a company plans to enter a sourcing relationship in order to expand, it* (company) *cannot use a cost minimizing sourcing strategy*", as stated by an IT-consultant from CONSULTANT4. Second, if the goals of the outsourcing project are not communicated well enough down the company hierarchy one will result in high attrition rates of personnel and tacit knowledge. Further discussions on this topic lead to new rules with social background that have been incorporated into the EBO Model.

Furthermore, the adjustment of the business and outsourcing strategy to each other has to be done on a continuous basis. A base line view of operations set up on the current knowledge cannot stay the same over the lifespan of an outsourcing partnership since operations do not possess a steady state.

From an implementational point of view, the term strategy is difficult to grasp and translate into the model. Therefore, experts have agreed to the following definition – the enterprise's outsourcing strategy is the bundle of planned actions for the achievement of set business goals. Thus one has two sets of items that have to be linked. By adopting this

definition of the strategy, it is possible to fall back on earlier work of Moss (Moss, 1998). In the critical incident management model agent's cognition is presented by problem space architectures – which are in effect relationships between goals and the sub-goals to achieve these goals – drawn from cognitive science. The construct is then rounded up by the use of Endorsements (Geller *et al*., 2007, 2010; Alam *et al*., 2008, 2010).

The drain of knowledge in the course of inadequately managed outsourcing actions can easily be implemented by the use of FSU (Taylor and Morone, 2007). Thus an extraction of the corresponding node with its children from the skill graph represents loss of information. The closer the location of the extracted node to the root, the bigger the damage to the tacit knowledge of the corporation.

5.5.5 Asset Specificity

Formalization of Asset Specificity was one of the main objectives for the TCT Model. An attempt to translate a loosely defined term into a formal simulation model can be regarded as successful since all of the interviewed stakeholders approved the suggested formalization – subjective function based on the number of other agents able to provide considered service. However, an institution of asset specificity, or core competency as practitioners tend to call it, remains a term which is hard, if not impossible, to define precisely. After in-depth discussions, the majority of experts referred to intuition and own experience as a guidance for core competency evaluation. The words of the senior consultant in the IT practise group at CONSULTANT3 reflect the situation accurately: "*It is our biggest challenge to find out the thin line which separates what can be standardized and what has to be customised*."

Thus an aforementioned definition of the loosely defined term asset specificity was defined in a qualitative manner. Despite the agreement of stakeholders on the presented definition of the term it became evident that the subjective nature of the issue prevails, thereby, making an exact definition of the term impossible. Even after the presentation of the model results it has not being possible to agree on a single definition of asset specificity with involved subject matter experts.

The notion of knowledge capital was considered by some experts as a subcomponent of asset specificity. In addition, some experts stated that in the field of IT outsourcing the knowhow is the only asset that matters. This finding let to the assumption to incorporate the issue of knowledge retention and erosion in the next version of the model. Furthermore, issues of the interplay of owned vs. exported knowledge as well as the usage of knowledge over time have to be considered in the EBO Model.

5.6 Conclusion

First, the example of the TCT Model showed that ABSS can be utilized as an appropriate tool for theory examination. Therefore a more critical observation of theories borrowed from different disciplines is needed before these can be established in the new field. The methodology used for TCT Model does not aim to criticize concepts of TCT as such, it just aims to point out obscurities where the theory is not clear enough. On the contrary, the author is of the opinion that it is a useful concept although it lacks an exact definition and metric, which are needed for its proper instrumentalisation. As the process of formalization is a discipline which needs to be precise ABSS claims to compensate for the lack of precision in the IT research so far. ABSS uses models to devise precise statements about these theoretical points, which are not clear in the theory *a priori*.

Second, the alternative metric of asset specificity used for agent's reasoning succeeded in reproducing results forecasted by TCT and offered a qualitative description of the term. Without measuring asset specificity by numerical value, TCT Model reproduced the semi-stable dynamic equilibrium predicted by the theory. Furthermore, the model and results produced by it were partly confirmed by domain experts used for cross-validation.

Third, organizational structures emerged from the interaction and information exchanges between individuals in the artificial world. It was shown that organizational structures depend on connectivity and information exchange between agents.

Nonlinear social behaviour needs to be included in the outsourcing research on the more elaborate basis rather than just excluding it from the outset. Nonlinear behaviour is excluded in most econometric observations as the concept of nonlinearity gives problems to statisticians and their forecasts. It needs to be emphasized that this chapter does not

imply the illegitimacy of the concept of asset specificity as such. On the contrary, the author is of the opinion that it is a useful concept although it lacks an exact definition and metric, which are needed for its proper instrumentalisation.

Finally, based upon desk research and survey data collected from a number of banking organizations a prototype model has been developed which provided the author with some initial findings, but more importantly, has allowed to identify the shortcomings of the assumptions of the TCT Model that need to be corrected in order to develop a more informative model.

6 Second Model – EBO Model

"You have to have an idea of what you are going to do, but it should be a vague idea."
Pablo Picasso
Spanish painter, draughtsman and sculptor (1881 – 1973)

This chapter presents the second of the two declarative evidence-driven agent based models, developed in the course of the outsourcing research, which is to capture some of the main features that govern the outsourcing process and the dynamics of that process. In the same way as the TCT Model the EBO Model was developed as proposed in the chapter 3. Thus, the model has undergone several iteration stages while incorporating evidence from desk research, media and stakeholders' feedback.

The chapter is constructed in the following way. First, section 6.1 introduces an overview of the model along general lines together with an abstract structure of a situation found here. Continuing in this vein the aims of the simulation are addressed and a mapping of research questions raised by the field research with corresponding sections from the current chapter is provided. Second, section 6.2 extends on an in-depth description of particular EBO Model components. It investigates some details of the case study with respect to their technical and conceptual realization in the model. Furthermore it discusses how empirical data of the case study are being integrated in the design process of the EBO Model. The evidence used for the model is scattered over the whole chapter and is labelled accordingly. It was the guiding assumption that a selective way of evidence presentation along the model description will increase the reading comfort and understanding where and how that evidence influenced the design of the EBO Model.

6.1 Overview of the Model and the Aims of Simulation

This section is concerned with the design of the EBO Model that is being developed under implications provided in the previous chapter. Whereas TCT Model is built around a theory and matched to evidence in subsequent steps, the EBO Model follows a different approach – it is built around evidence and is not burdened by theoretic constrains *a priori*. The model has been developed to reproduce to some extent the phenomena found in an outsourcing market. The model seeks to capture some key aspects of the reasoning and interactions of actors involved in an outsourcing process.

In the following, Table 6.1-1 and Table 6.1-2 juxtapose sections from the current chapter with these from the fieldwork chapter 4. Such a comparison demonstrates how evidence from the field research has been incorporated into the EBO Model and how the issues of stakeholders have been dealt with while designing the model. Table 6.1-1 offers an overview of how various tools deployed by practitioners on the operational level have been operationalized by modelled agents.

Tools of practitioners	EBO Model's component
Theory in practice	FSU (6.2.2)
Score cards and checklists	FSU (6.2.2)
Spanning trees	FSU (6.2.2)
SLAs and KPIs	Evaluation (6.2.3.6)
Benchmarking	Evaluation (6.2.3.6)

Table 6.1-1: Mapping with practitioner's tools.

As mentioned in chapter 4, the emergent themes from the fieldwork represented the focal interest of involved stakeholders and thus had to be further researched by means of simulation. In order to allow for investigation, the EBO Model ought to reflect these topics already in the model design accordingly. Table 6.1-2 provides the mapping of emergent topics from the field research to the various EBO Model's components. A link from research questions in Table 6.1-2 to simulation results in an equivalent manner can be found in chapter 7.

Emergent theme from field research	EBO Model's component
Dependencies	Skill Set Transfer (6.2.3.3) Dependency Issues (6.2.3.4)
Standardisation	Economies of Scale & Experience (6.2.3.5)
Relationship management	Cultural Elements (6.2.1.1)
Merger and Consolidation	The Setting (6.2.1.3) Dependency Issues (6.2.3.4) Merger (6.2.4.2)
International vs. Domestic	Cultural Elements (6.2.1.1) Geopolitical factors & Natural Disasters (6.2.4.1)
Overspecification	(Over)Specification (6.2.3.8) Economies of Scale & Experience (6.2.3.5)
Paradoxes of Multisourcing	Skill Set Transfer (6.2.3.3)
Knowledge loss	Skill Set Transfer (6.2.3.3) Dependency Issues (6.2.3.4)
Misperception of moderate cost increase	Evaluation (6.2.3.6)
Dynamics of Asset Specificity	FSU (6.2.2)
Myth of Enemy	(Over)Specification (6.2.3.8) Opportunism (6.2.3.7)

Table 6.1-2: Mapping to emergent topics from the field research.

Some of the sections in the present chapter describe model components that are of overarching significance and therefore have been influenced by evidence from the field research in general. These sections do not fit in the structure imposed by Table 6.1-1 or

Table 6.1-2 and are not enlisted in these. Sections affected are Agent's Cognition (6.2.1.2), Strategy (6.2.3.1), Vendor Selection Process (6.2.3.2) and Geopolitical factors & Natural Disasters (6.2.4.1). The evidence for these sections is provided directly in the particular chapter.

The components of the EBO Model draw their evidence directly from the information obtained from the field research. Evidence used in this chapter is provided directly in the respective section describing the model component and is labelled accordingly. In order to model the issues raised by the fieldwork, core features of the field work are abstracted. In the work reported here, it has been a guiding assumption that it is fruitful to build models on a medium level of abstraction, i.e. to keep just between too much detail and too much abstraction. Issues arising from this approach are discussed in detail in section 3.4.2.

6.2 Model

To capture decision dynamics of real world actors a rule-based approach was chosen (cf. section 3.2.4). Some of the compiled decision rules could be abstracted from storylines, while others were deduced from domain expertise and supporting literature. The evidence, which informs the EBO Model, stems from semi-structured interviews conducted with stakeholders and domain experts in the industry and corresponding literature from the field. Examining the decision rules of practitioners revealed that the internal dimension of past economic success and the external dimension of perceived social influence appear to play an essential role in the process of decision making. A sarcastic remark of the senior principal manager from CLIENT3 makes clear the dichotomy the stakeholders are caught at: "*We have dozens of sourcing relationships running. If you ask any of my colleagues from the middle or top management whether social aspects are less important than economic once you will get a clear "No" as an answer and be confronted with countless stories of past projects that failed or did not deliver anticipated returns due to neglect of social aspects in the particular context. However, if one sees the slides of these very same colleagues, that they prepare for steering committees one won't find much of social consideration there* (in the slides) (...) *First, we are not supported by the apparatus we have at our disposal. It* (the apparatus of management and economic theories) *only counts for hard dollars. Second, members of steering committees do not like to deal with things they consider as not tangible of quantifiable in the balance statement*

at the end of the year." This finding stands in a sharp contrast to a rationale of numerous economic frameworks used by the very same practitioners, since these frameworks only allow for the account of economic factors and neglect social elements. An overview of the impact of social issues on the IT Outsourcing behaviour is provided in section 2.1.5.

As already introduced in section 3.3.3, we adopt a strict distinction between the physical and the social environments of agents. The focus of this distinction is stated separately between physical and social spaces, both in terms of semantics and techniques used for their representation. Furthermore, since agents are considered here in more than one social context, an agent's social environment consists of and is modelled by more than one network layer. Section 6.2.1.3 outlines the issue in depth.

Before particular EBO Model's components can be described in detail a bird's eye view of the model is provided in Figure 6.2-1. It showcases the interplay of different components composing the EBO Model. The model represents actors from the case study as individual agents. Actors in this context are players of the outsourcing market – clients and vendors.

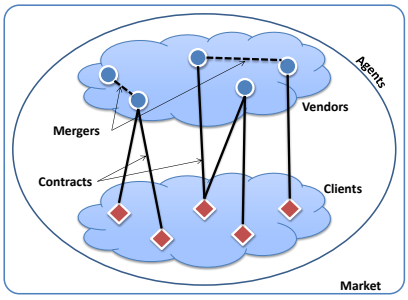


Figure 6.2-1: Schematic view of the model's components and their relations to each other.

A modelled population consists of agents of different types, who interact with each other and can react to different stimuli in a manner appropriate to their context. Furthermore, agents can record their actions and fall back on this information while estimating their behavioural strategies. Thus, the virtue of the model is not only the proactive behaviour of actors but their ability to alter their behavioural rules based upon past experience as well. The simulation is setup in an abstract marketplace. The idea of placing agent on a grid of any kind was dismissed after reviewing interview data and considering supporting literature. It was a legitimate assumption to reduce the outsourcing process to a binary choice of domestic versus non-domestic according to a technology architect from CONSULTANT6: "*It doesn't matter whether the company is located near-shore or off-shore or any other kind-of-shore. Still, it* (service provision) *is either in-house or not* (...) *It is*

really quite a binary choice here. Logistics and technical realisation, however, is a completely different story." Given that the proximity factor was negligible for the decision making process[76] it was concluded not to implement a physical space as it was done in TCT Model. Instead agents act in the abstract implementation of the market (see chapter 6.2.4 for more information). Even in the TCT Model the implementation of the production space does only represent the theoretical construct over which the concept of asset specificity was defined.

Figure 6.2-3 provides an overview of the model components, their coherence and possible structuring. Whereas Figure 6.2-3 provides a static view on EBO Model, Figure 6.2-2 offers a dynamic notion of the model and processes within the model. The flowchart diagram showcases five main processes that are run through by an agent during a single simulation cycle. That is, the processes depicted are repeated each cycle and run in parallel. The UML diagram is generic and can be used for all agent types deployed in EBO Model.

[76] For the EBO Model the term Outsourcing implies nothing about where the service is delivered but is concerned only with the issue whether a particular service is delivered in-house or not.

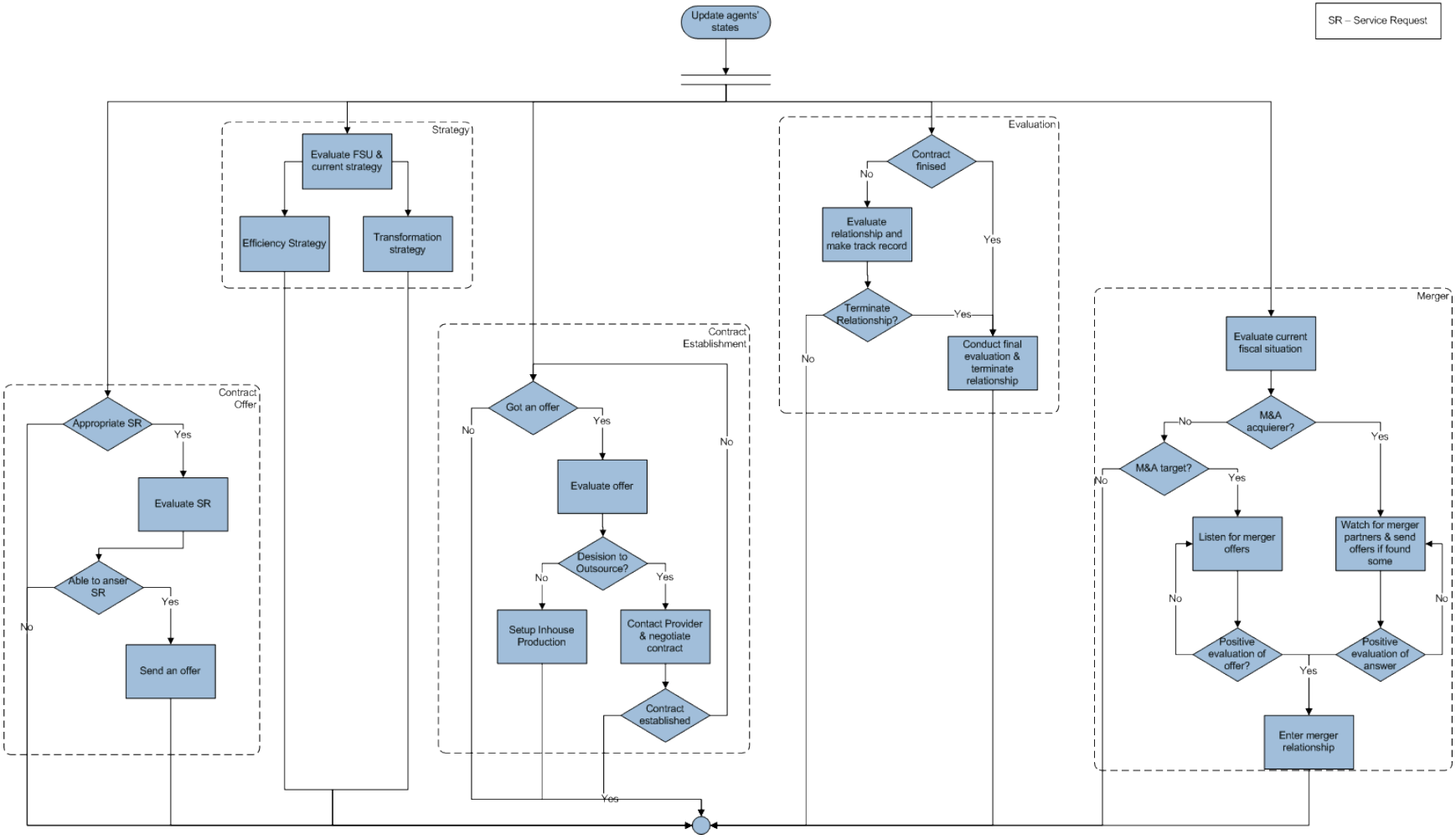


Figure 6.2-2: Flowchart diagram of the models simulation cycle.

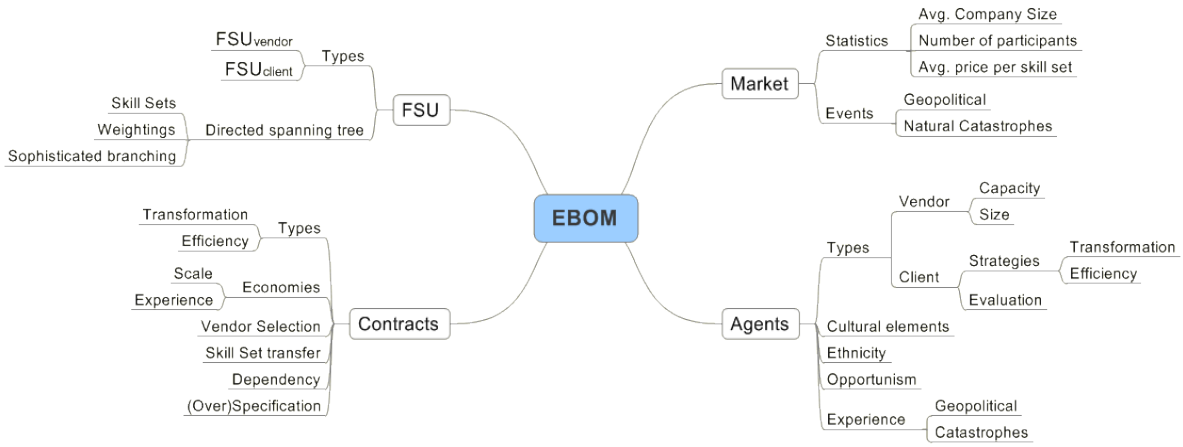


Figure 6.2-3: Mind Map of the EBO Model.

In spite of absence of the physical space, agents can be thought of as players of a narrow outsourcing market. This market functions as a liaison between agents and statistical information available from the system in a blackboard system fashion (Englemore and Morgan, 1988; Dodhiawala, 1989). Additionally, the market contains some information about a single agent. Figure 6.2-4 depicts a simplified blackboard architecture used in the model for implementation of agents' communication and information distribution in the system. Players of the market can collaborate and enter relationships of different kinds – collaboration relationships and merger relationships. These relationships govern and influence the actions of market players. However, agents can be involved in different kinds of relationships at the same time. Thus, agents are active on several social levels. Section 6.2.4 describes the market construct in detail.

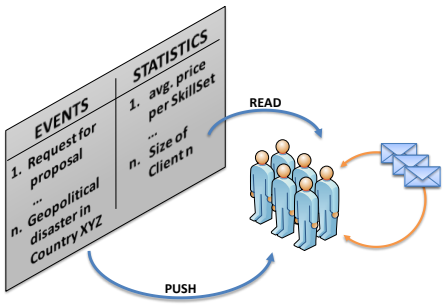


Figure 6.2-4: Simplified blackboard architecture used for agents' communication.

Particular building blocks of the model are described in the subsequent sections but first an execution cycle of the model is provided in general terms. The model is run at monthly steps. For each year (consisting of 12 ticks) the model executes the following sequence of events: agents proceed with re-evaluation of their situation, alter their strategies according to the results of their evaluation and act accordingly (see Figure 6.2-2). It is important to note that agents are synchronized at every step. Above all, this means that they take their decisions asynchronously.

More precisely, clients aim at either reducing their running costs of own service delivery or gaining new skills. Both objectives can be accomplished through outsourcing, in the case of cost reduction, and sourcing[77], in the case of acquisition of new skills. Clients interchange their strategies depending on their current situation. In an outsourcing[78] process clients are playing an active part, since it is the client who is triggering the communication. A client would broadcast a service request in a blackboard architecture fashion through the system and vendors, who can match the request, will respond with offers (see Figure 6.2-4). Depending on an evaluation of service request's respondents (several service characteristics, past experience with and ethnic origins of a vendor, price of a service, performance of a service, etc.) a client will either send a contractual offer or not. A vendor, in his turn, will perform an evaluation of all received offers based on several vendor-specific preferences with regard to clients. Only the most appropriate client will receive an offer, whereas other applicants will be rejected. After building some preferential order over the best matched respondents a client would enter into a negotiation round with these. Once the deal is accomplished it is followed by the transition of skill sets from the vendor to the client[79]. During a transaction each of the two partners may opt out of the contract prematurely or stay committed until the natural end of the transaction. In the case of a premature end of the transaction, sanctions are imposed on the defecting partner. Figure 6.2-5 depicts the sequence of the events during the model execution cycle.

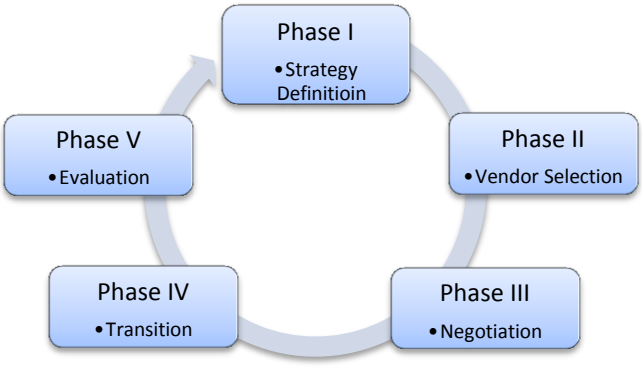


Figure 6.2-5: Process of entering a outsourcing relationship from a perspective of a client-agent.

[77] As already mentioned in the section 4.4.2 the term "sourcing" implies obtaining new services that were not available in the client's portfolio previously.

[78] In the following a process reflecting both sourcing and outsourcing will be referred to by the term outsourcing (cf. section 2.1).

[79] The choice of words in this case is misleading since outsourcing is always connected with "excising out" of units from the outsourcer to the provider. Due to the fact that the company is presented as an agglomeration of knowledge an outsourcing process has to be understood as leasing of the provider's knowledge to the outsourcer.

Figure 6.2-5 contains a generalised flow of processes while undergoing an outsourcing relationship as reported by stakeholders. The interviewed clients offered a slight variety of activities within particular phases but were sound in chronology and content of these. Figure 6.2-2 contains groupings of individual agents' activities within the scope of the EBO Model for phases from Figure 6.2-5. In the following, each phase depicted above is described shortly:

- Phase I:

  In the strategy definition phase, an agent considers his current situation, chooses an appropriate strategy from the two available – transformation or efficiency – and acts accordingly. See section 6.2.3.1 for more information.

- Phase II:

  In the vendor selection phase, a client evaluates answers from all vendors who responded on the service request sent in the previous step. Thus, a client has to build a preferential order over a set of vendors. See section 6.2.3.2 for more information.

- Phase III:

  The negotiation phase is a formal establishment of the contract. Both this and the previous phase are described in section 6.2.3.2.

- Phase IV:

  In the transition phase, skills from a selected vendor are transferred to the contractual partner. See section 6.2.3.3 for more information.

- Phase V:

  In the evaluation phase, a client is assessing his current relationships, alters his strategy and acts accordingly. See section 6.2.3.6 for more information.

Vendors, among themselves, are able to enter into merger relationships. These can happen in a voluntary manner, thus two suppliers deciding to collaborate, or in a hostile manner, thus an underperforming supplier is getting absorbed by a market rival. See section 6.2.4.2 for more information.

6.2.1 Agents

As the first step of an agent modelling process, generalized agent types were determined based upon elicited knowledge, i.e. the storylines derived from the interview evidence. These agent types differ along dimensions such as activities related to goal achievement and social network integration. EBO Model extends the assumption of homogeneous

agents in conventional economic models by populating the model with two types of potentially interconnected agents – clients and vendors. Economic models often have several types of agents such as firms, households and alike. The homogeneity assumption in these cases is that all entities of equal type – i.e. households or firms – are identical. In the agent based paradigm used for EBO Model (cf. section 3.2) agents of the same type are heterogeneous, they have different believes, preferences and they learn from their unique experiences. Thus, the model is based on the definition of two different kinds of agents that perform different tasks and are capable of autonomous actions in response to changes in their environment. A population of *N* clients and *M* vendors with $M > N$[80] is assumed.

As mentioned above, agents exhibit autonomy and all agents communicate by asynchronous message exchange. Thus, in order to communicate, an agent just sends a message to a destination. Alternatively, an agent is able to broadcast a message that is seen by everybody. The first communication method is used for negotiations between agents and the latter one becomes of use when service requests have to be communicated to individual service providers. Figure 6.2-4 exemplifies the process of agents' message and information exchange.

In order to explicitly contrast social and economic influences on the decision making of agents with regard to the success of outsourcing relationships, two driving dimensions were introduced to the decision making process of an agent's perception: economic success and social environment. On the basis of these two factors agents decide on their collaboration partners, i.e. a client-agent would not only consult the financial side of a deal but would also evaluate so called soft factors such as ethnicity of a vendor, vendor's reliability, etc.

Regarding the computational implementation, each agent exhibits proactive[81] behaviour. Agents' repertoire of actions differs relating to their respective situation. Since clients have two strategies at their disposal for coping with outsourcing needs, the process of decision making adapts to the needs of the corresponding strategy. Section 6.2.3.1 deals with different strategies of clients. Also, an experience gained by the client influences the

[80] This proportion (number of vendors predominates the number of clients) is strengthened by evidence from interviews and industry observation.

[81] Proactivity is claimed to be a distinguishing property of agent systems. Thus, an agent has its own set of goals and acts in ways to achieve these goals (Bellifemine *et al*., 2008).

way he goes about vendor selection. During the first encounter of a vendor a client-agent has to rely on publicly accessible attributes like size, international operations, ethnicity, location etc. However, at a later stage, a client can take into account his own past experience with the corresponding vendor and assess soft attributes such as reliability or trustworthiness.

In order to describe the proposed agent architecture, the implementation followed a strict separation of agent's functional components: perception, action repertoire and cognitive unit. Like the TCT Model, EBO Model relies on declarative programming and makes strong use of JESS for the representation of cognitive elements of agents, whereas perceptions and actions (transfer of services) are triggered from JESS but are conducted in JAVA (cf. section 3.3.3).

Against the background of the aforementioned issues it is the particular purpose of EBO Model to reflect the reasoning of actors involved in an adequate level of abstraction. In order to do so, the implementation is based on results of interviews with actual practitioners and other stakeholders from the area of interest. By purpose, agents were not endowed with exaggerated opportunistic drive *a priori*, as was done in the case of TCT Model. More importantly, however, a set of abstract decision rules for different types of actors was compiled, which forms the basis for the implementation of agent's decision rules in EBO Model. The following sections describe cultural elements of agents, agents' cognition and setting. Rules are used to produce new facts and delete or alter existing facts. In other words, to manipulate the agents' knowledge, each rule consists of a set of conditions and a set of actions to be performed when there are facts that match the conditions.

6.2.1.1 *Cultural elements*

Corresponding to stakeholder's responses, nondomestic providers reveal a lower cultural tolerance than clients. In the context of the fieldwork the term cultural tolerance was understood as a disposition of an entity (i.e. firm, department, single person) to allow for fruitful collaborative work with another entity, no matter what ethnicity the other entity represents. Therefore, a low level of cultural tolerance can lead to disruptions of business in case a client is sourcing services from vendors of different cultural backgrounds. Obviously, a breach of a contract or disruptions of service delivery are entailed by a negative track record for the supplier parties.

Each vendor has an attribute (implemented as an array) which captures the international operations of that agent. This attribute is publicly visible and exhibits a pivotal role in the vendor selection process, since according to interviewed stakeholders a non-internationally active vendor is not likely to be a first choice of a client (cf. section 4.6.5). After acquiring a new relationship partner or merging with a non-domestic vendor, an agent automatically acquires the attribute of international operations in the corresponding region. It is assumed that a vendor having operations in a foreign country necessarily acquires experience of that country. Accordingly, after a merger with a partner who already has an extensive geopolitical experience, one gains experience too. Figure 6.2-6 showcases the process of gaining geopolitical experience while undergoing a merger or outsourcing relationship respectively. Having entered into a relationship dyad, experience exchange is assumed to be shared.

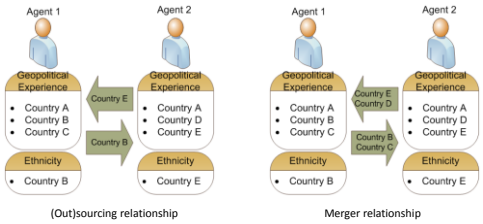


Figure 6.2-6: Process of geopolitical experience exchange in a relationship.

While an outsourcing relationship only entails a gain in geopolitical experience concerning a partner agent's ethnicity or country of origin, in a dyad of a merger relationship one additionally profits from a partner's geopolitical experience portfolio.

Despite a greater cultural tolerance of clients rather than nondomestic providers, there are still some cultural issues present in international projects. To capture the circumstances of the case, the system was endowed with a cultural matrix (initialized for each simulation run). It contains a random distribution of probabilities for different pairs of ethnicities to arrive at a cultural clash during the contractual time. In case a relationship has ended prematurely due to cultural discrepancies a negative track record is created by all parties involved in the collaboration.

The algorithm distributing agents' ethnicities entailed the assumption that clients are ethnically more homogeneous than vendors. This assumption was approved by all involved stakeholders. Whereas the majority of clients involved into outsourcing market are western companies the providers are scattered across multiple geographies. Any

multisourcing environment bears potential for bringing together conflicting ethnicities and therefore sparkle cultural conflicts.

6.2.1.2 *Agents' Cognition*

Like TCT Model there are two sets of rules in the model: *general rules* – which describe local actions of individuals independent of their capacity to interact with each other, and *topological rules* – which describe the possibility of interactions through connections between individuals. Interactions between two and more agents are an essential element in the outsourcing environment and therefore have been paid particular attention in the EBO Model. It was pointed out in the methodology part that cognitive elements of agents' reasoning are implemented via endorsements. Firstly, they demonstrate a "natural" way of computationally implementing reasoning about agents' knowledge or experience and, secondly, offered a smooth translation of the evidence into the model. Endorsements are used to capture the agents' process of reasoning about preferences and the consecutive establishment of preferential ordering.

Furthermore, fieldwork revealed another legitimate reason to use endorsements. In particular, tools used to commoditize and smooth the vendor selection process, presented in the section 4.4, resemble strong similarities in their underlying concept with that of endorsements. This issue is discussed in detail in section 6.2.3.2. Formal approaches for vendor selection used by interviewed stakeholders – weighted checklists and spidergrams (see appendix B) – use weights to represent client's different foci of attention. The gist of the argument here is that, in order to match a real-world situation in an abstract way, one needs an approach that can capture the subjective nature of a preferential ordering used by practitioners. Endorsements represent a methodological tool which can be used to emulate the aforementioned apparatus of tools.

In order to account for heterogeneity mentioned in the introduction of the current section (cf. section 6.2.1) endorsement schemes for each agent type developed. These are based on the conducted interviews and secondary data from literature and media. Several questions played a pivotal role in this process: *Which properties shall a transaction partner possess ex ante to appeal to the corresponding party? How shall the behaviour of the corresponding party be monitored and evaluated respectively? Which factors can lead an involved party to prematurely terminate the relationship?* Hence, an analysis of the data available was done under these premises.

The specificity of the service sourced is linked to the risk perception in the relationship. In the dyad of exchange parties this risk can be considered as perceived risk. However, a few interviewees mentioned several other important influences on perceived risk: trust, reliability, reputation, personal relationship and size of the contracting partner. Whereas the distinctiveness of some of these terms might not be transparent in the eye of the beholder, interviewees insisted on a strict differentiation of these terms. Accordingly, this categorisation was adopted for EBO Model (see Table 6.2-1).

The personal relationship was classified as an indirect attribute contributing to the overall contractual picture. An interviewed sales department employee from VENDOR2 echoes a general sentiment of the market: "*A waterproof contract with hundreds of SLAs* (service level agreements) *will secure a currently desired state of service delivery but what happens if a change is needed* (...) *here a personal relationship comes into play. However, one will not find any clauses with respect to personal relationships in a traditional contract. Thus, everybody has had to work an own way of going about the issue."* Reputation, trustworthiness and reliability ought to play a pivotal role in the perceived risk and thus in the resulting decision to interact with a certain agent. The latter three factors were linked to risk through an individual propensity of a transaction partner to act in an opportunistic way.

Endorsements in the EBO Model are classified into two distinct categories: static endorsements and dynamic endorsements (Geller *et al*., 2010; Geller and Moss, 2008). Whereas static endorsements are labels that once assigned, remain unchanged (i.e. ethnicity or particular policies), dynamic endorsements may be revoked, replaced, or dynamically adapted over time depending upon the interaction history and the individual endorsement scheme (i.e. reliability or pricing of services). Given that endorsements capture the reasoning process of one agent, the endorser, about another agent, the endorsee, the information collected by the endorser is of a subjective nature. Endorsements can be considered as labels, which agents use to describe certain aspects of their interaction partners (Geller *et al*., 2007, 2010; Alam *et al*., 2008, 2010). Table 6.2-1 provides an overview of clients' endorsement scheme distinguished by static and dynamic endorsement label character.

Trust, reliability and loyalty are operationalized computationally by means of endorsements. Whereas regional belonging and contractual policy are anchored as static

properties, which are permanent throughout the simulation, tags like reliability, trustworthiness, etc. are subject to a particular agent's experience, preserving a chance to change dynamically. One can see from the Table 6.2-1 that it is not necessary to have an antonym for every positive or negative endorsement.

Static	Dynamic
domestic / non-domestic	internationally-active / non- internationally-active
discount-policy /	above-average-size / below-average-size
no-discount-policy	additional-skills / no-additional-skills
ethnicity-n[82]	cheaper-than-own-production / more-expensive-than-own-production
	cheapest
	reliable / non-reliable
	untrustworthy

Table 6.2-1: Client's endorsement scheme subdivided into static and dynamic endorsements.

As already discussed in section 3.2.5 different agent types possess different roles and functional characteristics and should therefore also be equipped with a cognitive structure that explicitly corresponds with their type (*ibid*). Agents are embedded in distinct endorsement cosmos and care about certain endorsements more than they do for others. The solution for the above problem is to avoid assigning random endorsement weights w_j to the agents and instead assign weights that are in accordance with a particular agent type. Typically, agents are assigned endorsement schemes at creation, which may differ not only in the weights they assign to the labels but also in the absolute values used for the number base *b* (cf. section 3.2.5). Whether endorsement schemes are assigned completely randomly or in randomized, but empirically based manner is at the researcher's discretion. Each agent in EBO Model is assigned its (numerically) individual endorsement scheme by giving each of the endorsements listed in Table 6.2-1 a different weight for each agent. This means that while one agent cares most about reliability, another agent might consider size and good reputation as more crucial factors. It is believed that a greater heterogeneity of actors of the same type is achieved via this method. Therefore, endorsers base their decision on whether to interact with the endorsee upon the existence and weights of particular endorsements. If there are several endorsees, which fit the desired profile, the endorsee with the highest preference match – i.e. the highest E_{stat}[83] – is chosen.

[82] Here the label *ethnicity-N* stays for a particular ethnicity of an agent. The number of ethnicities in the system is a parameter that is used for initialisation of the EBO Model. The endorsement scheme of every agent contains the same number of *ethnicity-N* tags as the number of ethnicities the model was initialised with.

[83] Refer to methodology chapter section 3.2.5 for more information on how endorsements are calculated.

The endorsement scheme should have a diverse range of weightings on certain endorsements. In particular, according to interviewees, factors which influence the perception of risk for clients are different to those for vendors. Clients consider trust, reliability and personal relationship as crucial building blocks of a healthy transaction whereas vendors, on the other hand, care more about clients' reputation. In order to match this real-world situation in an abstract way an approach of assigning incompletely randomized endorsement weights e_i was chosen[84]. This way it was possible to capture distinct endorsement cosmoses of different agent types.

6.2.1.3 *The Setting*

As is the case for all agent-based models where agents interact with the environment, agents will be changing the state of the environment for one another. This characteristic of the model is pivotal for the course of the model as changes in the environments influence the patterns of rules and therefore actions of all of the agents taken together will be influenced by one another. The outcomes for the model as a whole are in these circumstances impossible to predict with any exactitude. In the EBO Model there are two types of environments that influence rule patterns of agents: market (cf. section 6.2.4) and relationships network. Both environments provide information that is utilised by agents for context dependent actions.

In order to capture intrinsic properties of the modelled social system, a multi-layered network of agents was required. EBO Model's environment represents agents' relationships as links in a network of multiple layers. An agent may be seen as a node in different social network contexts. Since agents are able to actively perceive their social environment they are capable of acting in their corresponding social network. Thus, an agent has two semantically different meanings depending on the context it is related to – outsourcing relationships network (*clients2vendors*) and organizational relationships network (*vendors2vendors*). Figure 6.2-7 captures schematically the simulated environment that is composed of two network layers – the collaborator and the merger network.

The collaborator network captures outsourcing relationships between agents. In this network, only relationships of different agent types are allowed. Thus, the network

[84] More information on customization of the endorsement concept and technical implementation of the concept can be found in the methodology chapter section 3.2.5.

contains vectors of the type *client2vendor* only. The merger network represents the dependencies between vendors among each other and contains therefore only *vendor2vendor* vectors. It becomes evident from the networks showcased in Figure 6.2-7 that, albeit the only client in an outsourcing relationship with *vendor3* is *client5*, every client in a presented network is dependent on *vendor3*. Dotted lines indicate hidden dependencies in the presented system. These logical dependencies resulted from the merger between *vendor1*, *vendor2* and *vendor4* with *vendor3* as a host. The hidden dependencies are not stored in the merger network but can be elicited via evaluation of network data by the researcher. Agents, however, do not have this information.

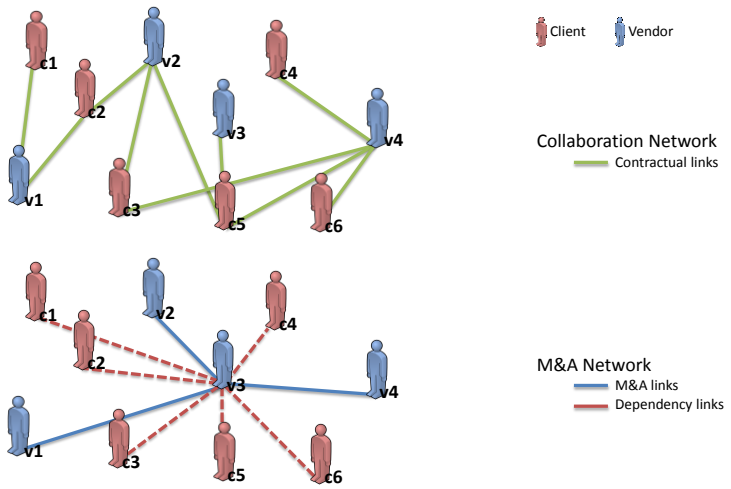


Figure 6.2-7: Logic connection of collaboration and M&A network in EBO Model.

Neither the merger nor the collaborator networks initially exist. These networks are created from scratch during each simulation run. Two networks differ in complexity depending on interactions of agents. The network is dynamic in the sense that clients and vendors are constantly establishing new relationships and terminating old ones. Due to mergers and acquisitions constantly taking place, organizational *vendor2vendor* network layer exhibits dynamic behaviour as well. However, while the collaborator network can build up and diminish, the merger network, on the contrary, can only grow. It is assumed that merger bonds, once established, cannot be broken. This matches in an abstract way a real-world situation, though cases of split mergers are evident, the chances of such an event are negligibly small.

6.2.2 The Knowledge of the Agent

Any outsourcing model deals with actors of an outsourcing process and goods/services they exchange. In order to choose interaction partners in an outsourcing environment, a preferential order over the participants of the market has to be built. A choice of an

environment agents are located in (in case of TCT) or a choice of a service representation (in case of EBO Model) is crucial for the model since this choice provides incentives for the consequent concepts of implementations as they are going to be developed with respect to these prior assumptions.

In the course of the fieldwork it became evident that building organigrams of IT services in use delivers a tangible structure to visualize interdependencies of particular services and delivers a well-grounded basis for implications on outsourcing strategies (cf. section 4.4.2). However, it is not that much about defining the core services as discovering the dependencies of these services. Not all interviewed stakeholders deploy organigrams that resemble directed graph or tree structure upfront. However, in any of these representations one could clearly identify layers of services that make clear dependencies of services on each other.

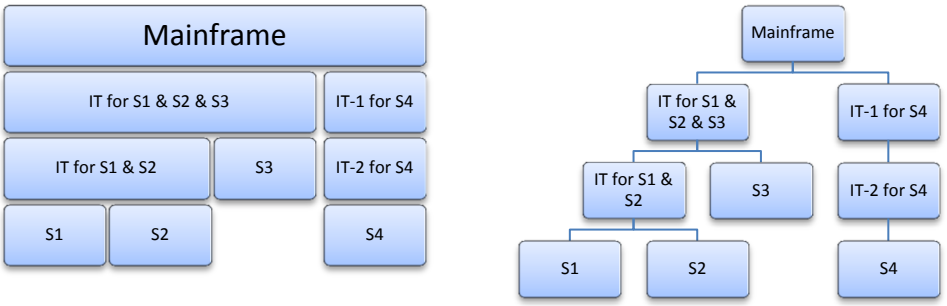


Figure 6.2-8: Simplified schematic architecture of the CLIENT2 mainframe based IT services.

The architecture in Figure 6.2-8 was drafted by the interview partner and is juxtaposed with the corresponding directed spanning tree representation. S1-S4 stays for services based on the mainframe. As one can clearly recognize from Figure 6.2-8, the organigram representation drafted by an interviewee can be easily transferred into a directed spanning tree representation. Indeed, while discussing this way of the company's IT assets representation it became evident that, at a time, the majority of interviewed stakeholders were using an IT representation form as a means of communication (some sort of common denominator) that bears a strong similarity to a spanning tree structure. There could be no consensus achieved with regard to a semantic meaning of the nodes in the spanning trees they used – suggestions ranged from hardware agglomeration points over software portfolio to knowledge or personnel skills of a corporation's unit. Ergo, as stated in the following, any nodes of the tree are referred to as a collection of tasks or so called skill sets.

A directed spanning tree is an adequate representation of interplay of goals with the skill sets necessary to achieve these goals. Also a spanning tree helps to capture the intrinsic character of the modelled system with respect to the growing process orientation among stakeholders due to applications of the multisourcing concepts. A similar concept was already used by Moss (1998) and Taylor (2007: p. 294-311).

The system is initially endowed with a Firm Skills Universe (henceforth FSU), which represents the whole knowledge cosmos of a modelled system. As mentioned above, the FSU is implemented as a directed spanning tree. Nodes represent a collection of tasks or skill sets gathered in separate units and links define requirements of each node. Moreover, the weightings of the links stand for the costs one has to incur to attain the next skill set.

Many companies operate internal markets or profit centres to keep their IT costs down. Therefore, not only FSU_{vendor} but FSU_{client} as well, is endowed with prices on the links. Since weighting of the arrows represents the cost of obtaining a certain skill set, it mimics internal IT departments which are in constant competition with outsourcing providers. It is conventional wisdom in the field that during a vendor selection phase, costs of in-house production are juxtaposed with these from a third party.

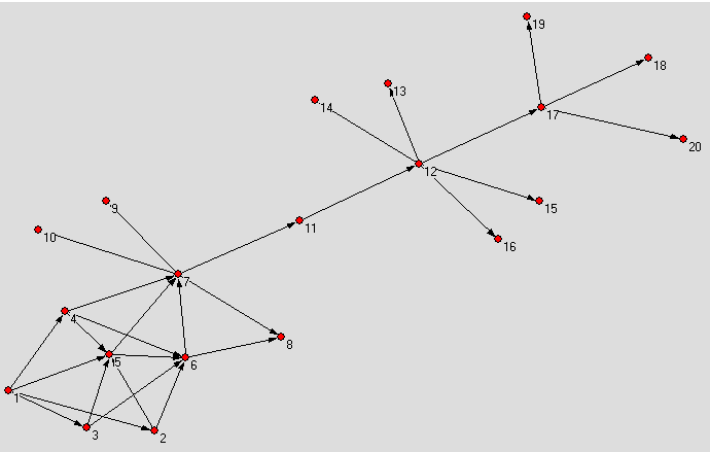


Figure 6.2-9: Representative FSU with weighted links.

Stakeholders' feedback suggests the design of a model based on a single master spanning tree. This conclusion is strengthened by the evidence from the field to the effect that most of the traded skill sets on the outsourcing market can be considered standardized or semi-comparable. Custom solutions are still present but are rare due to high costs. In order to keep costs down many market participants (mutual reaction between clients and vendors) standardized their skill set portfolios (cf. section 4.5.2).

Figure 6.2-9 exemplifies a representative FSU composed of 20 nodes (skill sets) with corresponding weightings on the links of the directed spanning tree. The diagram is constructed from a layered representation of the IT architecture at CLIENT4[85]. From Figure 6.2-9 it becomes clear that while some skill sets strongly depended on several basic (parent) skill sets, others, in contrary, developed more or less independently as branches of the tree. The use of FSU allowed for structure based operationalization of the asset specificity concept.

6.2.2.1 *Asset Specificity*

An issue of asset specificity represented a *sine qua non* while implementing the model. Despite attempts to confine a focus of stakeholders on a standard set of "skills", the notion of an asset being more specific than others was omnipresent. One of the goals for EBO Model was to disambiguate and improve the concept of asset specificity as used in the transaction cost economics (cf. sections 2.2.2 and 2.2.3). It is hoped that partial disambiguation was achieved by laying out the clear operationalization of the concept of asset specificity in detail.

EBO Model introduces, besides other behavioural indices, a definition of asset specificity inspired by the initial findings of TCT Model's development and evaluation process. These findings were elaborated in chapter 5. The TCT Model deals with AS by estimating the number of providers, who can provide a particular service of interest. Considering that this notion was endorsed by practitioners, it was now to determine how to incorporate this measure of asset specificity into EBO Model. A challenge arose from the fact that TCT Model did not distinguish the different services in a client's portfolio, treating them instead as a single service. During author's participation into an outsourcing strategy project a workshop on a topic of multisourcing relationships management was held. One of the outcomes was a guideline for managers to be cautious with outsourcing considerations of non-redundant[86] services. In a follow-up interview a redundant service was defined as a service that can be delivered in several alternative ways. In terms of spanning trees, this definition amounts to the requirement that any node representing a redundant service, has to be reachable from a root node via several paths. An in-degree could be used here as a specificity indicator of a skill set. A distance to the root node can

[85] Due to confidentiality reasons some parts of the full graph are excluded.

[86] The definition of the term "redundant service" is not consistent. The project team defined a redundant service as a service that does not cause disruption of serve delivery in case of failure of that very same service. Such definition insinuates the existence of a backup or alternative delivery option respectively.

be utilized as an indicator too – the further a skill set is to the root the more core-specific it is.

With time, companies start outsourcing more aggressively, namely, going for more specific skill sets. A widespread but erroneous belief is that companies believe they have gained experience after conducting several outsourcing deals and are then able to apply this knowledge to later projects. In order to capture this issue in the EBO Model the sketched asset specificity concept was used. Since the specificity of skill set in the FSU is defined upon the in-degree and the distance to the root node, with time, the "overconfident" agents start choosing nodes with lower in-degree and a shorter path to the root node for outsourcing.

Following sections describe the concepts of a FSU and sub-FSU and draw upon algorithms used for creation of the FSU_{system} and FSU_{agent} respectively.

6.2.2.2 *Algorithm for FSU_{system}*

This section introduces an algorithm used to generate the master FSU – FSU_{system}. The algorithm presented here is a slight modification of the algorithm used by Taylor (2007: p. 294-311).

FSU (Φ, Ψ), where

Φ = {K_i} is a set of skills/requirements to go from one node to another

Φ = {K_i}, K_i is an i^{th} node, i = 1, 2, ..., n

P = { K_i} is a set of parents of a child node

P = {K_i}, K_i is an i^{th} node, i = 1, 2, ..., n

Ψ = { V_{ij}} is a list of requirements to go from one node to another

Ψ = { V_{ij}}, V_{ij} is a vector beginning in K_i and ending in K_j (gives a list of requirements to go from one node to another)

Γ = { P_{1j}} is a set of all possible paths to any node in the tree.

Γ = { P_{1j}}, P_{1j} is a path from the 1^{st} to the j^{th} node; starting point is always unique – root node.

At the beginning of the simulation FSU_{system} is created from an initial list of nodes K_1 *to* K_i with $i > 1$ from Φ. These nodes are themselves each linked to the root node $K_0 \in \Phi$. The nodes K_1 to K_i are added to the parent list P. The remaining children from Φ are added in turn with the following loop:

Step 1: determine the set of parents P ⊂ Φ that the child will have

Step 2: select these parents randomly from the set P, and make a link from each one of them to the child

Step 3: for each parent in P, with a small probability p_D delete that parent from P

Step 4: add the current child to the parent list P

Step 5: with a small probability p_S, split P into two independent parts. Subsequently, child nodes will be attached to one specific parent list (chosen randomly), from where all its parents will be drawn

Step 5 causes branching of the FSU_{system} such that different areas of it can develop independently. In other words, later nodes are positioned such that they depend on a limited number of earlier nodes that are themselves interdependent. This specification is intended to represent the real-world situation that it is feasible for a firm to specialize, or to learn some advanced skills without first having to learn almost everything else at a more basic level.

6.2.2.3 *Creation of sub-FSUs*

As mentioned in the previous section, the model is endowed with FSU_{system}, which contains the whole knowledge of the system. While creating different agents and agent types the question arose with respect to an initial amount of agents' knowledge baggage – *Who shall possess informational advantage over whom?* and *How much of the whole knowledge universe will the agent obtain on his birth?* Here, the appropriate literature, together with the fieldwork data could reveal a unified opinion on the topic.

If one observes a "standard" pool of skill sets, which are generic to the IT in the financial sector, then it becomes evident that the majority of foreign providers possess a considerably higher quality and coverage of services rather than customers from the domestic market (Ambert and Wiener, 2006: p. 69-76). The words of a sales manager from VENDOR2 emphasise the aforesaid: "*We simply cannot afford to offer low service quality since nondomestic providers do not enjoy a good reputation in western countries anyway. The only way for us to penetrate the market is to offer the best of breed service standards and being able to cover as many needs of customers as possible. Each time we deny a request of an already existing customer for additional services we weaken our position on the market.*" Domestic providers, however, frequently do not have the liquidity to broaden their services portfolios to match that of foreign competitors and,

therefore, pursued the specialization strategy in recent years. In other words, non-domestic providers offer wider but more flat skill set portfolios than their domestic counterparts.

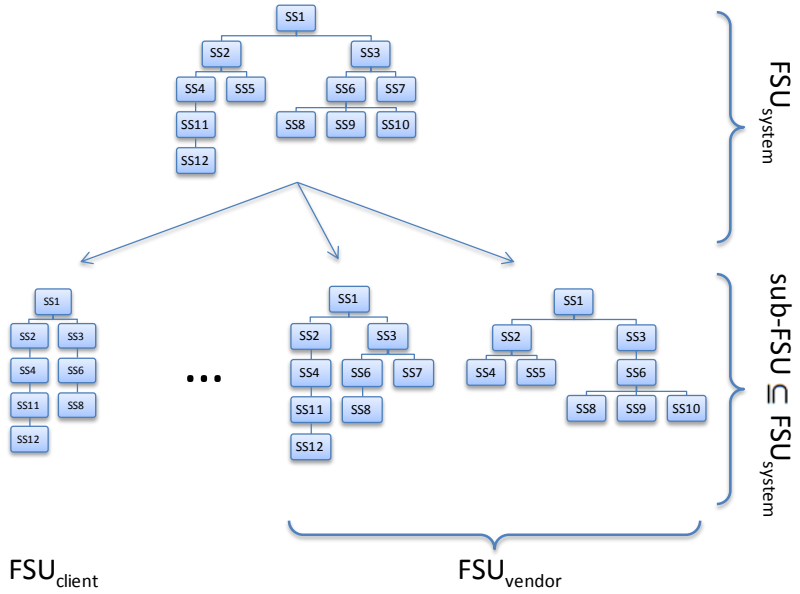


Figure 6.2-10: Inheritance of the skill sets from FSU_{system} to sub-FSUs.

Figure 6.2-10 depicts the origins of the various sub-FSUs – FSU_{agent} and FSU_{vendor} – from the FSU_{system} and their inheritance of the skill sets. In order to incorporate the abovementioned evidence, the following assumptions were made while creating agents. Firstly, vendor-agents possess knowledge advantage over client-agents. This is realized by giving bigger sets of nodes from the FSU_{system} to vendor-agents at their creation (technical aspects can be found in the next section). Secondly, vendors' FSUs exhibit different branching grades. Thus, there are vendor-agents who cover a wide scope of services and, again, there are vendor-agents who cover only exclusive ranges of services but in greater depth.

6.2.2.4 *Algorithm for FSU_{agent}*

From a modelling perspective, a diversification of the FSU_{agent} is obtained via the following algorithm:

Step 1: determine all possible paths $\Gamma_{full} = \{P_{1j}, \dots, P_{1m}\}$ through FSU_{system}

Step 2: select at random $\Gamma_{part} \subset \Gamma_{full}$ paths to be copied from FSU_{system} to FSU_{agent}

Step 3: determine Φ for FSU_{agent} based on Γ_{part}

Step 4: determine Ψ for FSU_{agent} based on Γ_{part}

Step 5: with obtained Φ and Ψ rebuild FSU_{agent} (Φ, Ψ)

By means of copying random path sets Γ_{part} from Γ_{full}, presented algorithm allows for generation of cases where $\Psi_{agent}(i) \subset \Psi_{system}(i)$ while $\Phi_{agent}(i) \subseteq \Phi_{system}(i)$. This nuance makes an implementation of a statement possible, put frequently forward during the interviews, that different companies holding the same skill sets portfolios achieve their goals with diverse approaches.

6.2.3 Contracts[87]

As mentioned in section 4.5.7, the process of relationship management in a multisourcing environment is rather challenging. In order to capture the intricacies of the modelled system the EBO Model has to contain the same relationship constellations as encountered in the outsourcing market. This way the results would be enlightening in terms of insights into the mechanisms and, especially, hidden traps of contract management in a multisourcing environment. Indeed, the process imposed a task of a much higher complexity as originally anticipated. Ample descriptions of the difficulties and findings with respect to the issue addressed here can be found in section 7.1.1.6. Figure 6.2-11 shows constellations of the outsourcing market as reported by interviewed stakeholders.

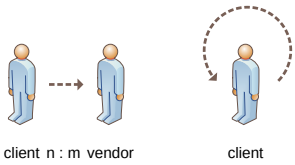


Figure 6.2-11: Possible relationship constellations, where *m* and *n* are agent specific.

Agents can build relationships with each other in a non-exclusive way. Scenarios are possible where a client-agent is collaborating with several vendor-agents and vendors, in their turn, can collaborate with multiple client-agents too. These collaboration relationships of agents are of a non-permanent nature, thus they can be built up and broken respectively in accordance with agents' perceptions of the current situation. Once entered into an outsourcing relationship there is a minimum time until another one can be initiated by an agent (see Figure 6.2-12). This time delay between relationships accounts for one-off payments connected with entering an outsourcing relationship – redundancy packages, communication infrastructure, knowledge transfer, involvement of consultants, etc. As a result of the interplay of aforementioned factors an emerging network of agents obtains a dynamic flair.

[87] The author defines contracts as any sort of outsourcing relationship from the collaborator network. Mergers do not belong to this category.

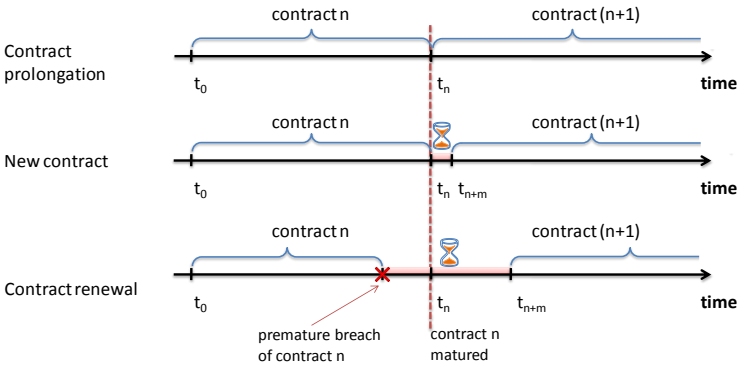


Figure 6.2-12: Idle time between contracts regarding the type of expiration of the previous contract.

Figure 6.2-12 shows that the longest idle time a client-agent encounters is in the course of premature contract breach. An establishment of a new contractual relationship requires a minimal idle time and the prolongation of an existing contract is seamless. Contract initiation is always done by a client. Thus before a client can start looking for a contractual partner, he has to define his own outsourcing strategy. The different strategies available in the model and the decision process of the client-agent are both dealt with in the next section.

6.2.3.1 *Strategy*

Before an agent can enter into an outsourcing relationship he has to define his outsourcing strategy. There are various incentives for entering into an outsourcing relationship which have been covered in chapter 2.1.3. In practitioner circles, a congeries of incentives is reduced to only a few generic ones. Consequently, in accordance with stakeholders, EBO Model allows for two types of outsourcing deals – transformation/enhancement and efficiency. Efficiency deals are concerned primarily with reducing costs, i.e. outsourcing in-house services, and transformation deals are concerned primarily with acquisition of new skills. Figure 6.2-13 showcases two different FSU_{agent} structures. In the first case an agent chooses a transformation outsourcing strategy since he aims to obtain an additional skill set C_9. In the second case an efficiency outsourcing strategy is chosen, hence, all goals have been achieved and costs ought to be reduced now. This fact implies skill sets C_2, C_4 and C_9 to be designated to be outsourcing candidates.

Majority of interviewed stakeholders assigned a high proportion of success in an outsourcing endeavour to an alignment of the outsourcing and business strategies to each other. Thus, companies switch between both strategy types according to the current business needs. A corporate strategy officer from CLIENT5 sums up the sentiment of

interviewees: "*we certainly do not switch between strategies in a flip-flop manner but we do aim at strongly aligning our outsourcing strategies to our business goals. Thus, whenever there is a shift in the business strategy an adjustment to the outsourcing strategy is necessary*".

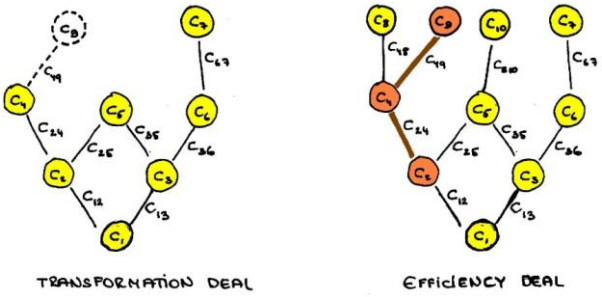


Figure 6.2-13: FSUs of two vendors that pursue different strategies.

The inclusion of several strategies for clients was demanded by stakeholders, as any change between these would reflect the dynamic nature of business or agility in response to changing business circumstances. Subsequent sections discuss each strategy in detail.

6.2.3.1.1 Transformation Strategy

The skill set acquisition strategy is a strategy pursued by most agents at the beginning of the simulation. Initially, agents are endowed with a subset of FSU_{system} paths. Once, the FSU_{agent} tree is reconstructed from the initial paths pool, an agent estimates the proportion of goals he has already achieved to all possible goals in the system – comparison of the leafs between FSU_{system} and FSU_{agent} (in the context here leafs stay for agent's goals). Each agent has a different threshold of goals he has to achieve in order to switch to the cost saving strategy, thus reflecting different facets of the company's profiles. This value is drawn from a range [0.6, 0.7]. The range values are backed by practitioner's statements, which state that clients start thinking about reducing costs only after having achieved approximately 60% to 70% of goals set *a priori*.

Initial simulation constellations allow for some client-agents to possess the necessary amount of goals they need to break the threshold upfront. These agents will resort to the cost saving strategy directly.

6.2.3.1.2 Efficiency Strategy

The efficiency strategy comes into play after an agent has achieved a certain number of goals (this threshold is agent specific). The ultimate goal of this strategy is not the reduction of cost for a particular skill set but the reduction of the overall costs of FSU_{agent}. To achieve this goal, an agent has to analyse all possible paths through the FSU_{agent} on

their financial aspects and draw the comparisons with market averages. The necessary information is drawn from the market (cf. section 6.2.4) via black board like architecture (see Figure 6.2-4). Once analysed, the most expensive paths are selected and are analysed repeatedly on the most expensive skill set transition. As a result of this process one obtains skill sets that are considered for outsourcing. The number of skill sets per deal is not limited, thus whole skill set chains can be outsourced to a vendor-agent.

A cost-saving request, made by a client, is not accompanied by costs of own production in order to avoid opportunism on the vendor's part. In case a vendor would know clients' production cost and his own production costs would be smaller than those of a client, they would try to cheat and make an offer which is only slightly cheaper than the production costs of a client.

Once all possibilities of cost saving are exhausted a client-agent would consider switching back to skill set acquisition (provided that some of the goals are still not achieved). At later stages of a simulation run, an agent could stick to the efficiency strategy simply because he has already achieved all of his goals. After having decided on a strategy to be pursued, a client-agent is involved in a vendor selection process which is intended to result in a contract candidature. Some light is shed on this process in the following section.

6.2.3.2 *Vendor Selection Process*

The interviews with practitioners highlighted the Achilles heel of the outsourcing process – vendor selection. *Inter alia*, all participating stakeholders invariably categorized this task as precarious. Indeed, field research did not encounter commonly accepted processes. Instead, stakeholders abide by best practices distilled from past experience. Particularly striking was the fact that, despite different approaches, all of the interviewed stakeholders share a common base architecture which can be divided into sections or individualized blocks.

The initial step of the vendor selection process consists of fabricating a *Request for Proposals* (henceforth RfP) and a *Request for Information* (RfI) and issuing these to suppliers in the subsequent step. After the arrival of supplied bids, preferred candidates are selected by comparison with a list of criteria specific to a company. Figure 6.2-14 exhibits a schematic representation of the aforementioned vendor selection process as being adapted for client-agents.

Figure 6.2-14: Schematic representation of vendor selection process from client-agent's perspective.

In *Phase I* a client-agent is evaluating strategy, selecting skill sets for outsourcing and broadcasting an RfP/RfI message containing services required for outsourcing. The cost of their own production is not broadcast on purpose in order to avoid opportunistic behaviour on the vendors' side. In *Phase II*, after a broadcast is made, vendors, who offer requested services and have spare capacity to serve another client's needs, submit a bid message. A bid message contains requested services with corresponding production costs of a vendor. The whole process resembles strong similarities with the bidding auction sealed first-price auction (Bagnall and Toft, 2006). Hereby, all participating vendors submit their "sealed" bids concurrently. Thus, at any time in the bidding process no vendor has knowledge of any other participant's bid. Vendors are entitled to submit one bid each, which distinguishes this auction from an English auction. A delicate task for every participating vendor is setting up a price to ask for delivered services. Since, vendors cannot see the offered bids of other contesters they are not able to adjust their offers in response. According to stakeholders, this process is followed up by a subsequent negotiation round between the client and the winning vendors. The preselection of vendors is then reduced bit by bit until only one finalist remains. This process was shortened in the model in a way that vendors chose the finalist straight away (merging *Phase II* and *Phase III*).

However, it has to be emphasised, that clients' preferential ordering upon received offers is not exclusively cost based. In this regard, in *Phase III* a client-agent is considering a whole range of vendors' attributes and own experience from the past, if available. They try to evaluate and estimate both the current costs of their purchase and what the purchase is expected to cost them in the future. A social assessment, on the contrary, is trying to establish a reliability of the eventual partner from social bits of information available. The social assessment can only be conducted if a corresponding vendor has had contact with the same client-agent in the past. Thus, after the second and the third phase have been run through, an overall rating of a vendor is built. The described process offers a good application area for, and makes a strong usage of, the endorsements concept described in chapter 3. Once the preferred partner is selected, a skill set transfer is triggered.

The process of moving a company function to a supplier has many common elements, irrespective of the type of function being moved (Bragg, 2006: p. 35) For this reason, the transition process was modelled as a unified block instead of fragmenting it. The next section describes this process.

6.2.3.3 *Skill Set Transfer*

Knowledge gain and loss are two processes that are inherent to an outsourcing project. In the field work chapter a conceptual side of the issue was characterised (cf. section 4.5.8), whereas the current section exhibits a technical realization of the point in question. Figure 6.2-15 depicts the process of a skill transfer between *client1* and *vendor1* in an outsourcing relationship. For reasons of clarity a scenario of a single skill set outsourcing is introduced. The same procedure can be extended to any set $N_{agent}(i)$ of *i* nodes, where $N(i) \subseteq \Phi_{agent}$ and all *i* nodes belong to the single path P_{ij} from the i^{th} to the j^{th} node.

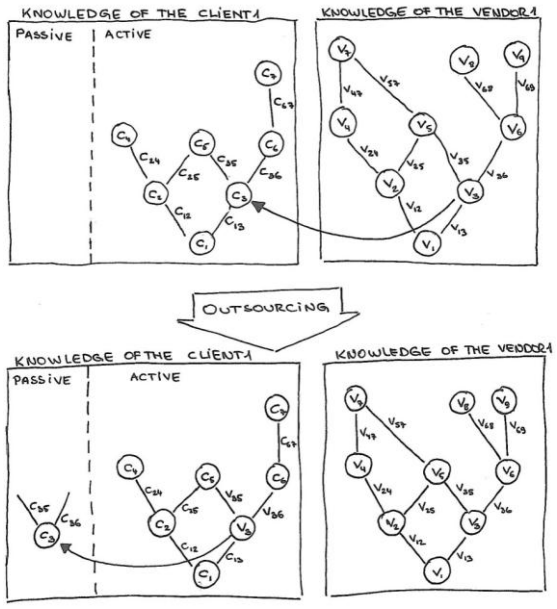


Figure 6.2-15: Skill set transfer in an efficiency deal (outsourcing process).

As one can see in Figure 6.2-15, an implementation of clients' knowledge assumes existence of active and passive knowledge parts. An active part represents knowledge currently in use and a passive part resembles knowledge that is not currently in use but is still contained in the knowledge cosmos of a client-agent. Passive knowledge comes into play during both, sourcing and outsourcing relationships. In the scenario above, the passive knowledge of *client1* comes into play, when he decides to outsource the skill set C_3. During an ensuing transfer procedure, *client1*'s skill set C_3, together with its branches c_{35} and c_{36}, is substituted through *vendor1*'s skill set V_3 with corresponding branches v_{35} and v_{36}. However, the skill set C_3 and links c_{35} and c_{36} are not lost instantaneously, but are

moved to the passive part of the knowledge cosmos. Once a contract between *client1* and *vendor1* is matured the substitution goes the other way around.

Dependency on a particular vendor emerges when a client outsources the same skill set several times in a row. The passive part of a client's knowledge cosmos has a limited retention time. If any skill set is stored longer than a particular client specific threshold it decays – thus, the bit of knowledge is lost forever.

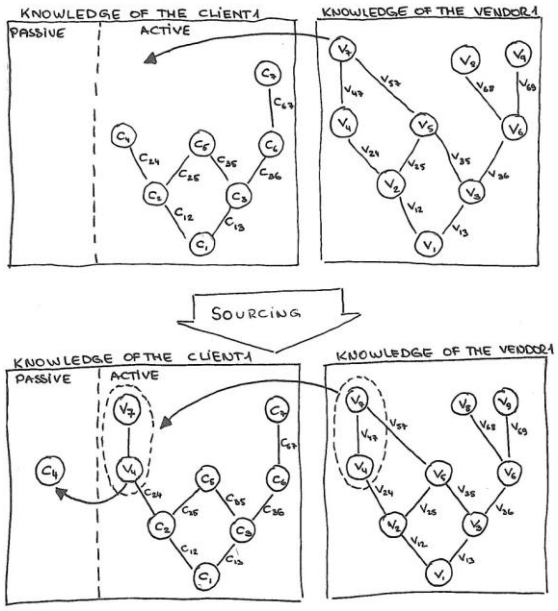


Figure 6.2-16: Skill set transfer in a transformation deal (sourcing process).

Figure 6.2-16 showcases the interplay of both knowledge parts in a case of a skill set sourcing. It is anticipated that the sourcing process requires a substitution of the skill set preceding to the sourced skill set. Thus, sourcing entails a transfer of, at least, two skill sets. The rationale is to trace back to the fact that, in order to attain new skill set, there should be a fundamental innovation of the lower level skills. Even sourcing the next level skill set requires a radical innovation on the level below in order to be able to cope with newly gained skills. This statement was backed by numerous interviews conducted during the field research. Transferring aforementioned heuristics to an agent would mean that in order to build a new link from C_4 to V_7 a radical innovation has to be made in *client1's* knowledge portfolio – which is not possible in a short time. V_4 has to be sourced as an addition in order to compensate for the shortcoming. The scenario in Figure 6.2-16 introduces *client1* trying to source a skill set V_7 from *vendor1.* During that process *client1*'s skill set C_4 also has to be replaced by *vendor1*'s skill set V_4. Consequently, *client1*

obtains skill set V_4, V_7 and an link v_{47}[88]. From the beginning of the contract C_4 is stored in the passive part of the knowledge cosmos with an agent specific retention time. In a similar manner the presented sourcing scenario can be extended to any chain of skill sets starting with V_7.

If a skill transfer has been applied successfully, both participating agents build an outsourcing relationship. Possible issues of dependency, resulting from a bilateral relationship between a client and a vendor, are dealt with in the next section.

6.2.3.4 *Dependency Issues*

Similar to the TCT Model described in the previous chapter, EBO Model addresses some issues of dependency between agents. An asymmetrical dependency entails a social dilemma. However, unlike TCT Model, where dependency is imposed by underlying theory, dependency relationships of EBO Model can be viewed as an artefact of agents' actions. In order to present the gist of the argument, one has to delve into the problem of the knowledge drain while undergoing an outsourcing project. The issue of knowledge loss during outsourcing has been studied in a variety of outsourcing settings (Nonaka *et al*., 1995; Sabherwal *et al*., 2005; Santoro *et al*., 2004; Schultze *et al*., 2002) and always entails a dependency issue. In order to impose dependency issues indirectly, an approach of "fading memory" was taken. That means that there is no explicit extraction of knowledge spots from FSU_{client} but an implication of a non-persistent memory. According to corresponding literature and interview responses, every outsourcing project encompasses a problem of knowledge loss and a deterioration rate in most cases strongly depends on the way the project is managed.

The issue of different paces in deterioration rates posed some technical intricacies for the modeller to implement these in the EBO Model (cf. section 6.2.3.3). To avoid the issue a single deterioration rate was chosen. After consulting practitioners it became evident that the probability of losing outsourced skills from a company's knowledge portfolio increases dramatically if the same skills are sourced repeatedly several times in a row. Despite, each company having its own distinctive deterioration rate a representative industry standard can be assumed. A human resources officer from CLIENT1 sums up: "*After the vendor is on board the staff deterioration has two waves. First, a young part of*

[88] In the presented scenario it is assumed that path v_{47} is cheaper than v_{57} which is the reason why the *V4* and not *V5* is sourced.

the affected staff is dissolving. The employees with greater seniority are still lurking to take their chances in case the vendor fails. However, after some initial ramp-up time or contract prolongation one gets short of these employees too."

6.2.3.5 *Economies of Scale & Experience*

According to BCG an absence of the experience curve effects is considered as a sign of possible mismanagement (Stern and Deimler, 2006: p. 12-24). In that context a reference to Henderson's experience curve was set. The experience curve has been applied in 1966 to overall cost behaviour by the Boston Consulting Group and holds over a wide range of industries. The phenomenon expresses the relationship between experience and efficiency. The name was selected to juxtapose the observed phenomenon from the well-established learning curve (ibid: p. 12).

To understand the functionality of economies implemented, one has to recall a skills representation in the model. Each of the nodes in FSU_{agent} holds agglomerated skills or tasks to a particular knowledge unit. Thus, if a vendor is leasing a particular skill set from his FSU_{vendor} to several clients, he can experience economies of scale. Furthermore, if the same vendor has already leased the same skill set several times in the past, he can also experience economies of experience.

In order to incorporate issues of innovation and technological progress, a probability was introduced from which a random node in FSU_{agent} can obtain reduced weightings on the links. The probability is arbitrary and is different for each agent. In accordance with fieldwork data, the probability is higher for vendor-agents, since vendors innovate with higher intensity than clients. A vendor management officer from CLINET5 explains: "*Innovation for our suppliers and us has different tenor. If we innovate, we create a new product, if they* (providers) *innovate, they discover a new way of optimizing existing services and deliver these to reduced conditions."* On the contrary, if a number of leasing partners for a particular skill set diminishes, the price for that skill set goes up.

The same applies if a vendor-agent stops leasing a particular skill set for a long time, having experienced economies of experience for that skill set in the past, the price would go up again. A product manager from CLIENT2 states: "*I stopped trying to remember names bellow our vendor's middle management because it did not make sense anymore. Each time I was there* (at provider's site) *I encountered completely new faces. The competition is rough and vendors do not try to retain people sitting on these services.*

Once the demand for the services appears again the corresponding staff is hired afresh." However, despite the aforementioned economies or diseconomies, respectively, the price will never fall below a minimal price per skill set (initialised at simulation beginning for each agent and skill set separately) and will not go higher than the initial price either. It is assumed that there is a zero margin price. Though, there are frequent cases of vendors offering services bellow the base price (cf. section 4.5.9). For the EBO Model, however, the base price is assumed to be the lowest price possible. A statement of sales manager from VENDOR3 supports this choice: "*We frequently offer our services below breakeven levels in cases of market penetration or during a ramp-up period* (period shortly after setting up a new contract). *But however low it* (price) *is, it still does not hit the rock bottom*".

6.2.3.6 *Evaluation*

Performance measurement is an inherently chronic problem of businesses, according to Malchione (Stern and Deimler, 2006: p. 237). Thus, a major challenge for clients is to determine whether participants are complying with applicable rules and policies agreed while establishing a contract. There is clearly a need for verifying compliance, for example, to ensure correct behaviour: *"Trust is laudable, but we cannot tell our clients to forgo controlling their partners*", said a senior analyst from CONSULTANT2. Hence, trust does not replace compliance verification. Therefore, methods were needed to specify how agents can evaluate their ongoing and past relationships. According to stakeholders' feedback, information on whether a partner complied with his commitments in the past, became a litmus test for estimating his trustworthiness. Also, constant re-evaluation of an ongoing relationship keeps the vendor constantly under pressure to perform. A statement of a senior consultant responsible for vendor relations at CONSULTANT4 underlines that state of affairs as follows: *"*(...) *what gets measured gets done – for better or worse."* Recent market developments have focused renewed attention on performance measures. There exists a wide range of metrics that calibrate agents' responsiveness and operational effectiveness in various ways but there is no consensus in the field on the superiority of any particular method in use.

Moving on the terrain of multisourcing, that is, leaving the realms of singe unit outsourcing, brings several difficulties (cf. section 4.5.7). Indeed, it doesn't bring new problems as such, but exaggerates the existing ones. Performance measurement is a

science of its own and expanding degree of relationships adds to the complexity of the process. Recent advancements in the computer industry led to the companies' IT being increasingly viewed as commodities. Consequently, CEOs treat IT as profit centres. A product manager from CLIENT5 states: "*These company walls do not protect us or make us immune in any sense. We stay in a direct competition with the outside market. This thinking goes even further as we stay in a direct competitions with our internal departments.*" Profit centres seem to be easy manageable from the managerial point of view as they can be measured on results. Thus, one can discover malfunctioning or underperforming units upfront. Projecting this thinking on the concept of EBO Model leads to the natural assumption to concentrate the attention on skill sets in FSU_{agent}. Depending on the granularity of the observer's lens one can think of organisational IT as a monolith block or, alternatively, as a collection of knowledge and skills.

The aforementioned view is captured by means of the FSU_{agent} concept. This means that, any contract of the client-agent is not measured on the overall performance of that agent but only on the performance of services mentioned in that particular contract instead. Recalling the implementation of the FSU_{agent} (cf. section 6.2.2), helps to understand the concept of evaluation in place. In the case of the scenario exhibited in Figure 6.2-13, an evaluation of a relationship between *vendor1* and *client1* will be done not upon the overall performance of *client1* but upon the performance of the *client1*'s skill sets V_4 and V_7. Drawing parallels with the real world, it would mean that *client1* will evaluate a success of his bond with a supplier *vendor1* upon the performance of two profit centres V_4 and V_7 that have been sourced from that vendor. A vendor management officer from CLIENT1 provides an example for the aforesaid: "*As a general rule we conduct a satisfaction survey on a yearly basis where we try to evaluate how satisfied our employees are with provider's service delivery. Our service dependency diagrams provide a good starting point to pin down the affected units. Since we have so many external supplies we try to narrow our evaluation on the directly affected units.*"

As shown in 4.4.1, 4.4.3 and 4.4.4, the most crucial elements for the evaluation of the contract are service quality (service levels agreed and delivered) and cost dynamics. While it is self-evident that any interruption of (out)sourced service or noncompliance to the SLAs originally agreed will result in a negative evaluation of the provider, the role of the financial factor is less clear. The evidence presented in the field work section entices the

reader to come to the following assumptions – firstly, it is important for clients to have reliable long-range financial planning. Thus, any unpredictable cost development will be reflected in a negative relationship evaluation. Secondly, some clients expect cost reduction during a lifetime of a contract. Affected by the overall gradual decline in information technology costs, providers are still able to realize a profit margin while delivering decreasing costs for services, even with the pricing strategies described in chapter 4.5.9.

Agents use endorsements to categorize and assess their acquaintances. The applications of endorsements as presented in 5.2.6 did not adequately represent the dynamic character of cognitive processes. A missing temporal dimension in the assessment of clients' satisfaction with vendors' performance over the transaction cycle led to several problems[89]. The discrete assessment of the endorsee's endorsements results to a binary perception of the environment by agents and is contradictory to the field data. A vendor management officers from CLIENT2 points out: "*It is not that we are only able to distinguish between black or white. It can happen that a provider who has been reliable for years has a rough patch. It would be foolish to write him off because of a single failure. Therefore, it is crucial to have a track record of all incidents, be it good or bad, in order to make a profound verdict about vendor's reliability.*" In EBO Model an improved endorsement procedure that allows for a continuous formalization has been used (cf. section 3.2.5).

The dyad of exchanging partners endorses each other constantly during the whole period of a transaction. In the case of a client, this models the constant monitoring of the vendor's performance and compliance to clients' requests, and in the case of a vendor it models the monitoring of the payment duties. An associate from a CONSULTANT3 remarks: "*We noticed an interesting behaviour pattern of providers contracted by several of our clients. If one would plot the level of service delivery over time one would usually see a dip in the middle of the contract. Thus providers offer outstanding service delivery at the beginning and close to the end of the contract, since they know that this period is relevant for the evaluation process. Therefore we urge our clients for permanent tracking of service delivery and proper definition of key performance indicators together with*

[89] The research on an improvement of the endorsement concept as presented in 5.2.6 is part of an ongoing work at Centre For Policy Modelling. For further reading on the topic refer to Geller *et al*. (2007, 2010) and Alam *et al*. (2009, 2010).

service level agreements." The temporal evolution of each endorsement label (here only dynamic labels from Table 6.2-1 are considered) is tracked by accumulating individual values over time. The continuous evaluation process applies a time window and thus relies on experience. A time window[90] models an agent's memory that allows it to collect endorsement data over time as if it would gain knowledge and experience.

6.2.3.7 *Opportunism and Repercussion*

One could not circumvent a presence of opportunistic element in a dyad of contractual parties. As stated by a sales manager from VENDOR2 "*It* (opportunistic behaviour) *is always present in any kind of deal, since one party wants to obtain something for as cheap as peanuts and the other party, aims at selling that something for the most expensive price possible.*" Therefore, the fact that a provider is not offering his best price belongs to the realm of truism and one has to concentrate on the monetary pain barrier of the corresponding client. In contrast, the following statement of the same sales manager form VENDOR2 brings in a different aspect of opportunism into play: "*The time where our clients could scare us with horrendous penalties is over. The vast majority of our clients does not come up to even one tenth of our NET revenue. It is not a secret that sometimes it is cheaper to get a parking ticket once instead of constantly paying a parking fee. Same analogy applies to our business – sometimes I am better off paying the penalty fee instead of investing in new hardware or additional personnel. It is not a swindle, it is a risk based calculation.*"

In agreement with stakeholders, penalties resulting from not fulfilling the contractual agreements were not included in the EBO Model. According to fieldwork research, contracts are no longer regulated by punitive damages. A public relations officer from CLIENT4 complains: "*Our legal and regulatory environment became complex but, sadly, didn't mitigate the risks as these have got more substantial. Due to vendors becoming more powerful* (size and market position) *the risk of litigation is regarded by them* (providers) *as marginal. This development causes the extent of opportunistic actions in a sourcing relationship to increase.*" Most clients safeguard themselves with renegotiation clauses in the contracts. This option leaves them a possibility to remediate any relationships that got off the track or rescind contracts that become a burden.

[90] The size and decay factor are chosen randomly from a numerical range in order to allow for agent heterogeneity. The time window is sampled from a lognormal distribution with the expected value of 6 months and therefore varies in the population.

In order to provide a modelling equivalent for the aforementioned state of affairs, a series of behavioural assumptions for an agent had to be made. As discussed in the section 6.2.3.5, vendors experience economies of scale/experience which leads to dynamic pricing. In case a price for a particular service drops while this service is being sourced by a client, it is up to a vendor whether to inform a client about price reduction or not (the same applies for the price surge). There is no way client-agents can discover this reduction in the vendor's production cost. Clients can only compare the price, they are paying for the (out)sourced service, with statistical information available from the market (cf. section 6.2.4 for more information on market implementation). If the discrepancy between the offered price and the average market price becomes too big the client reserves the right to renegotiate a price or, in worst case, opt out of a relationship prematurely. The client is at liberty to decide how to deal with the insight gained by the aforementioned comparison. Here the memory window and the track record of endorsements described in section 6.2.3.6 comes into play.

It is, however, not only vendor's initiatives that cause prices go over the market average. An issue of inappropriate service delivery specification can also influence the final price for the service to a great extent. Next section examines, how this behaviour was mapped into EBO Model.

6.2.3.8 *(Over)Specification*

Over-specifying or giving loose definitions for service delivery specification is another disputed topic amongst practitioners. Not providing enough specifications means exposing oneself to the arbitrariness of a vendor and giving too few means suffocating the vendor's proactive behaviour and initiative respectively. In most cases there is a strong linkage between this decision and a state of the partnership a client and a vendor have with each other. In the case of a more "personal" relationship, clients tend to give vendors more leeway rather than in hard-negotiated contracts where a vendor is seen as a foe. Also, it should not be concealed that a track record of positive experiences does contribute a great deal to the decision making process of the issue above.

For the purpose of investigation of the over specification issue, agents were endowed with different patterns of behaviour. Thus, there are process oriented client-agents, who tend to submit meticulous specifications of how an outsourced service has to be delivered and there are goal oriented clients who just want to obtain a needed service

disregarding the way in which it is delivered. That is, a process oriented agent forces with his over specification a vendor to follow the exact path in the FSU, whereas a goal oriented agent allows a vendor to draw benefits from the branching of the FSU by giving vendor absolute freedom with regard to the choice of the path. At the end of the simulation run performances of both client-agent types can be juxtaposed and compared against each other.

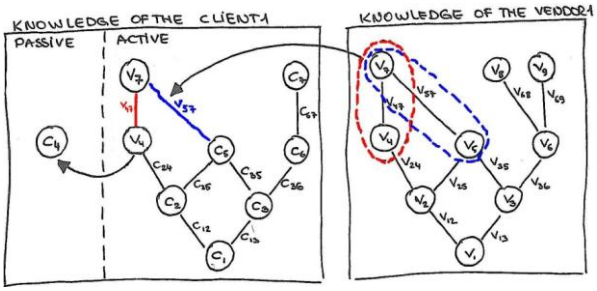


Figure 6.2-17: Implications of the over specification issue.

The following example symbolizes the aforementioned concept on the conceptual level. Recalling the sourcing example from chapter 6.2.3.3, where *client1* aims at sourcing a skill set V_7 from *vendor1* (Figure 6.2-16), it becomes evident that the desired skill set V_7 can be delivered on multiple ways. Since *client1* has both required antecedents – C_4 and C_5 – *vendor1* can deliver the skill set V_7 via the link v_{47} or v_{57}. Clients do not have any knowledge about FSU_{vendor} but possesses only information on whether a particular vendor is below or above average vendor size and whether that vendor would possess any additional skill sets to those of the client (in other words, whether a collaboration with a given vendor will enrich FSU_{client}). Thus, if *client1* does not over specify the delivery of a service, *client1*'s RfP/RfI would consist of identification for a needed skill set and a list of all available skill sets in the $FSU_{client1}$. This information will give *vendor1* enough leeway to select an appropriate path. Naturally, it could be argued that this information can be misapplied by *vendor1* to choose, not necessarily, the cheapest path. It is true, but in a way it is compensated by competing for the contract with other vendors. Alternatively, if *client1* would over specify the delivery, *client1*'s RfP/RfI would consist of identification for a needed skill set and a list of skill sets that *client1* would like to see as possible antecedents of V_7. Projecting it onto the example in Figure 6.2-17, means that *client1* might see C_4 as the only possible antecedent of V_7, thus defining the transition v_{47} as the only possibility for *vendor1*. In reality, however, transition v_{57} might be a cheaper solution but is *a priory* excluded due to the over specification of the service delivery.

6.2.4 Market

Economics has been less concerned with individual consumers or business firms than with larger artificial systems – the *economy* and its major components, *markets* (Simon, 1998: p. 30). The current section deals with the latter and its implementation for the EBO Model. According to Williamson (1975, 1985, 1996) markets poses a good governance structure to coordinate decisions and behaviour of multitudes of economic actors. However, the implementation of a market in EBO Model is not entirely in line with literature and prohibits a market to take a governing role in the decision making of actors. The market is used more as a medium for retrieval and transfer of information, such as non-personalized information with respect to market players, aggregated statistics, geopolitical events[91] and natural catastrophes. Agents can query the market (passive environment) to obtain statistics or they can be informed (active environment, which is rather not typical for blackboard systems) about events that took place (see Figure 6.2-4).

Market information	Processes
Relative size of a vendor*	Estimation of trustworthiness and reliability of a vendor
Number of clients and vendors on the market	Statistical information for various calculations of average values
Average price per skill set	Evaluation of offers and relationships
Geopolitical status of a country	Evaluation of offers, relationships and intentions to offshore
Natural catastrophes	Evaluation of offers, relationships and intentions to offshore
Ethnicities of agents	
Array of international operations of an agent	

* Size calculated in relation to other vendors on the market.

Table 6.2-2: Information available from the market and corresponding processes it is used for.

Information regarding geopolitical stability of a particular country may be a missing piece of the (non-domestic) vendor evaluation puzzle. Repeatedly, stakeholders pointed out that they are cautious to enter relationships with vendors from politically unstable countries, even if a vendor on its own does not have a negative track record. In the case of a geopolitical event or a natural disaster, all agents having operations in a country with an occurrence of such events are informed instantaneously about the incident via means

[91] A definition of the term *geopolitical event* has to be understood as any event with reference to spatial politics (putsch, insurrection and likewise). See section 6.2.4.1 for more information on geopolitical factors.

of market communications[92]. Besides specific geographic data, agents can elicit general statistical data, such as average market prices for particular services and average size of companies. Market provides an indirect price discovery function – clients and vendors respectively use an average value from the market as a benchmark. Table 6.2-2 below juxtaposes the retrievable data from the market with corresponding processes that make use of this data.

For a thorough procurement process any business that considers offshoring should conduct extensive political and geographic analysis of potential locations. A risk assessment of political stability and natural disasters is a vital aspect of any procurement phase. One needs to assess the preparedness of a supplier to cope with these events. When considering potential suppliers it is imperative that a vendor's disaster recovery process is thoroughly examined. Next section deals with the process of agents dealing with geopolitical information.

6.2.4.1 *Geopolitical factors & Natural Disasters*

The concept of geopolitical experience and natural disasters was incorporated into EBO Model after dealing with stakeholders involved in multinational projects. Going offshore entails taking on new risks that can be disregarded by a domestic supplier. Advances in telecommunication created an "always on, always available" level of expectation that needs to be maintained by domestic and non-domestic partners likewise. In order to prevent business degradation, vendors need to possess a defined strategy to prevent interruptions of any kind to their daily work. In today's competitive workplace, adequate disaster recovery plans in the wake of events such as hurricane Katrina (BBC, 2005) or recent strikes in India (BBC, 2007), which impacted countless businesses over an entire geographical region, are imperative for businesses to be prepared against every possible form of disruption that could potentially impede service delivery. Thus, supplier's disaster recovery serves as a reliable indicator for the estimation of the maturity of business.

Geopolitical factors[93] play an important role in the success or failure of a relationship between agents. In this context, it is commonplace to regard political stability and legal

[92] Here market communications stays for companies like Bloomberg, Reuters and alike. These companies are specialized at providing financial news and data services and are mapped into EBO Model via push routines of the market (see Figure 6.2-4).

[93] In the following, the term geopolitical event is referred with respect to a host country.

environment as influential factors. Figure 6.2-18 shows a breakdown of geopolitical factors into geopolitical events and experience with examples for each category.

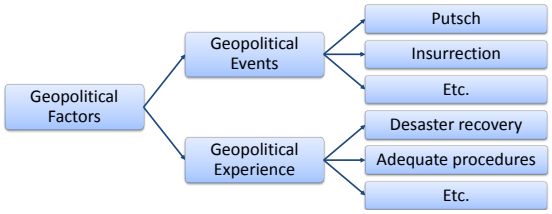


Figure 6.2-18: Fragmentation of geopolitical factors in constituents.

While geopolitical events – such as level of political stability, legal constraints and governmental regulations – are always attributed to a host country (providers), geopolitical experience is attributed to the receiving part (clients). From the conceptual point of view, geopolitical experience is represented as a probability of an outsourcing relationship to terminate. A termination of a relationship due to a geopolitical event entails a negative track record for both parties involved. The probability abates reciprocally proportional to the number of international relationships entered by both parties in the past. This means that if a client had or currently has some relationships with vendors in target geographies, the complexity of shifting other services to this destination decreases (reflecting in a lower probability for a breach of the contract).

However, as was mentioned in the fieldwork chapter, one shouldn't juxtapose the number of past deals with outsourcing competency since no deal should be considered a standard one (Cohen, 2005: p. 12). Consequently, in order to reflect this circumstance – that a relationship can have a negative outcome even with geopolitically experienced parties – the probability can get smaller but will never diminish completely. The same treatment, as was applied before to geopolitical events, can now be used for natural disasters – earthquakes, hurricanes, thunderstorms, etc. These events are triggered by a random number generator and clients with activities in affected regions are informed about the occurrence. In the case of an event of any nature mentioned above, the market[94] takes over a proactive role and broadcasts information to all market players active in affected localities.

Vendors' susceptibility to unforeseen events allied with an aftermath of any aforementioned disasters will cause interruptions of service delivery. Depending on the

[94] Global news agencies like Reuters and UPI are specialized at providing news and data services. Services of these companies are used by businesses for analysis and enquiries on various geopolitical events.

durability of disruptions, some clients may opt out of the relationship prematurely. Enterprises without adequate disaster recovery processes in place are particularly vulnerable to such situations. Thus, a contract breach as a result of natural disaster or geopolitical event is seen as an indicator of missing disaster recovery ability on the side of a client and obviously leads to a negative evaluation of a vendor. Besides the evaluation of a vendor, it will result in the country being left with a negative track record.

6.2.4.2 *Merger*

Incredibly challenging economic times and the collapse of various stock markets have placed huge pressure on outsourcing providers (Bahree, 2009) and many have been forced to reposition themselves. Merger leaps to the fore as a possible solution and enjoys high topicality in the corresponding literature (Alsbridge, 2006; Goasduff, 2006). The issue of merger, in particular that of vendor consolidation, has many sides and is politically charged. In some respects, the consolidation of service providers will bring some clarity for buyers in terms of fewer credible market participants with acceptable risk profiles. Consequently a reduction of the completion volume will harden the negotiation process as buyers will lose their superior position at the negotiation table. So far, experts' common sense was to advise outsourcing providers to only acquire companies that can enhance the existing services portfolio. Lately, however, these voices call for an appeal to scale up. The appeal seems to work if one considers the late takeovers of EDS by HP (Ogg, 2008). In the everlasting quest for cheaper labour providers peered into further regions of the world. This trend is also partly fuelled by the fact that it becomes harder for non-globally active providers to acquire new contracts. It is hoped to provide sustainable cost reduction through cheap labour and management that is located on a global scale. All these seemingly independent strategies have a common effect on the global outsourcing market, namely vendor consolidation[95].

EBO Model should contribute to the understanding of the hidden mechanisms that govern the consolidation process and show where this tendency might lead the market to. A merger can be a result of mutual agreement of the two companies, *A* and *B*, to collaborate. Respectively, company *A* may offer a takeover bid for another company *B*. It has to be clarified, that in the following the term merger is going to be used including both mutual agreement and acquisitions or hostile takeovers. Furthermore, according to

[95] More background information on the process of vendor consolidation can be found in the field work chapter section 4.5.4.

Sloman and Sutcliffe (2003: p. 203) there are three types of merger – conglomerate, horizontal[96] and vertical[97] merger. The EBO Model, however, considers only the latter two since EBO Model is situated in a single industry.

A concept of merger can be thought of as a replacement for a concept of vendors going bankrupt and vanishing due to various economic and political reasons. It was discovered during the field work that vendors as such do not vanish from the market but are absorbed by a rival company. A product manager from the CLIENT1 comments: "*I've got external employers in my team that I know for years. In that time the logo on their business card has changed several times. Some colleagues even make fun of it and build strips of business cards of the same company.*" In the version of the model presented here, other scenarios, where a bank would absorb a struggling vendor or multiple banks would move to the shared service portfolio to consolidate banks' internal IT operations, are not allowed for. Thus, the concept of merger is only applicable for vendor-agents.

Technically, merger is comparable to the process of skill set transfer, described earlier in section 6.2.3.3. Suppose *vendor1* is getting taken over by *vendor2*. Then, similar to the process depicted in the Figure 6.2-13, all skill sets from $FSU_{vendor1}$ that are not included in $FSU_{vendor2}$ are copied over. In addition to copying skill sets all initial weightings on the links of both FSUs are compared to each other. In case the same transition is weighted less in $FSU_{vendor1}$, it is copied over to $FSU_{vendor2}$ (the original weightings for that transition in $FSU_{vendor2}$ are overwritten). In the final step $FSU_{vendor1}$ is replaced by the updated $FSU_{vendor2}$ and both client pools are joined. Hereafter, vendor1 and vendor2 can be regarded as a single entity, since they share the same FSU and same pool of clients. Merger is an irrevocable process – two vendor-agents that merged previously will be regarded as a single entity until the end of the simulation run.

Threats regarding client's dependence on the vendor become evident considering a situation of the insolvency for a subcontracted provider. While a vendor merger under normal circumstances entails a host vendor perpetuating current contracts, in a hostile takeover a host vendor is not obliged to perpetuate acquired vendor's contracts. Thus, affected clients have either to enter into the renegotiation of former contracts, where threat of opportunistic behaviour on the part of the vendor is high, or look out for a new

[96] Merging of two companies in the same industry at the same stage in the production process.
[97] Merging of two companies in the same industry but on the different stages in the production process.

provider. In either case one has to anticipate business disruptions which are damaging for clients' businesses.

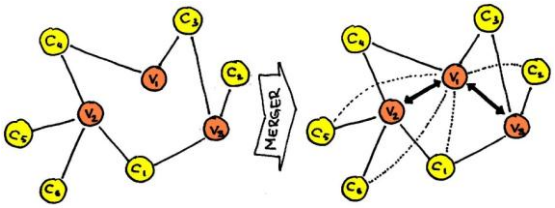


Figure 6.2-19: Schematic representation of the merger concept.

Figure 6.2-19 showcases a scenario where *vendor1* acquires *vendor 2* and *vendor3*. Before the acquisition each of the vendors has his own (not necessarily disjunctive) set of clients: *vendor1*={*client4*, *client 3*}, vendor2={*client1*, *client4*, *client5*, *client6*} and *vendor3*={*client2*, *client3*}. After the merger, physically, it is still the same network. However, if one considers the bold arrows, which stay for the organizational ties, than it becomes evident that all of the clients presented in the Figure 6.2-19 become dependent on the *vendor1*={*client1*, *client2*, *client3, client4*, *client5*, *client6*}.

6.3 Conclusion

This section is concerned with the design of the second model – EBO Model – developed in the course of the current research. The model is being developed under implications provided by the first model – TCT Model – and objectives described in chapter 1. Both models, being evidence based, differentiate from each other essentially. The TCT Model is built around a theory and matched to evidence in subsequent steps. Thus, the fundamental constructs are theoretically grounded and have been examined against available *a posteriory* evidence. In contrast, the EBO Model follows a different approach since it is built around evidence and is not burdened by theoretic constrains *a priori*. The model has been developed to reproduce to some extent the phenomena found in an outsourcing market. The model seeks to capture some key aspects of the reasoning and interactions of actors involved in an outsourcing process. The modelling and the field work were carried out by the researcher with data engineering involving stakeholder interactions.

The EBO Model represents an attempt to describe an outsourcing process that is consistent with both the qualitative data provided by stakeholders and other domain experts and observed characteristics from desk research. As introduced in chapter 3 an iterative approach to model development was adopted. Each successive version of the

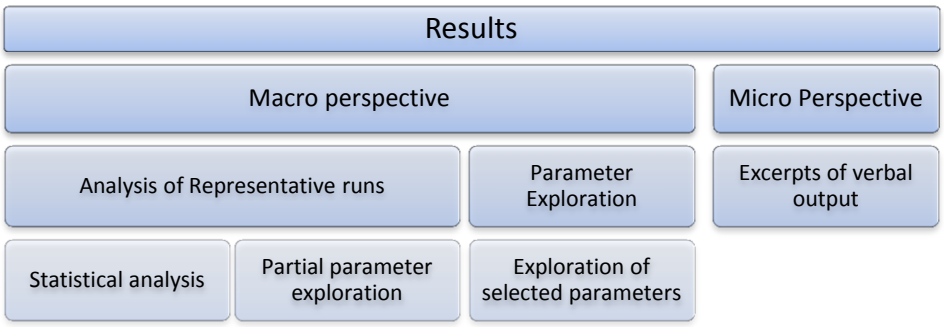
model has been subject to validation by domain experts. Figure 3.2-3 exemplifies how the TCT Model informed the development of the EBO Model. The validation of stakeholders in the 2nd interview round concerned the representation of agent behaviour and interaction. Whereas the 3rd interview round was mainly focused on characteristics of the aggregate time series output. The author argues to have extended the usual approaches to qualitative research. The model reported in this section has been developed through three consecutive development cycles (ref. Figure 3.2-3). First versions of EBO Model were constructed with little input of "fresh" domain expertise in order to capture the feedback of stakeholders given on the TCT Model. Consequently, the EBO Model was augmented with the stakeholders' feedback with qualitative insights gained through the constant feedback loop during the model development process, thus fostering a strong usage of anecdotal evidence.

The emergent themes from the fieldwork represented the focal interest of involved stakeholders and thus had to be further researched by means of simulation. In order to allow for investigation, the EBO Model ought to reflect these topics already in the model design accordingly. In order to model the issues raised by the fieldwork, core features of the field work are abstracted. In the work reported here, it has been a guiding assumption that it is fruitful to build models on a medium level of abstraction, i.e. to keep just between too much detail and too much abstraction (issues arising from this approach are discussed in the methodology chapter). Exploration and validation of the final models' results happened in a feedback-loop manner together with domain experts leading to changes, alterations and the addition of relevant organisational modules. As an outcome of this collaboration a model was generated that seeks to explain the pathway of decision making in financial organizations with respect to risk and, what is more important, to uncertainty arising as a result of social interactions. The EBO Model provides insights into managerial processes of decision-making under uncertainty situations in IT outsourcing projects. Based on the experience in the fieldwork interviews, the author strongly encourages a constant cross validation with stakeholders while conceptualizing the model.

7 EBO Model – Simulation Results

"Every true, eternal problem is an equally true, eternal fault; every answer an atonement, every realisation an improvement"
Otto Weininger
Austrian Philosopher (1880-1903)

This chapter provides an overview of the simulation results that were produced with the described model. The challenge of the section at hand was to find an appropriate structure for the representation of the model results. While some of the results were extracted conducting the simulation runs with a standard setup, others were discovered during the process of parameter exploration. Therefore a proper framework was needed to draw the borders between different result types. Similar to the analysis of the TCT Model the results are subdivided into parameter exploration, macro and micro perspectives. However, it was decided against a tripartite division of the section and, instead, to incorporate parameter exploration into the macro perspective chapter. The findings from parameter exploration that are relevant for policy makers are thematically coupled with these from the macro perspective. Below is the graphic illustration of the structure found in the current section.



The Structure of the results' section is divided into macro and micro views on the EBO Model. Macro view subdivides into further two parts – consideration of the model behaviour upon the representative runs and a series of parameter explorations. Micro view provides insights into an agent's life by means of monographic excerpt analysis. The remainder of this chapter is organized as follows. In the next section 7.1.1, a set of varying but representative EBO Model runs is reviewed. This is followed by presentation of various findings arising from parameter exploration phase in section 7.1.2. Both parts constitute the macro perspective section 7.1. Consequently the micro perspective section

7.2 is introduced by the refined examination of selected excerpts with respect to some findings from the prior sections.

In the following, table below juxtaposes sections from the current chapter with these from the fieldwork chapter 4. Such a comparison demonstrates how EBO Model dealt with emergent topics that represented a focal interest of involved industry experts.

Emergent theme from field research	EBO Model's results
Dependencies	7.1.1.6.1
Standardisation	7.1.1.3, 7.1.1.5
Relationship management	7.1.1.6
Merger and Consolidation	7.1.1.4
International vs. Domestic	7.1.1.4
Overspecification	7.1.1.3
Paradoxes of Multisourcing	7.1.1.6
Knowledge loss	7.1.1.6.2
Misperception of moderate cost increase	7.1.1.2
Dynamics of Asset Specificity	7.1.1.5
Myth of Enemy	7.1.1.6, 7.1.1.7

Two distinct categories of results are presented – statistical analysis of 100 varying but representative simulation runs (macro perspective) and excerpts from a random agent's life (micro perspective). Furthermore, the macro perspective results incorporate a series of selected parameter explorations (e.g. multisourcing features, various market constellations and external influence factors were explored). For purposes of clarity the stakeholders' feedback from the cross validation is incorporated in and reported with model's results.

7.1 Macro Perspective

In the methodology chapter (cf. section 3.2.4) it was stated that the sequence of actions represents agent's behaviour, the totality of which represents the overall course of the simulation and thus stands for the model dynamics. Therefore, to observe a model from a bird's eye perspective it has to be abstracted from a single agent and concentrated on the aggregate behaviour. The present section observes cumulated behaviour by means of the statistical analysis of the rule activations and diverse outputs from 100 various but representative simulation runs.

For the statistical analysis discussion a set of representative simulation runs with standard parameter values was conducted. Table 7.1-1 contains the standard parameter values that were used for that purpose.

Rules	Number of activations
Number of clients	100
Number of vendors	100
Max. vendor capacity[98]	unlimited
Perturbation[99]	false
Ethnicities[100]	5
FSU_{system} parameter[101]	3
$FSU_{client/vendor}$ parameter[102]	0,7
Geopolitical exposure[103]	0,3
Client's max. number of contracts[104]	unlimited
FSU_{client} skill set retention time[105]	24

Table 7.1-1: Set of standard parameter values for conducted 100 representative runs.

Since the model incorporates probabilistic features in behavioural implementation, 100 simulation runs of the same model were conducted to minimise the influence of the random number generator. Subsequently the results have been averaged.

7.1.1 Statistical Analysis of EBO Model

In the earlier discussion of the TCT Model results in chapter 5 it was already mentioned that consideration of rule activation statistics provides a good *entrée* into the review of model dynamics. Thus the EBO Model analysis is introduced by the comparison of aggregated rule activations for both client types – agents and vendors.

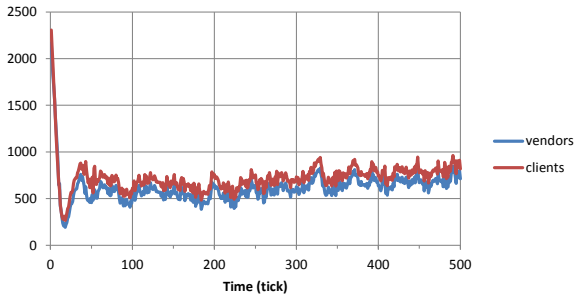


Figure 7.1-1: Number of rules that fired per tick for each type of agent.

Figure 7.1-1 represents the number of rules that fired per time step for each type of agent during the simulation run. In average 1100 rules fired per tick (1054 if one excludes the time steps 0 to 14) during these simulation runs (500 ticks, cf. Table 7.1-1**).** The graph

[98] Maximal number of clients a vendor can operate. Once the value is reached the corresponding vendor will not respond on outsourcing requests.
[99] Switch to turn on/off of a perturbation mode. In the perturbation modus at the predefined tick(s) a predefined set of clients and vendors is poured into the model. Perturbation modus is outlined in section 5.3.3.1 in detail.
[100] Number of different ethnicities that are assigned to agents (cf. section 6.2.1.1).
[101] See section 6.2.2.2 for more information on FSU_{system}.
[102] See section 6.2.2.3 for more information on sub-FSU_{system} and $FSU_{client/system}$ respectively.
[103] Probability for occurrence of a geopolitical incident in a non-domestic geography (cf. section 6.2.4.1).
[104] Maximum number of contracts a client can handle (cf. section 6.2.3).
[105] Client's retention time within a passive part of the FSU_{client} for a skill set (cf. section 6.2.3).

depicted in the Figure 7.1-1 is obtained via calculating the average from 100 representative runs for each single time step.

In general, Figure 7.1-1 indicates that agents, and thus the model, are in a constant state of activity. Between tick 0 and 14 a sharp decline in the number of rules that fired is recognizable. This is not only due to a high number of rules that fire during the model setup, like in the TCT Model (cf. section 5.3.2), but, in the case of EBO Model, it also mirrors an organizational process. Since both networks – *Vendor-to-Vendor* (henceforth V2V) and Client-to-Vendor (henceforth C2V) networks – are initialized as empty at the start of the simulation, agents intensively endorse each other and select with whom they want to interact in that initial organizational phase. Therefore, the explosion in the number of rules cannot be solely attributed to the artefact of the model.

After the decline comes to an end in tick 14, two interesting developments occur. On one hand, both agent types, vendors and clients, start getting very active from tick 15 to tick 48, on the other hand there is another raise of vendors' activity to observe from tick 51 to 78 while the rest of the agents remain in the constant state of action. The frequency of this constant activity is between 718 fired rules per tick for client and 614 fired rules per tick for vendor. Concerning the time shift of both effects one can conclude that there are two different processes at work.

Indeed, increasing activity among vendors and clients indicates, from an agency point of view, the establishment of a dense network among these two types of interacting agents and cooperation take-offs. This might be as well a consequence of the model's initialization as well as of the number of agents in the model. Naturally, the likelihood of mutual interactions increases with an increasing population density. The first take-off is attributed to the build-up of the C2V network. After the initial endorsement process in ticks 0 to 14 is over agents start to issues request for proposals, negotiate contracts and finally establish a relationship. Since both agent types are involved in the process, the activity increase is equally present in the clients' and vendors' curves. The frequency of this activity for vendor-agents is smaller than that of clients. The issue of the workload of outsourcing activities is outlined in chapter 7.1.1.6.4.

The second wave of activity between ticks 80 to 112 is affecting only vendor-agents. The underlying process here is the build-up of the V2V network. There are no pre-initialised

merger relationships in the model. Vendors cannot sustain in the market for a long time without contractual relationships. These underperforming vendors are now trying to find an adequate merger partner. Thus the whole choreography of merger offers, requests and negotiations respectively is getting on momentum. This result appears to depend highly on the initial distribution of agents. The effects of both, model setup and population density on mutual cooperation and monopolisation issue is analysed in chapter 7.1.1.4.3 in detail.

7.1.1.1 *Endorsements and Relations*

"*Today, the era of cheapest offer wins is getting to an end. Many companies consider not simply price but also reliability and quality of services to be sourced,*" so a senior technology architect from CONSULTANT5. Therefore, there is a preceding extensive process of partner evaluation in place before market participants can get to the negotiation table. Furthermore, this process is always at place if an agent is contemplating about undertaking any actions with respect to the future or ongoing partnership, be it a merger or an outsourcing relationship. Analysing endorsement behaviour of agents can, therefore, lead to better understanding of cognitive processes taking place in the model. The TCT provides researchers with a limited view on that process as it offers only a snapshot view (cf. section 5.3) of the cognitive basis and it is, therefore, necessary to observe endorsement process with respect to a temporal component. In the current section a statistical analysis of the endorsement process is provided, whereas section 7.2 provides an in-depth view on the process from a standpoint of a single agent.

Figure 7.1-2 illustrates the total number of endorsements made per tick over simulation period of 500 ticks in 100 varying but representative simulation runs. According to the figure, a distinctive feature of the endorsement process is its sharp decline in the initial phase of the model and then increasing intensity over time. 93 out of 100 conducted simulation runs ended up with a significantly higher endorsement frequency level than at the beginning. Remaining 7 out of 100 simulation runs exhibit approximately the same magnitude of endorsements per tick at the end as at the beginning of the simulation run. None of the runs showed a decreasing endorsement frequency. The reason for this is a gradual consolidation of contractual (C2V network) and merger (V2V network)

relationships and can be better understood if one juxtaposes Figure 7.1-2 and Figure 7.1-3.

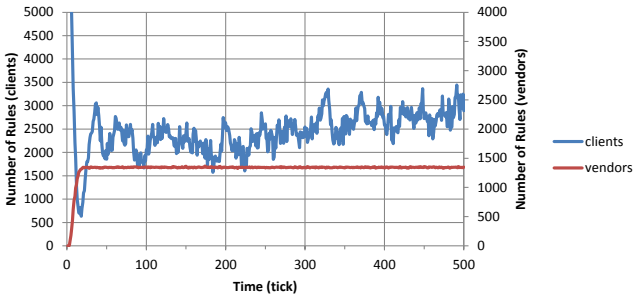


Figure 7.1-2: Total number of endorsements made by agents.

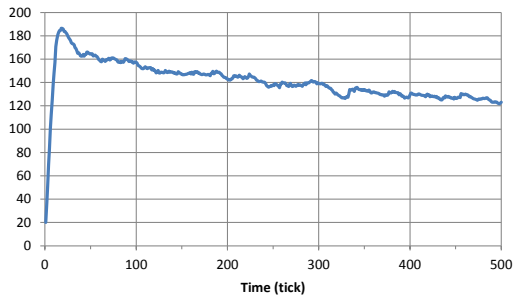


Figure 7.1-3: Total number of contracts.

The sharp decrease of endorsements at the beginning of the simulation was already explained in the previous section 7.1.1 as initialisation of both networks. The observation of endorsements made by vendors and clients separately provides clarity about the workload of the initialisation process. While the pattern with the dramatic decrease is typical for clients only, vendors, on the contrary, are picking up on the endorsement frequency gradually up to a certain level and remain semi constant after reaching it. Analysis of the models verbal output reveals the fact that before clients issue their requests for proposals they have an extensive process of self-evaluation as to which strategy to pursue and which services to source. After this process is finalized a phase of market discovery follows. Thus, clients are endorsing vendors on the market according to the features relevant for them – domestic, internationally active, scale, just to mention a few (cf. Table 6.2-1). In the meanwhile, vendors react passive in that phase. Thus, they do not approach clients proactively but are listening to the market and reply on issued requests for proposals. This process, however, does not involve endorsements. Endorsements come into play only after a vendor enters into a negotiation with a client. Figure 7.1-3 depicts the number of contracts established at each time step and exhibits a dramatic increase at the beginning of the simulation. As long as it is possible to establish new relationships the endorsement frequency increases. The closer the artificial society comes to materializing all possible relationships within a particular parameter setting, the endorsement frequency curve starts exhibiting a decreasing and finally nearly horizontal gradient for clients. At this moment in time contractual relationships are still being subsisted, but new ones are created with a lesser frequency and in most cases as a substitutes for either broken or matured relationships. It is therefore not surprising to

discover in Figure 7.1-2 and Figure 7.1-3 that while endorsement frequencies increase, the number of network links created per tick between agents decreases over time[106].

Again, the 100 differing but representative runs exhibit a volatile phase at the beginning, with the contracts curve showing a distinct negative gradient (cf. Figure 7.1-3). After about 350 ticks the system converges toward a situation in which the amount of relationships reaches a dynamic equilibrium state. Thus, mature or premature contracts are coming to an end but at the same time an equal number of contract that finished are reinstated. Indeed, the C2V network is in a constant flux. The contract creation reaches the inflexion point between ticks 25 to 32 and shows a slow but distinct negative gradient with a couple of local maxima thereafter.

Per contra, V2V network exhibits a static behaviour. If one consults Figure 7.1-9, representing a merger network, there is not much dynamics to observe after the first 30 ticks. The curve starts flat followed by the sharp increase of mergers and gradually exhibits a decreasing gradient until the vendor cosmos materialises all possible merger opportunities. Therefore, the most merger relationships and, consequently, the monopolistic structure of the market, are manifested at the beginning of the simulation. Subsequently some occasional mergers take place but in general a V2V network layer can be considered as semi-static.

Another aggregated dimension that can be used as a proxy for the dynamics within an established contract is the price development. Juxtaposing the individual and aggregated (market average) price development may shed light on potential interactions between the market and individuals acting in it. The following section covers the topic of pricing behaviour within EBO Model.

7.1.1.2 *Pricing Behaviour*

The EBO Model reproduced the exact pricing behaviour on the market as stated in the chapter 4.6.9. Providers frequently use the first-under- and then over-price strategy. From a client's perspective, that means that vendors are offering competitive pricing with prices sometimes under the current market average. This perception is however elusive and disadvantageous for clients as already stated in the fieldwork chapter and evident

[106] A link in a C2V or V2V network is created when a contractual or merger relationship has been established, and is retracted if the contract breaks up or is mature; in V2V network no links are retracted – once the link is established it remains permanent until the end of the simulation run.

from the model results in Figure 7.1-4. Δ_n expresses the perceived savings by the client-agent. During the term of the contract the value of Δ_n gradually decreases and becomes even negative soon after the contract has been established. The graph is obtained via the calculation of the average for each time step from all contracts that subsisted during 100 runs with identical parameter settings.

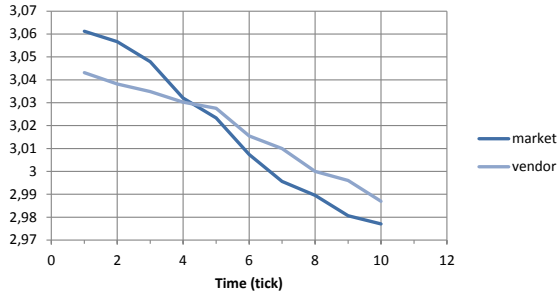


Figure 7.1-4: Development of the price per Skill Set ratio over the contract time span.

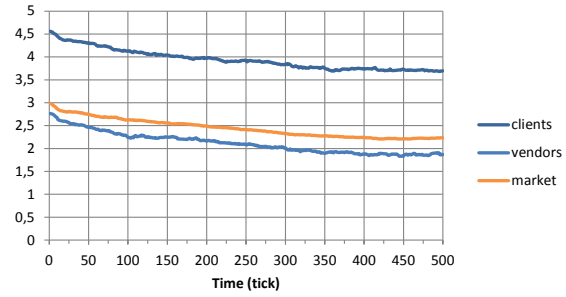


Figure 7.1-5: Development of the average production costs and market price per SS.

Figure 7.1-4 depicts the price per skill set development from a client's perception. It was surprising to discover that the aforementioned strategy of vendors evolves as a natural behaviour without being incorporated explicitly into the behaviour rules arsenal of vendor-agents *a priori*. Figure 7.1-4 is the exact representation of the issue that was reported repeatedly during the fieldwork workshops with stakeholders. An instrument that is frequently used by clients to annul the overpricing exposure is the reduction of the contract length. This way it is hoped to forestall the moment where both curves in Figure 7.1-4 intersect. Figure 7.1-5 depicts the development of production costs during the simulation run for client and vendor agents respectively. Additionally, an average price a skill set is traded for on the market is juxtaposed in Figure 7.1-5. The graph is obtained via the calculation of the average value for each Skill Set for all vendors and clients.

In Figure 7.1-5 the average market price lies well above the actual production costs of vendor-agents. This behaviour can be explained while considering the pattern in Figure 7.1-4. The analysis of contracts in the EBO Model showed that the intersection point lied in the 78% of cases in the first quarter of the contract period. Hence, clients pay inflated fees for acquired services from subcontracted providers for the most of the term of the contract.

The ulterior reason for the aforementioned state of affairs is the interplay between economies of scale and experience. Unless a vendor-agent reaches his lowest possible production price he is always able to deliver the same service at t_n cheaper than at t_{n-m}

with *m<n* (provided the vendor-agent possesses enough scale). Therefore all clients, who undergo a contractual relationship with any vendor that did not materialize his full capacity (economies of scale can be utilised) and is offering a service since recently (economies of experience exist), are in danger of being affected by the overpricing issue and end up paying the price well over the market average. In words of a senior consultant from CONSULTANT1: "(...) *Despite the new fashion of going for short contracts many of our clients still end up paying above market prices in contracts that looked rather lucrative at the moment of closing them* (contracts)."

The implications of the EBO Model result presented above for policy makers shall be seen as a caution not to rely too much on a single dimension of the issue, namely, the contract length. Contract length represents already a good proxy for vendors' price evaluation but is inevitably connected with an administrative overhead. A less costly solution might be the increase of the renegotiation checkpoints frequency. Incorporating the renegotiation options in an outsourcing contract will mitigate the exposure to the overpricing issue at later stages of the relationship.

These are not only vendors' actions that may lead to the disadvantages for clients. Sometimes customers' own actions may create aggravating circumstances for themselves. An issue of an over specification is such an example. Next section covers that topic.

7.1.1.3 *Over Specification Issue*

Over-specification is a chronicle issue for companies that are novice on the outsourcing arena and are attempting to get active on it. The first "fork in the road" that such an organization comes across is the decision whether they are intending to give a vendor some decision freedom in service delivery or employ a rather restrictive collaboration policy. Many deals are being left at that "fork" and companies are focused on rigorously controlling every move of the vendor be it sensible or not.

In order to investigate the issue with the help of EBO Model the clients population was exclusively subdivided into two types – outcome (*type I*) and process (*type II*) oriented clients. *Type I* clients are concerned only about the outcome of the contract, thus obtaining a service from the vendor for an acceptable price with acceptable service levels. *Per contra*, *type II* clients are process focused and require the vendor to deliver the service exactly the same way as it was delivered in FSU_{client}. Naturally, *type II* clients are

still interested in obtaining the service with acceptable service levels for the acceptable price. In the following some performance indicators for both client types are juxtaposed.

Multiple bar chart in Figure 7.1-6 represent the dispersion of the population for both client types – *type I* and *type II* clients – with respect to the FSU_{client} cost reduction. The number of clients for each type, grouped by cost reduction value (in %), is shown.

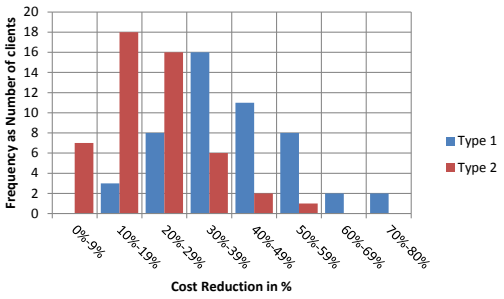


Figure 7.1-6: Dispersion of total cost reduction for two types of agents.

It is evident from the histogram that majority of *type I* client-agents achieves a higher cost reduction rather than *type II* client-agents, who restrain their contracted vendors in choosing the best path in their FSU_{vendor} graph.

The 30% reduction in "run the business" costs was frequently mentioned in the interviews as the magic threshold. Clients reaching that mark considered their outsourcing endeavours as successful. In the light of that fact it is worth looking at the success rate of the aforementioned client types. Figure 7.1-7 depicts the ogive from the histogram in Figure 7.1-6. The abscissa denotes the number of clients while the ordinate denotes the cumulative frequencies of FSU_{client} cost reductions relative to the total price of FSU_{client}. The horizontal line denotes the 30% frequency level, i.e. the level where the FSU_{client} could be reduced by 30%. That level could also be defined as the turning point of the outsourcing relationship. It becomes now clear that in the end less than 38 out of 100 clients of *type I* and nearly 89 out of 100 client of type *type II* fail to break the threshold of 30% cost reduction. The plot in Figure 7.1-7 indicates that it indeed makes a significant difference with respect to cost saving which strategy one adopts. The horizontal line indicates the 0.3 frequency level. The blue plot – *type I* clients – lie farther to the left than the red line – *type II* clients. This suggests that a greater population of *type I* clients is able to experience cost savings rather than this is the case for *type II* clients. Besides the *post factum* finding, that the over-specification strategy puts its advocates in disadvantage, one shall pay attention to the chronology of the events. Verbal output of the model

shows that *type I* clients not only experience greater cost savings but also reach these faster. The observation of both client types, who achieved the desired mark of 30%, points out that on average *type I* clients spend 37 ticks and *type II* clients spend 53 ticks to reach that state.

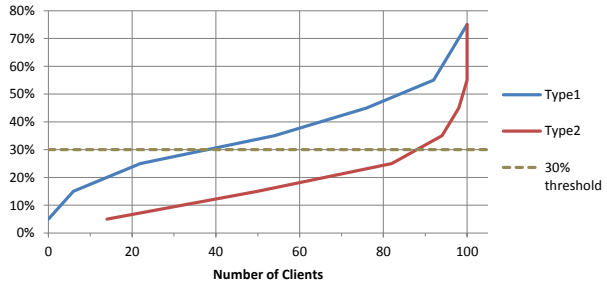


Figure 7.1-7: Cumulative frequencies for FSU_{client} total cost reduction.

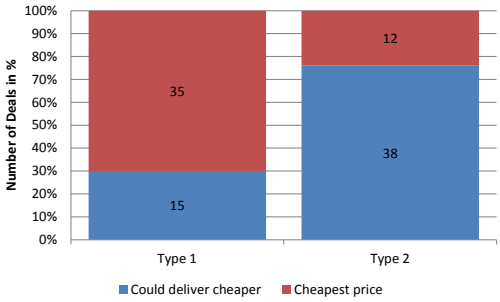


Figure 7.1-8: Evaluation of deals with respect to the price offered.

Superior efficiencies of scale and experience enable vendors to be more efficient in the delivery of a specific service rather than clients. This advantage is, however, erased when clients start to prescribe vendors to deliver the service in FSU_{vendor} the same way it was delivered in FSU_{client}. The offer may still be cheaper for a client rather than delivering the service in-house (in FSU_{client}) but it is definitely not the optimal price that could be achieved out of the contractual relationship. As evident from Figure 7.1-8 *type II* agents suppress an optimal choice of vendors' service delivery on average in 75% of relationships during a simulation run. After a deal between client and vendor was sealed, an offered price was examined on whether it was the optimal price a vendor could deliver. The values were obtained via calculating an average for 100 runs with identical parameter settings. It is not surprising to see that *type I* agents also have an issue of vendors offering not always the optimal price. This behaviour, however, results from vendors' opportunistic behaviour, trying to offer the service cheaper than the market average but still not as cheap as it could be delivered from FSU_{vendor}.

Despite the strident topicality of the over specification issue, the mistake is eminent. While this finding of the model was presented to a senior business adviser from CONSULTANT2, he put it that way: "*If you come to a Michelin-Star restaurant, you will not start explaining to the chief cook how to prepare your meal* (...) *a self-explanatory fact indeed but our clients still do it.*" While the customer's requirements will largely be captured in specifications and statements of work, a degree of flexibility is likely to be required to react to changes in circumstances and to deal with interdependencies between different services. The advice to clients to be more hands-off and be ready to

accept some degree of change within the vendor management policy is in line with the latest guidelines on vendor management from the Outsourcing Institute (Casale, 2009). Agents who over-specify the ways a service is delivered are hindering vendors to deliver the best value possible. Therefore it can be argued that if one over-specifies the requirements for the vendor service delivery, one will, in all likelihood, end up with cost savings far below the expectations.

The agents' interactions, described in preceding sections, influence the structure of both agent networks – the V2V and the V2C network (cf. section 6.2.1.3) – to various extents. Next section covers the dynamics and properties of both networks.

7.1.1.4 *Mergers and Acquisitions*

According to industry experts (cf. chapter 4.5.4) they are expecting more M&A activity in the IT suppler sector in the near future. In spite of these prognoses it is enlightening to investigate the merger behaviour of the EBO Model's artificial society under influence of different factors.

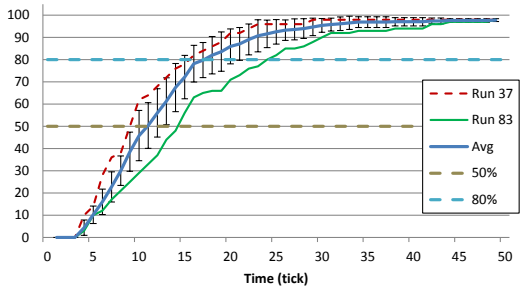


Figure 7.1-9: Average cumulative frequencies for vendor-agent mergers.

Figure 7.1-9 depicts the average cumulative frequencies for vendor-agent mergers for 100 representative simulation runs with identical parameter settings. Additionally, example runs 37 and 83 are plotted in the graph. The abscissa denotes the number of time steps while the ordinate denotes the cumulative frequencies of merged agents relative to the total number. The error bars denote the standard deviation ($\sigma = 1$). The horizontal dashed line denotes the 0,5 frequency level, i.e. the level where 50% of the vendor-agent population has entered merger relationships of various kinds. Average values are obtained by averaging over 100 simulation runs with identical parameter settings. Solid line denotes average frequencies in cases where a non-domestic vendor has a centroid position of the vendor merger network; dashed line denotes cases where a domestic vendor has a centroid position of the vendor merger network.

The 0,5 level can be used as a proxy for the pace of merger dynamics since the level separates the population in half. Although it appears that the first half of the vendor population is more quickly entering into merger relationships no obvious conclusion can be drawn from the simulation results with regard to the evolution of the critical condition. However, it becomes now clear that in the end nearly the whole vendor population has undergone mergers. This happens in a very short time, namely in the cases at hand within 41 to 49 ticks. The author is not aware of a case where at the end of the merger process more than maximum two or three hubs[107] existed – out of 100 conducted simulations in 92 runs a single hub, in 5 runs two hubs and in 3 runs three hubs persisted.

Another remarkable cumulative frequency level is 0,8 (80%). While consulting the Figure 7.1-9 it becomes evident that the pace of the merger dynamics in the artificial society stagnates dramatically after reaching 80% mark. Therefore it can be concluded that the majority of the V2V network, together with emergence of strong hubs in it, has been built before the cumulative frequency mark of 0,8. This statement is supported by the analysis of the error bars that suggest decreasing volatility hereafter.

Again, the error bars suggest a relatively low volatility in the system at the beginning and in particular at the end of merger activities on the market. It becomes evident that the first half of the vendor population is merged in less time than the second half. The first half of the population is incorporated in the V2V network between ticks 3 to 14 and it takes more than twice as long (from tick 14 to 49) for the second half of the population. The relatively stable cooling off phase together with the prolonged merger process can be explained through the emergence of strong hubs in the V2V network. Single vendors are vulnerable for mergers since they quickly can encounter in financial problems. Once a hub is built, the final decision to merge belongs the party, who occupies the centroid position in that network. Through the possibility of cumulative pooling of resources such hubs can sustain relatively prolonged drought periods of contracts. Hence, the more hubs are created in earlier stages of the merger process the longer it takes for the artificial society to converge to a final state. However, as mentioned earlier, majority of these hubs is created before reaching the cumulative frequency level of 80%.

[107] The term hub is used in the context of this thesis to represent the conglomeration of the agents. The hub is controlled by a central agent (centroid position) who is linked to each single agent in his hub. Hubs are characterised by cumulative pooling of resources.

Moreover, the simulation demonstrated that the state of low volatility is reached quicker if centres of the conglomerates are occupied by domestic vendors. More on the issue of domestic and non-domestic vendor favourisation can be found in section 7.1.1.4.2. Whereas it is not feasible to derive any unambiguous conclusions from the data with regard to the evolution of a critical condition, the plots in Figure 7.1-9 indicate that it indeed makes a difference who occupies a centroid position in the V2V network. The solid line (cases in which the centroid of the network was occupied by a non-domestic vendor) lie further to the right than the dashed line (cases where a domestic vendor occupies a centroid position). This suggests that if a domestic vendor occupies the centroid position in the V2V network, the merger dynamics have a higher intensity in the artificial population.

The verbal simulation output helps to understand the driving factors of the observed behaviour. Due to the issue of domestic vendor favouritism, domestic vendors quickly gain financial power (through an extensive clients network) and consequently acquire the weakened non-domestic competitors. Following subsections discuss factors like international activity (section 7.1.1.4.1), domestic over non-domestic favourisation (section 7.1.1.4.2), monopolisation issue (section 7.1.1.4.3) and finally vendors' size (section 7.1.1.4.4) that influence the merger behaviour of the investigated artificial society.

7.1.1.4.1 Internationally Active vs. Internationally Non-Active

The favouritism of internationally active providers by clients (cf. section 4.5.5) represents a real hurdle for vendors with operations only on the domestic market. This fact weakens the position of these vendors and makes them vulnerable to potential hostile takeovers. Indeed, as evident from the Figure 7.1-10 internationally non-active providers make out only a small proportion of the clients' vendor-portfolio in the EBO Model. The average value is calculated through building the average ratio for each single client over the simulation run and building an overall ratio for the whole model subsequently. This composition of the portfolio has some twofold reasons. On the one hand, clients are endowed with rules that favour internationally active vendors. On the other hand, vendors know this and, in their turn, try to acquire foreign rivals in order to compensate for own lack of international activities and, hence, to obtain international operations. This behaviour is typical for both vendor types, as well as domestic as non-domestic. In

majority of cases however non-domestic vendors are not getting their turn to acquire somebody since they are acquired by a domestic vendor *a priori*. Due to the issue of domestic favouritism, discussed in section 7.1.1.4.2, domestic vendors win on power earlier than non-domestic vendors and therefore possess automatically the first mover advantage with respect to mergers and acquisitions.

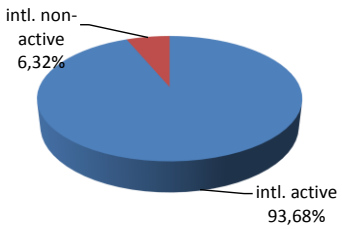


Figure 7.1-10: Constitution of clients' vendor-portfolio grouped by the vendors' regional operations.

Again, as mentioned above, acquisition of international subsidiaries represents a typical behaviour for all vendors, regardless of the geography. The issue of international aspiration influences the merger dynamics in EBO Model's artificial market in a great manner. Figure 7.1-11 depicts the average cumulative frequencies for vendor-agents' internationalisation of operations over time, recorded for 100 representative simulation runs with identical parameter settings. The abscissa denotes the number of time steps while the ordinate denotes the cumulative frequencies of agents gaining international operations relative to the total number of agent population. The error bars denote the standard deviation ($\sigma = 1$). The horizontal dashed line denotes the 0,5 frequency level, i.e. the level where 50% of the vendor-agent population has obtained operations in the foreign geography. A vendor-agent is regarded as possessing international operations when he either has acquired or was acquired by another foreign vendor (provided, the agent did not have foreign customers before entering the merger). Having clients from foreign geographies in vendors' client-pool qualifies as possessing international operation too.

Similar to Figure 7.1-9 the 0,5 level can be used as a proxy for the pace of merger dynamics. It appears that the second half of the vendor population is gaining on international activities more quickly than the first half. This is an indication for a snowball-like distribution of relationships. It becomes clear that in the end the whole vendor population has become internationally active. This happens in a very short time, namely in the cases at hand within 30 to 40 ticks. In the previous section it was mentioned that the V2V network converged in the majority of cases at hand to a single hub structure. It is

therefore not surprising to see the complete internationalisation of operations in the network (100% mark in the Figure 7.1-11). Another remarkable property of the system is that the complete internationalisation of the artificial society was reached in all 100 conducted simulation runs. There was no conducted simulation run where at the end of the merger process there have been vendors left without international operations. Also, the internationalisation is reached before the merger process in the system comes to an end – compare Figure 7.1-9 and Figure 7.1-11. The reason for this is twofold – as mentioned above, a vendor is regarded as internationally active if he either himself has clients of ethnicities different to his or entered an M&A relationship with another vendor who is internationally active. Therefore the process of internationalisation takes place on two levels. On the one level it depends on the pace of the M&A activities in the vendor arena (V2V network) and on the other level it also depends on the dynamics of the V2C network. Combination of processes on both levels effectuates an acceleration of international relationships in the system and therefore presupposes a faster termination rather than by M&A activities alone.

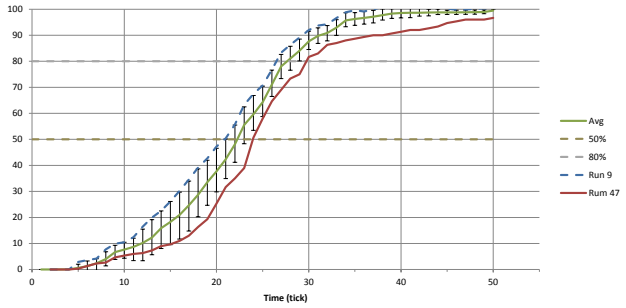


Figure 7.1-11: Average cumulative frequencies for internationalisation of vendors' operations.

On the contrary to the Figure 7.1-9 there is no prolonged cooling off phase in the internationalisation process. As a result of the snowball effect, the internationalisation pace increases constantly up to tick 32 and gains on momentum until full internationalisation is reached. Juxtaposing both cumulative frequencies from the Figure 7.1-9 and the Figure 7.1-11 it can be concluded that the stagnation of M&A activities in the V2V network is getting compensated by strong dynamics in the V2C network. Activities in both networks build a seamless symbiosis as indicated by the analysis of the error bars that suggest low volatility. Again, the error bars suggest a relatively low volatility in the system between ticks 0 and 11 that pretty much resembles the behaviour of M&A activities (cf. Figure 7.1-9). The process resembles a greater volatility from tick 12 to tick 28 and gains on stability again from the tick 28 onwards.

Similar to Figure 7.1-9 the state of low volatility is reached quicker in Figure 7.1-11 if centres of the hubs in the V2V network are occupied by domestic vendors. The dashed plot (cases in which the centroid of the network was occupied by a non-domestic vendor) lie further to the right than the solid line (cases in which the centroid of the network was occupied by a domestic vendor). As mentioned above the domestic vendor at the centroid position of the hub causes higher intensity of the M&A activities and consequently intensifies the internationalisation process too. More on the issue of domestic and non-domestic vendor favorisation can be found in section 7.1.1.4.2.

The aforementioned results of the model are supported by the field research. So far, the main IT outsourcing suppliers in China, India and other booming outsourcing locations are either large US-based suppliers such as Accenture, Cap Gemini, Dell, EDS, HP and IBM, or large Indian-based suppliers with subsidiaries in Europe and US such as TCS, Infosys and Genpact. International operations allow, besides increased governance efforts, for multiple benefits like better tapping into cheaper labour pools, penetration of foreign markets and seamless service delivery to clients based in several geographies to name a few. In 2005 a five-year contract started between India-based Tata Consulting Services and ABN Amro bank representing the new way of vendors going about the aforementioned market sentiment and the issue of domestic vendor favouritism. Through various acquisitions on the European market Tata Consulting Services is able to provide IT services to ABN Amro offshore in India and Sao Paulo, nearshore in Budapest and Luxemburg and onshore in Amsterdam. An increasing number of clients and suppliers are moving to such a delivery model for IT services (Willcocks *et al*., 2009). Based on model results it is legitimate to assume that in order to survive with the current market sentiment, vendors will have to put great efforts in internationalisation of their operations.

Besides the preferred requirement of customers for the vendor to be active on the international arena, the origins of the company play a pivotal role in the vendor selection process too. Next section delves into the issue of domestic over non-domestic vendor favouritism.

7.1.1.4.2 Domestic vs. Non-domestic

The aforementioned market sentiment (cf. section 4.5.4 and 4.5.5) creates an unfavourable atmosphere for non-domestic providers on the western market. Coupled

with increased government spending on infrastructure projects these factors lead to more domestic outsourcing. However, it is a frequent fact that domestic vendors subcontract foreign vendors acting as a middleman – a fact that is not always apparent to affected clients. In spite of the lack of transparency of the V2V network from the clients' perspective it is worth looking more closely at the full supply chain of the delivered services. This means to trace the real origin of the service delivery and go beyond the 1st degree neighbourhood in the C2V network. The analysis of the C2V network reveals a surprising pattern structure. Despite the majority of clients being connected to domestic vendors, their 2nd degree relatives are rarely domestic. Figure 7.1-13 illustrates an average decomposition of a client's vendor portfolio grouped by the neighbourhood degree. The average value is calculated via *(i)* building the average ratio for each single client over the simulation run and *(ii)* building an overall ratio for the whole model subsequently for 100 varying but representative simulation runs with identical parameter settings. The 2nd degree neighbourhood was constructed by overlaying of the C2V and V2V networks (see Figure 7.1-12). For reasons of clarity the number of agents in Figure 7.1-12 has been reduced to 50 client and 50 vendor agents. This representations visualizes the monopolistic position of the vendor controlling the centre of the hub.

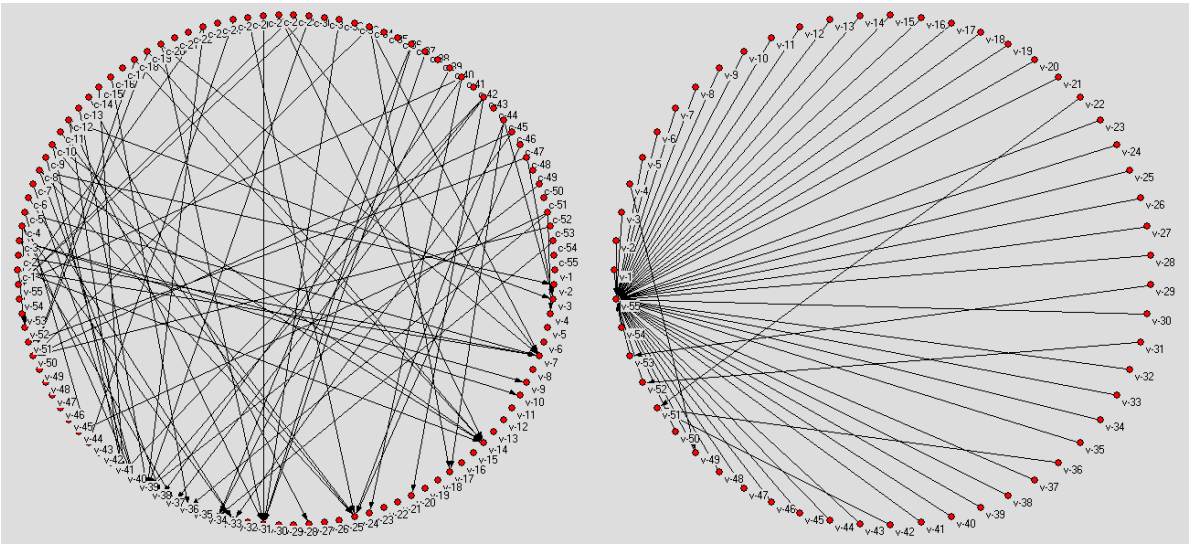


Figure 7.1-12: Final state of the V2V (right) and C2V (left) networks for the representative run 48.

The interplay of the C2V and V2V networks emerges naturally with the advancement of M&A activities on the vendor arena. In order to be able to deliver competitive pricing vendors subscribe services from their non-domestic subsidiaries while tapping into cheaper labour pools. These circumstances of the case are represented in the model by

reified vendor rules that push providers for acquisition in foreign geographies (cf. section 7.1.1.4.1).

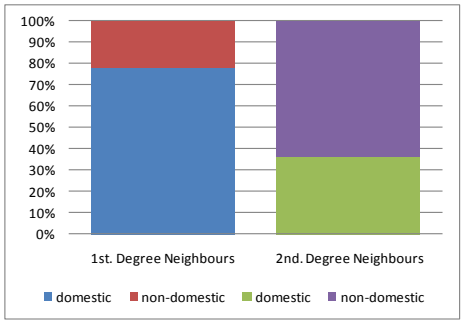


Figure 7.1-13: Average constitution of clients' vendor-portfolio grouped by the regional affiliation of vendors and the degree of neighbourhood in the C2V network.

The clients' logic is biased towards collaboration with domestic vendors. Therefore, a non-domestic vendor-agent can use an acquisition of a foreign rival as a shortcut to obtain domestic presence and operations if he has not had any (consult section 7.1.1.4.1). The same applies to domestic vendors as they are not able to offer competitive pricing without international subsidiaries. Due to these constraints, there is an intensive process of relationship building between the domestic and non-domestic providers. For the customer, however, this process remains transparent. Transaction costs are not explicitly implemented in the EBO Model in contrast to the TCT-Model, (cf. section 5.2.3) but are implicitly present via endorsements and higher risk of geopolitical disasters that are characteristic to foreign geographies. More on the topic of transaction costs issues can be found in section 7.1.1.5. A recent example of the aforementioned trend is sale of UBS India Service Centre subsidiary to Cognizant Technology Solutions[108], a US based technology service provider.

Despite the optimism, many organisations are wary of non-domestic IT services. Language barriers, cultural barriers, and fear over losing intellectual property remain significant obstacles for many institutions in North America and Western Europe (cf. chapter 4.5.5). A client may be reluctant to enter into an outsourcing agreement with some non-domestic vendor for fear that important intellectual property may be diffused, sometimes by outright theft, but more likely by inadvertent leakage through employees or by employee attrition. It is hoped to counteract this threat by contracting domestic suppliers. This reasoning is explicitly reified in the clients' logic. However, this

[108] Cognizant is a global information technology services and consulting company with headquarters in Teaneck, New Jersey, United States and with significant operations in Chennai, India.

countermeasure is not proved to be an effective tool since the absence of transparency in the vendors' network leads to illusive perception of security as was shown by the model results above.

The EBO Model's results reveal developments in each of the networks – C2V and V2V – that disadvantage clients' domestic bias. While the C2V network is dominated by relationships between domestic clients and domestic vendors the V2V network, *per contra*, is prevailed by relationships between domestic and non-domestic vendors. The decomposition of the V2V network can be seen with a bifocal view. On one side, powerful vendors are acquiring underperforming rivals. On the other side non-domestic vendors are trying to acquire domestic counterparts to get a footprint on the domestic market. Both reverse developments foster relationship building between domestic and non-domestic vendors. Clients' perspective on the whole process remains deceptive as clients are only aware of processes in the C2V network.

The gist of the findings in this section for policy makers is the advice to examine the collaboration and subsidiary network of a provider of interest in order to obtain an informed view on the origins of the process delivery. Otherwise issues of dependency due to monopolisation might arise. The following section covers the topic of monopolistic patterns discovered in the EBO Model's artificial society.

7.1.1.4.3 Monopolisation

The EBO Model results showed a feedback loop between the issue of monopolisation and the current trend of multisourcing. The ample discussion of diverse concomitant phenomena of multisourcing can be found in section 7.1.1.6. Here, only the link between monopolisation and multisourcing is examined. Gartner's Key Predictions for IT Organizations for 2007[109] (Gartner, 2006) includes the forecast that through 2009, market share for the top 10 IT outsourcers will decline to 40% from 43,5% now. As market share declines, some key outsourcing vendors will cease to exist in their current named form due to M&A activities on the outsourcing market. The secondary effects of multisourcing, like reduced numbers of large contracts, increased amount of competition and reduction in contract size have placed great pressure on outsourcing providers. These secondary effects are boosting M&A and, inevitably, monopolisation amongst vendors.

[109] Published as a part of a series of „Gartner Predicts" research. The entire series of "Gartner Predicts" research includes nearly 50 reports that discuss the major trends that will affect IT users, high-tech and telecom companies and most industries in 2007 and beyond.

Monopolisation issue, in turn, increases the aforementioned secondary effects of multisourcing – a feedback loop is established. The model confirmed that the aftermath of these processes result in a hub-like structure of the V2V network (cf. Figure 7.1-14). For reasons of clarity the number of agents in Figure 7.1-14 has been reduced to 50 client and 50 vendor agents.

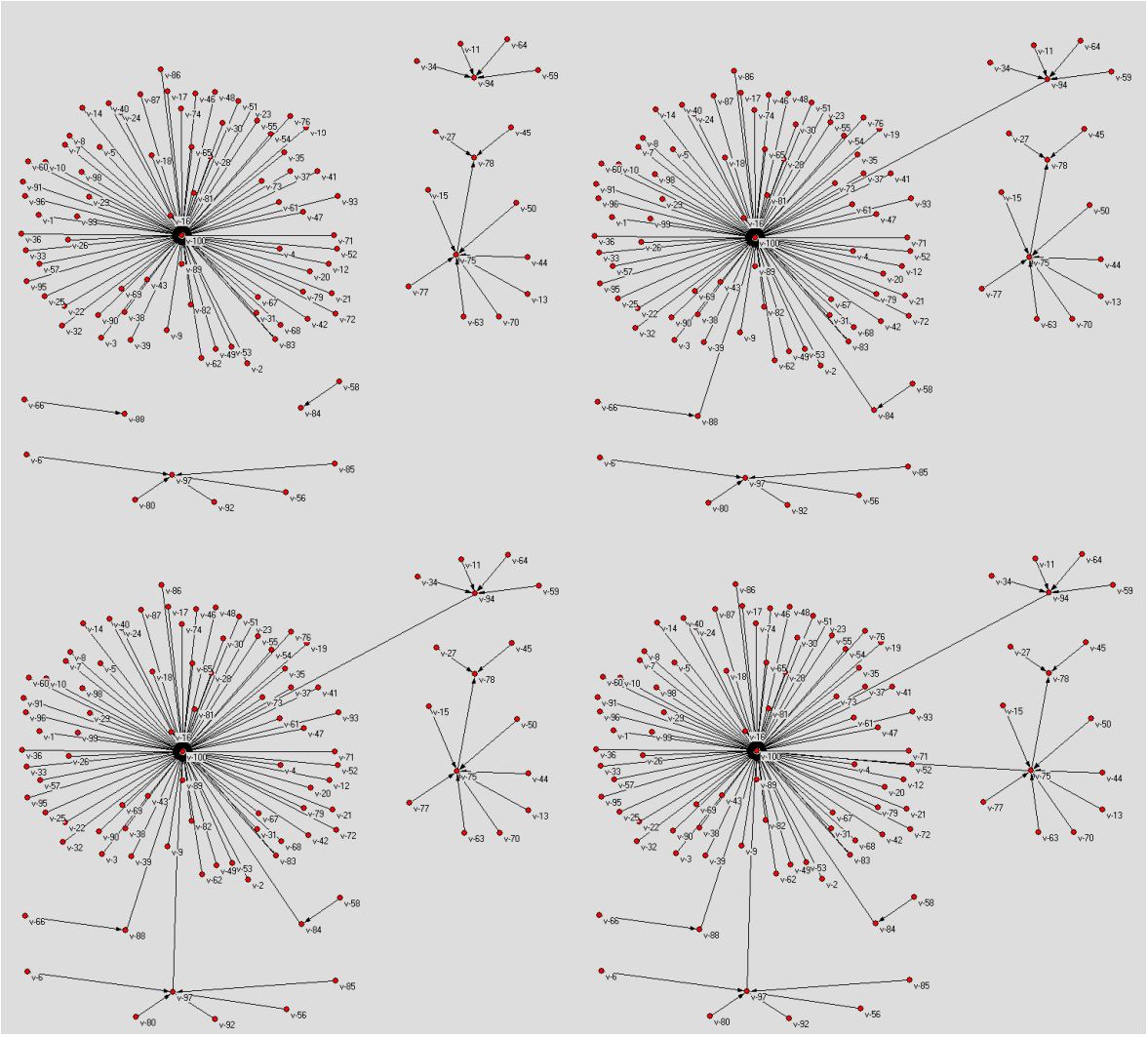


Figure 7.1-14: Snapshots of the V2V network for the representative run 57 at the time steps 100 (upper left corner), 250 (upper right corner), 350 (bottom left corner) and 500 (bottom right corner).

Figure 7.1-14 depicts a simple network visualisation for the EBO Model output from the representative run 57 at the time steps 100, 250, 350 and 500. Agents in a relationship are linked via a line. In the first snapshot the V2V network looks still dispersed. Between the start of the simulation and the first snapshot, however, a lot of organisational activities have been taking place – according to the analysis of the mode's textual output – and as a result of such 4 distinct but nevertheless interconnected clusters of agents are visible in the network. Each cluster consists of a variety of agents' ethnicities. Domestic vendors are prevalent in the two more dense clusters dominated by vendor 100 and

vendor 75. There are two exceptions to this finding, namely vendor 97 and vendor 94. This seems to be counterintuitive at first sight. A closer look at both exceptional cases, admittedly, reveals constant maximal capacity utilization. Furthermore, the analysis of the log-file shows that vendor 97, as well as vendor 94, does not have to wait more than 2-3 ticks on average for matured contracts to be reinstated. Partly this happens due to a great amount of existing lock-ins (cf. section 7.1.1.6.1) on the clients' side and partly due to the competitive pricing for services that both vendors are offering. At the beginning of the simulation both providers were initialised with attractive pricing models for services, thus they could agglomerate a voluminous customer base instantly. This fact allows both agents to preserve their autarkic position.

Between the start of the simulation and the first snapshot the semi-final constellation of the V2V network with 3 strong clusters is reached. This constellation remains until the tick 476 where the last hub of vendor 75 merges with vendor 100 creating a complete monopoly of the vendor market as one can see from the last snapshot in Figure 7.1-14.

The reasons for the evolution of clustered relationships in Figure 7.1-14 are manifold but can, nevertheless, be all attributed to the monopolisation issue. Due to various considerations, underperforming vendors are issuing calls for tenders with respect to mergers and are establishing business relationships with more successful rivals. This process is iterative and gains on momentum after some vendors in the V2V network reach a critical size[110]. Although it appears that the whole population reaches interconnection in a short time (cf. Figure 7.1-9), no obvious conclusion can be drawn from the simulation results with regards to the evolution of the critical condition. However, it becomes now clear that in the end the whole population is dominated by a single hub. Consolidation of resources in a monopolistic relationship provides a hosting vendor with enormous acquisition power and lets him appear as a lucrative merger partner for others. This perception of agents can explain a star-like cluster form of the network. The moment a powerful vendor arrives on the scene, a big merger gap opens up. The gap is aggravated by the fact that situation of the remaining vendors is getting less beneficial with every merger of the new monopolist. In turn, this "crushing to death",

[110] In the context of this section a size of the vendor refers to the number of merger relationships this vendor is hosting.

accelerates the process of monopolisation. The effects of the size on the merger dynamics are viewed in section 7.1.1.4.4 in detail.

In general, however, the clusters can be perceived as emergent properties of vendors' strive for scale and expansion of customer base as reified by agents' rules. Thus, the model generates data of the sort that is expected by interviewed analysts (see field work chapter 4.5.4), admittedly, to a much higher intensity. It can be argued that the intensity in the artificial society of EBO Model is higher due to the focus of the model on the integral features of the outsourcing market, disregarding concomitant effects of the economy like state subsidiaries, interdiction of commerce and politics. The intensity is high in cases where the monopolisation process in the artificial society gets "out of hand", thus in the runs where some vendors gained on size in a short time and therefore snowballed the process.

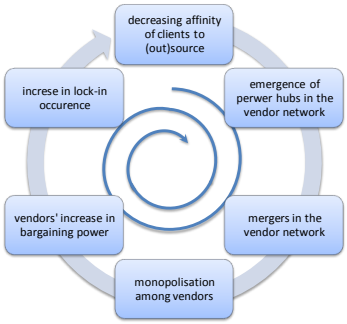


Figure 7.1-15: Feedback loop of monopolization.

Analysis of the isolated runs, where monopolisation intensity was high, exposes the intrinsic properties of the growth process of a monopolist agent. At a certain point in the simulation some vendors reach the size where they have enough (this value differs for vendor-agents depending on their utilisation preference) clients caught in the lock-in so that they can dictate the price above the market average. Since clients, in their turn, are trapped in the lock-in and cannot bring their services back in-house, they are forced to tolerate exorbitant prices. Under normal circumstances (that is a mediocre monopolisation pace) it is highly unusual to observe any vendors offering prices that differ much from the market average. It was observed, nonetheless, that in cases with high monopolisation degree of the network (that is, vendors dictating prices above market average) that the level of lock-in was extremely high. However, it cannot be backward chained that high levels of lock-in led to exceptional market situations with high prices and intensity of monopolisation – results did not support that logic.

Another side-effect of monopolisation is the decreasing disposition of clients towards outsourcing. As mentioned above, vendors reaching a certain monopoly are able to dictate the pricing rules. The clients with lock-in issues are trapped in a *cul-de-sac* where they inevitably have to accept the new conditions to sustain an uninterrupted service delivery. Admittedly, the reaction of remaining clients (that is, clients, who escaped lock-in) is to further deliver existing services in-house and to refrain from obtaining any new skill sets from third parties. This behaviour limits the amount of new potential contracts in the system. Now the mergers take place in a snowball manner since the decreasing affinity of clients to outsource boosts mergers which in their turn decrease the amount of new contracts through the feedback loop even further. Therefore, this spiral dynamics intensify the natural merger mechanisms of EBO Model until the whole V2V network is monopolised and has reached a stable state. A schematic representation of the feedback loop with its components is illustrated in Figure 7.1-15.

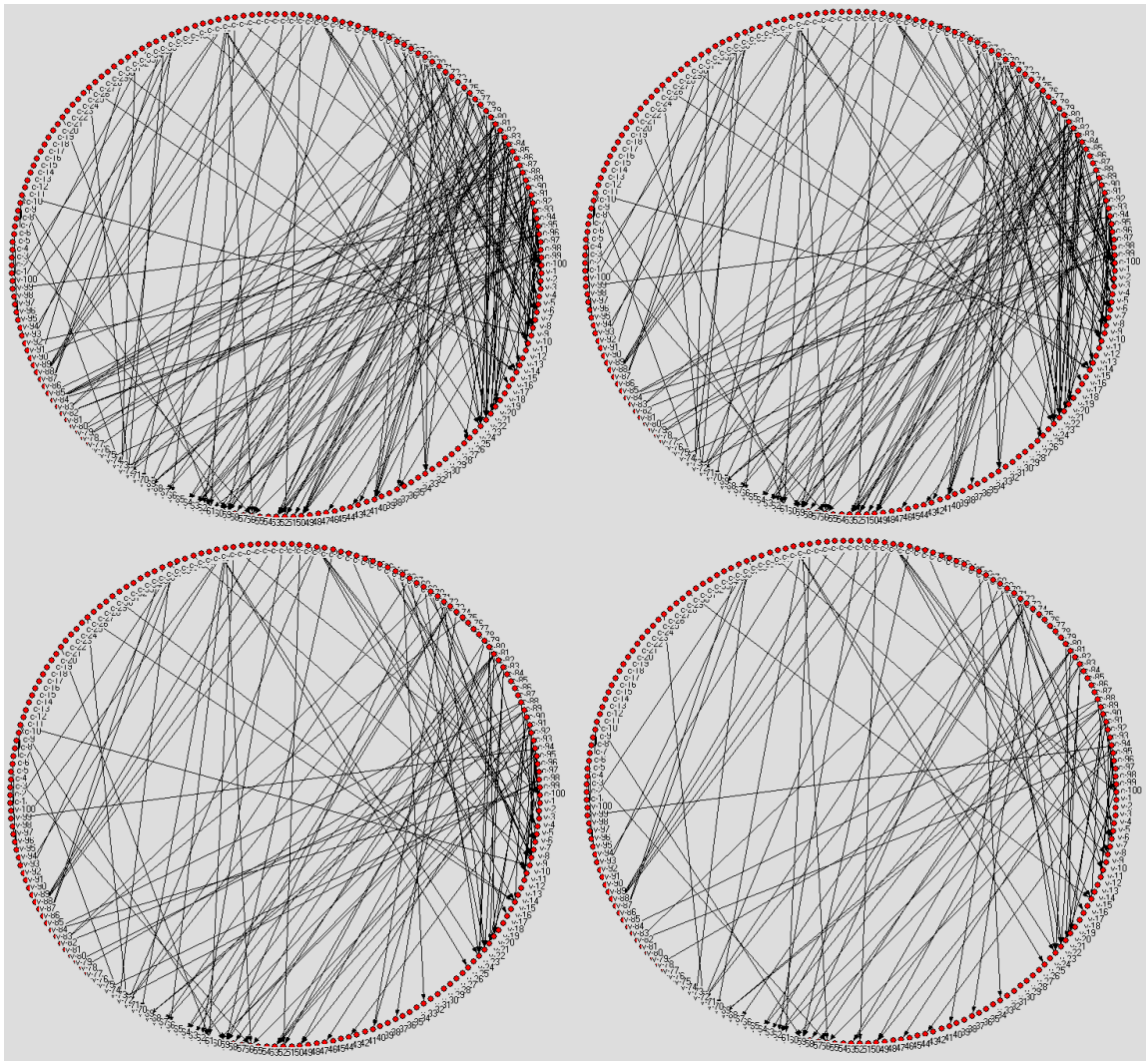


Figure 7.1-16: Snapshot of the V2C network for the representative run 48 at time steps 100 (upper left corner), 250 (upper right corner), 350 (bottom left corner) and 500 (bottom right corner).

So far only the V2V network was considered individually, apart from the short excurse in 7.1.1.4.2. Next, the effects of the dynamics in the V2V network on the V2C network are considered. Corresponding to the network representation in Figure 7.1-14, Figure 7.1-16 represents snapshots of the V2C networks at isochronal time steps from the representative run 48 at time steps 100, 250, 350 and 500. No obvious pattern in the network structure can be denoted. The only tendency is the slightly decreasing density of the network that arises from the aforementioned clients' decreasing disposition towards outsourcing with higher monopolisation degree of the vendor network. The increasing sentiment of clients to refrain from undergoing further contractual relationship with vendors comes to the fore from the Figure 7.1-16 as the depicted representative run 48 showed the above-average merger intensity.

With lacking competition vendors embodying strong network positions loose boundaries and can dictate price politics after their own discretionary. Combined with *Lock-In* (cf. 7.1.1.6.1), *knowledge loss* (cf. 7.1.1.6.2) and *vendor's market dominance* (7.1.1.4.4) it creates a great threat of dependence for clients. Subsequent sections dwell on these topics.

7.1.1.4.4 Size matters

Previous results made it evident that offering the best service delivery is not the only competitive play happening in the outsourcing market. Outsourcing is now an integral component of an IT strategy of most companies. Therefore, against the paradigm of dynamically constrained firm's growth by Edith Penrose (1959), a quick "grow to sustain" strategy is adopted by leading providers on the market since everybody wants to secure the biggest piece of the pie. Big US-based players such as EDS, IBM, Accenture, HP and Unisys are scaling up dramatically in locations such as India and China (cf. section 4.5.4). A recent example of the current trend of alliances and acquisition is the purchase of Kanbay International – a global IT services firm focused on the financial services industry – that is aimed at accelerating Capgemini's growth in India and integrating operations in India, Europe, North America and Asia-Pacific (Vidalon, 2007). This trend is followed as well by UK-based BT and Germany-based T-Systems, each adding thousands of people among their offshore resources via diverse M&A activities while slowly consuming available resources in these locations.

A striking fact is that EBO Model produces similar behaviour patterns without definition of rules for vendors that cultivates uncontrolled growth. In retrospective, considering the structure and dynamics of the V2V network (cf. Figure 7.1-14) together with verbal output of the model a statement can be formulated that the growth of providers has no explicit but implicit reasons. These are the outer circumstances and diverse feedback loops that implicitly foster the growth. Previous sections reified various reasons for mergers but none of these reasons explicitly pursued the pure aspiration to grow. The market however fosters the survival of the strongest. EBO Model showed that only powerful agents were able to sustain and develop further in a long run. Despite the fact that no obvious conclusion could be drawn from the simulation results with regard to the evolution of the critical condition, as to when a survival of the vendor can be guaranteed, it can be stipulated that number of vendors in a network hub can be used as a proxy for the strength of the provider occupying the central position. A size of a monopoly is however a good guarantee to sustain longer on the market as an independent entity.

Again it is clients' behaviour that forces providers to adopt the behaviour which leads to the creation of power hubs on the market. The market is a medium that creates the feedback loop between clients' and vendor's behaviour patterns. The biggest fear of clients and one of the reasons for the hype of the multisourcing strategy – creation of power islands amongst vendors – is fostered by the very own behaviour of clients. Sections 7.1.1.4.1, 7.1.1.4.2 and 7.1.1.4.3 show that clients prefer a domestic over non-domestic, internationally active over internationally non-active and finally cheaper over expensive providers. EBO Model's output supports the conclusion that the aforementioned preferences create market constellations that make it possible to sustain only for powerful[111] vendors. During the conducted simulation runs no case could be recorded where a main hub of the V2V network was dominated by a poorly performing provider. A consequence of the above is a process of natural selection that makes already powerful providers even more powerful and weak counterparts even weaker – intensive M&A activity is the immediate consequence.

Section 7.1.1.4.3 highlighted negative effects of the monopolisation on the clients. However, the increasing size of a vendor has, at certain points in the development

[111] In section 7.1.1.4.3 a power of a vendor agent is measured on the amount of providers being acquired by that agent. Therefore an agent entailing a central position in a dense network hub is considered to be powerful in that sense.

process ,even positive effects. Here the utilization of the economies of scale and experience are meant. Since in a monopoly all agents are considered as being places in a common pool, all vendors involved in a monopoly can profit from this fact with respect to the aforementioned economies. The benefit for the clients, however, turns into the opposite when vendors reach a maximum utilisation of economies but do not pass them to the contracted customers. Figure 7.1-17 indicates that there is a correlation between the monopolisation degree of the market and the average market price per skill set. Due to the immense scale available a monopolist can leverage economies of scale and offer a price which is always slightly more lucrative than the average of the market[112]. After reaching a certain size there are neither further economies of scale nor size possible. It is therefore not surprising to discover in Figure 7.1-17 that while monopoly is further growing, the average price per skill set is never reaching the base price (cf. Figure 7.1-5) and even goes slightly up while the system converges to a complete monopoly around time step 40. Vendors try to stay in a lucrative price region, thus keeping the average price above the base price. The monopolisation is calculated as a ratio of vendors being in a merger relationship to the number of all vendors. Average values have been calculated for every of the 100 conducted runs and then averaged again to obtain a single graph.

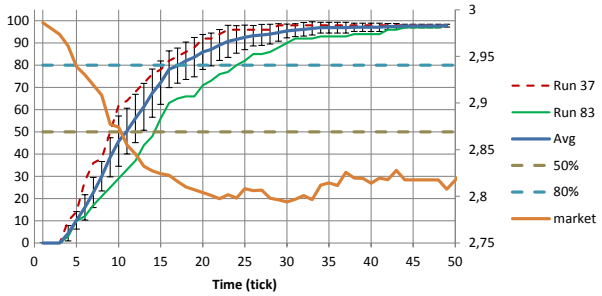


Figure 7.1-17: Correlations between monopolisation of the market and average market price per SS.

The current trend of alliances and acquisition will continue to grow. An analyst from CONSULTANT3 reflected after being confronted with EBO Model's result above: "*The global market will look very different two years from now and offshore players will have a larger market share. We will probably soon see only the Big 3 or Big 5 instead of the current dominating Big 10 outsourcers.* (...) *The age of pure-plays coming out of domestic market is over. In order to sustain they are becoming hybrid players and without a sustainable growth they are deemed to vanish.*"

[112] As can be recalled from the chapter 6.1.4.2 on vendor selection process, vendors are not able to see the bids of the competitors and therefore try to act in accordance with the market averages (cf. 6.1.5 Market).

The shrinking barriers of the globe represent an opportunity and a challenge simultaneously. Companies looking to offshore can now consider the US- and UK-based providers along with the local providers that are native to a particular country. The ongoing consolidation process amongst IT providers changes the game dramatically. The domestic providers already have a great hook in the domestic market. So non-domestic companies are now competing with large domestic providers for services delivered out of non-domestic locations. Clients' preferences combined with growth of domestic rivals make the breakthrough of non-domestic providers nearly impossible. The competition is high and a lot of the market is up for "grabs". Under these circumstances the entire global market is up for restructuring and a size is an imperative to sustain and secure growth.

7.1.1.5 *Asset Specificity and Transaction Costs*

The asset specificity is one of the central concepts in the TCE and therefore was imposed on the TCT Model. Despite the fact that the operationalization of asset specificity, as present in TCT Model, was chosen by the modeller, the presence of the asset specificity as such was, however, theory driven. EBO Model followed a rather different approach and the model was driven by the field research. Thus EBO Model does not incorporate any adaptation of the theory driven behaviour patterns. Only the system properties[113] that, according to the interviewed stakeholders, could be attributed to asset specificity, have been mapped into the model. The implementations of the TCT artefacts, such as asset specificity and transaction costs, have been modelled in an implicit way. Both, transaction costs and asset specificity are implicitly present via endorsements and higher risk of geopolitical disasters (cf. sections 6.2.2 and 6.2.4).

Referring to the fieldwork chapter, the specificity of an asset was frequently compared by practitioners with the redundancy property of the service, i.e. the option that a particular service can be delivered in several, alternative ways. This circumstance was mapped into the EBO Model's spanning tree concept in a way that any node, representing a redundant service, shall be reachable from a root node via several paths. Therefore, the in-degree of skill set in the FSU_{agent} was used as a measure of the specificity of a skill set. Both, the proximity of the skill set to the root node and the aforementioned in-degree of the skill set were utilized in the endorsement concept as the asset specificity indicators. The chosen representation of the asset specificity captured intrinsic properties of the system

[113] This term incorporates behaviour patterns and other system inheritance.

that were reported by stakeholders. Indeed, the definition of the asset specificity over the in-degree of branches combined with the proximity factor to the root node in the FSU_{agent} can be utilized as an alternative quantifiable metric. That handling of the, by theory ill-defined, term reflects its usage in the practice and could, therefore, be conveniently transferred into the notion of endorsements.

However, the results of the EBO Model led to the assumption that asset specificity is a context dependent term. Two agent based models, TCT and EBO Model, provide different representations[114] of the term and both successfully apply the defined construct. Moreover, both representations of the asset specificity were confirmed by stakeholders as applicable for the operational side of the business.

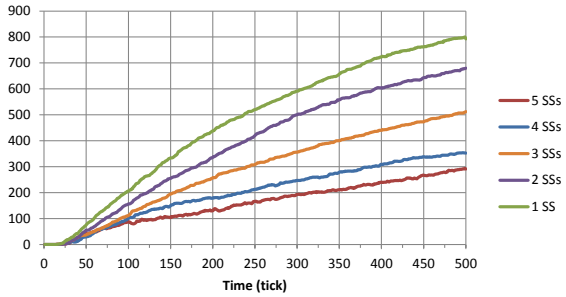


Figure 7.1-18: Lock-In curves for different FSU structures (SS stays for parent skill sets).

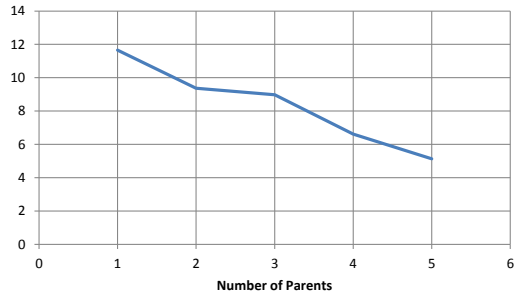


Figure 7.1-19: Idle time of a client-agent under different FSU structures.

In the following, lock-in curves from 5 simulation runs with different FSU_{agent} structures are juxtaposed. The varying FSU_{agent} structures were obtained via alteration of the algorithm for initialising the FSU_{system} (cf. section 6.2.2.1). For each of the 5 runs the variable limiting the maximum number of parents for the node was adjusted in order to obtain some denser and thinner branching of the spanning tree – in the first run the maximum number of parents was limited to one, in the second run to two, in the third run to three, in the fourth run to four and in the fifth run to five parents. The graph in Figure 7.1-18 shows that a lock-in degree of the system is negatively affected by the aforementioned parameter that limits the number of parents for any node. Values are obtained via average calculation for 5 simulation constellations with 10 runs and identical parameter settings each. The number of lock-ins decreases with the growing in-degree of edges for the nodes in the FSU_{system}. As evident from the figure, all depicted curves differ

[114] In case of the TCT Model it is a subjective function based on the number of other agents able to provide considered service (cf. section 5.5.5). In case of the EBO Model asset specificity is defined of the in-degree of branches combined with the proximity factor to the root node (cf. section 6.2.2.1).

in the intensity of the lock-ins happening but not in the pattern of the curve. All the curves exhibit a sharp increase in the initial phase with an asymptotic boundary.

The reverse correlation between the number of skill set parents and lock-in degree of the system caused confusion while presenting the results to stakeholders as the initial inference was to expect the opposite. Indeed, the increased number of skill set parents causes much stronger branching of the FSU_{system} and as such produces a strongly interlaced spanning trees. As far as the experience of stakeholders goes, interdependencies are considered to be the stumbling blocks of outsourcing contracts, since service dependencies nourish lock-in issues. Whereas interdependencies are, indeed, hard to deal with while setting up "clean" outsourcing contracts, it has to be understood that stronger branching and an increase in the number of parents does not mandatory mean higher degree of lock-ins in the system. Here, a reference to the EBO Model's definition of asset specificity helps to resolve the confusion. The asset specificity was defined in the EBO Model, *inter alia*, over the existence of redundancies in the structure of FSU_{system}. The lock-in happens when an agent cannot return a particular skill set because he will, otherwise, suffer an irrecoverable loss of knowledge, thus losing skill sets that have been built upon the sourced skill set. Increase of parents, however, counteracts the aforementioned threat of knowhow loss per definition – increased number of parents for any node offers alternative routes to the child node and therefore resolved potential lock-in situations.

According to the TCT a higher asset specificity will lead to higher transaction costs. That statement is partly supported by the EBO Model's results. Transaction costs as such have not been implemented in EBO Model explicitly but are present in an implicit way through geopolitical events and appropriate endorsements clients have been equipped with. The probability of geopolitical events and service disruptions or even premature breach of the contract connected with these events is higher for non-domestic providers. Coupled with endorsements that enforce clients to favour domestic vendors (cf. chapter 7.1.1.4.2) an implicit implementation of transaction costs was created. The idle time – a time to recover from an unexpected service loss – agents incur under different FSU_{system} structures, can be used as a substitute for the theoretical construct of transaction costs. Indeed, the calculated average idle times for the simulation runs from Figure 7.1-18, as depicted in Figure 7.1-19 provide evidence for TCE. The increase of the number of parents

minimises the idle time – for one parent it is 11,66 sec., for two parents it is 9,37 sec., for three parents it is 8,98 sec., for four parents it is 6,61 sec. and lastly for five parents it is 5,13 sec. ticks. Values are obtained via average calculation for 5 simulation constellations with 10 runs and identical parameter settings each.

Obviously, activities associated with core competencies should not be outsourced as they are crucial part of the firm's intellectual property. It is of great importance to decide if the outsourced activity could mean loss of future control of processes and knowhow. Even by outsourcing non-core activities, the company may facilitate transfer of own discretionary systemic competence to a vendor that will also use this to supply the competitors. Porter (2003) suggests that extensive outsourcing also has a tendency to standardize end products and thereby forego a strategic advantage. Therefore one sources the standardised bits and the rest is kept in the internal IT departments. Indeed, the decomposition of the sourced skill sets supports Porter's statement. The charts in Figure 7.1-20 show the decomposition of the sourced skill sets by the degree of the in-edges at different time steps during the simulation run. The representation in Figure 7.1-20 and Figure 7.1-21 makes evident that with the progressing simulation run predominantly less specific skill sets, thus skill sets with multiple in-edges and further distance from the root node in the FSU_{agent}, are getting outsourced. In the course of the simulation run, the margin of skill sets with only one parent decreases from the initial 23% in tick 5 to 1% in tick 100. Same susceptibility can be observed while analysing the distance to the root node of the sourced skill sets. The margin of skill sets with shorter distance to the root node decreases gradually in the course of the simulation run (see Figure 7.1-21).

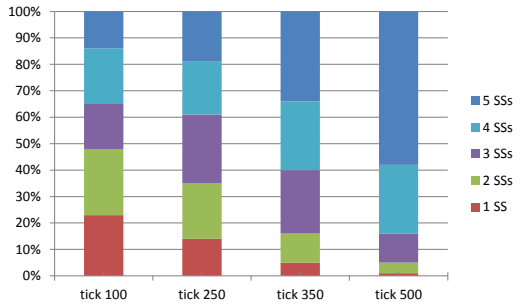


Figure 7.1-20: Decomposition of sourced skill sets by the in-degree of edges.

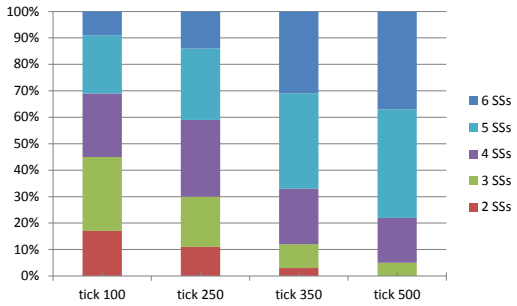


Figure 7.1-21: Decomposition of sourced skill sets by the distance to the rood node.

The pattern observed in Figure 7.1-20 can be explained while taking into account the concomitants of the merger activities described previously in the section 7.1.1.4. Average values have been calculated for 100 representative runs with identical parameter

settings. Clients who “burned” themselves on lock-in are getting cautious about outsourcing same skill sets again and therefore keep these in-house. This behaviour fosters vertical integration. This explains the overall slowdown in outsourcing relationship building (cf. Figure 7.1-3) and aforementioned outsourcing behaviour patterns in Figure 7.1-20. Both characteristics, the distance from the root node and the number of in-edges, indicate the specificity of an asset in EBO Model. Following Porter, extensive outsourcing will lead to the natural outcome of standardized end products (*ibid*). Translating this statement for the EBO Model setup means that with the progression of the simulation clients evolve a strategy to source standardised, thus less specific, skill sets. Indeed, the further any skill set is located from the root node the less probable it is for this node to be the parent for a child skill set that may be sourced as well and, therefore, cause lock-in issues. Same applies for any skill set the higher the in-degree of that skill set. In contrary, skill set with multiple in-edges can be delivered in various ways as they can be reached via manifold paths from the root-node.

In spite of the credit crunch, interviewed practitioners admitted to having started to review their internal processes for core and non-core applications more thoroughly. Current thinking among practitioners suggests that a concentration in the areas of the organisation’s unique competencies and leaving the other activities to outside specialists increases competitiveness. Consequently, the issue of asset specificity will further retain its high topicality. The classification of services as core or non-core is a complex process and requires significant effort to accurately define the scope and contents, as well as an understanding of current service levels and costs. In the cosmos of IT services, some areas can be more complex to outsource than others. A general rule of thumb that was frequently cited in the interviews reads as follows – the more discrete the service group can be bundled, the easier it is to handle it within the outsourcing context. Comparing the various kinds of services available, there are clear differences between them with regard to the outsourcing complexity, ongoing management and benefits achievable. However, one should not overlook the fact that discrete parts are easier to outsource but are also, as results have shown, harder to substitute in case of malfunctioning relationship with the provider. The suggested definition of the asset specificity over the in-degree of branches combined with the proximity factor to the root node can be utilized as an alternative quantifiable metric and an indicator of how troublesome it will be to resolve potential lock-ins.

Furthermore, Figure 7.1-20 indicates that asset specificity might not be such a central component for the notion of dependence between actors as prescribed by TCT (cf. section 2.2.2). As mentioned in section 7.1.1.6.1, the existence of the lock-in in a relationship can be utilised as an indicator for possible dependency issues between the parties involved in a transaction. Therefore, the analysis of the skill sets that have caused a lock-in situation can be utilized as a proxy for investigation of the dependence issue with regard to asset specificity. From the charts in Figure 7.1-20 it is evident, that the proportion of skill set defined as specific diminishes gradually, leading to the state with majority of skill set in the lock-in being less and less specific. Thus, it can be argued that asset specificity is not the necessary condition for the lock-in creation and, consequently, for the notion of dependence.

7.1.1.6 *Concomitants of Multisourcing*

As indicated in the introductory chapter, multisourcing is not an upcoming trend anymore but has become *de rigueur* in any make-or-buy decision process. Accompanied by growing process orientation the new paradigm has left behind the time of mega deals, while increases in the size of the provider pool together with the overwhelming reduction of the contract's scope and length is becoming a reality. In her book, Cohen (2006) introduces multisourcing as a saving silver bullet for various outsourcing issues. Indeed, the fieldwork showed that all interviewed companies are adopting the new methodology. However, many interviewees admitted having severe problems with the new paradigm. The intricacies of multisourcing and interlacing of services impose new difficulties. The IT representative from CLIENT1 reflected: "(sourcing) *projects that we compile nowadays have much higher complexity degree rather than these that we have been doing several years ago* (...) *unfortunately there is no reliable paradigm on the market that can cope with interdependencies that arise in that* (multisourcing) *context. We've got our strategies to cope with these challenges, but these strategies are mere workarounds and are far away from optimum.*"

Indeed the development process of the EBO Model shed some light on the mechanics and traps of multisourcing that are not clear from the cursory look on the approach. Most of the model development time was dedicated to the implementation of skill set transfer from the FSU_{vendor} to FSU_{client} and vice versa. The difficulty persisted not in the relocation process of a particular skill set a_1 from a vendor *A* to a client *B* but in the retrieving of that

skill set a_1 at the end of the contract from the FSU of the client *B*. There are multiple possibilities how the aforementioned skill set a_1 could have been utilised in other outsourcing contracts as an intermediary skill set. Thus, the retrieval process imposes a task of a much higher complexity as was anticipated by the author at the beginning of the model development process. This set of problems is covered in the section 7.1.1.6.1. The issue of lock-in is aggravated by the fact of natural knowledge drain that is imminent to outsourcing. The influence of the knowledge drain factors on the number of the system lock-in is discussed in section 7.1.1.6.2.

Multisourcing can spread the risk but makes change management difficult to a considerable degree. Again, the abovementioned difficulties faced during the EBO Model development represent an illustration of the elaborate change management process under circumstances of multisourcing. A slightly cynical remark of an IT representative from CLIENT2 during a cross-validation session summarises the aforesaid: "*You* (the modeller) *had difficulties shifting couple of nodes from right to left and vice versa. Yet, in my world each of these nodes stays for various IT units with dozens of employees and millions of pounds of hard- and software assets. The overarching choreography to master these complexities on the operational level is hard to conquer.*" The corresponding simulation results are covered in the section 7.1.1.6.3. The interviewed practitioners consider a strategy to use multiple providers as risk averse as one spreads the risk over multiple "heads". Thus, multisourcing compels buyers to increase their provider portfolios. The aftermath of this proposition with respect to the workload management efforts for the buyer-provider dyad are explored in section 7.1.1.6.4.

7.1.1.6.1 Lock-In

IT services often depend on external providers such as maintenance contractors, leased circuit providers, hardware leasing companies and software companies. Major concerns clients try to address with multisourcing is avoiding dependency on particular vendors. The fear is that, due to the proprietary nature of their new environment, should the new products entail sub-standard service levels, major upheavals would be involved in shifting over to another provider. Thus, the dependent client will have little practical access to products from alternative vendors. Similar to the TCT Model, EBO Model assumes a client-agent to be in the lock-in situation if the termination of a particular contractual relationship will lead to the deterioration of service levels. In the EBO Model a client can

have several ongoing contracts (cf. section 6.2.3), which could potentially lead to the lock-in situation. The lock-in is regarded as resolvable if the resource that is causing the lock-in can be replaced without degradation of client's service levels. Thus, the lock-in situation, provided it cannot be resolved, forces a client to prolong the contract with the vendor under terms and conditions that might be unfavourable for the client. This analogy can be mapped to the construct of FSU_{client} if one visualises the FSU_{client} as an accumulation of the skill set chains c_i where $i = 1, \ldots, n$ with c_1 being the root node and c_n being the leaf node. As depicted in Figure 7.1-22 any FSU_{client} can be disaggregated into multitude of skill set chains. Any skill set c_j with $1<j<n$ can be considered as a potential lock-in candidate if c_j has to be returned (be it due to the premature or mature termination of the contractual relationship for that skill set) while there is still an ongoing contract for the skill set c_k with $j<k\leq n$.

Figure 7.1-22: Decomposition of the SS chain from FSU_{client} (C_1 - root-node and C_n - leaf-node).

The loss of the skill set c_j in Figure 7.1-22 will lead to the immediate and irrecoverable loss of all skill sets c_k with $j<k\leq n$. In EBO Model it is assumed that in the case of the lock-in situation the contract is reinstated in order to keep the interrupt-free flow of service delivery. Depending on the opportunistic nature of the vendor the contract can be reinstated with old conditions or can be renegotiated again, thus offering a new vendor's price for the service delivery. Thus, the lock-in event represents a good opportunity to study the opportunistic nature of the contractual dyad (cf. section 7.1.1.7).

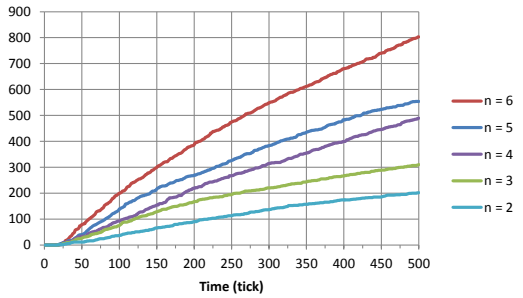


Figure 7.1-23: Affection of the lock-in by the number of contracted vendors by the client.

Against the expectations of the stakeholders, the lock-in degree in the system was slightly affected by the number of contractual relationships held by the client. Figure 7.1-23 shows the average lock-in curves, each built over the 20 representative runs with the maximum number of concurrent relationships varying from 2 to 6 and identical remaining parameter settings. There are marginal differences between the calculated average lock-

in curves to observe. This finding contradicts the anticipation of interviewed practitioners since they expected a decreasing level of lock-in in the system while gradually moving to the multisourcing paradigm. Both paradigms, that of single- and multisourcing are juxtaposed in section 7.1.2.2.

The EBO Model revealed the behaviour that was not in line with the paradigm of multisourcing. The lock is stands primarily for the dependency issues between clients and vendors. The variable that limits the number of simultaneous contracts any client can maintain at a time maps the archetype of multisourcing from the real world into the EBO Model's arena. Therefore it was surprising to discover that the level of system lock-in was gradually increasing with scaling up of the simultaneous contracts for clients. Hence, the system showed a negative effect of multisourcing on client's performance with respect to lock in cases. Since, proponents of multisourcing are pointing out the value of matching supplier capabilities to specific needs and reducing the risk of being completely dependent of a single supplier the analysis of EBO Model's results was surprising. It was expected to find a higher degree of the system wide lock-in with the integrated supplier approach (single supplier).

One possible explanation for the weak positive correlation between the lock-in degree and the number of concurrently maintained contracts can be drawn while taking the results presented in the section 7.1.1.5 into account. It was shown that the increase in the number of lock-ins in the system goes hand in hand with increasing asset specificity. Also, the assumption that the interwoven FSU_{system} structure bears potential lock-in at later stages of simulation could not be supported as long as there are alternative paths to the affected skill set. However, it should not be euphemised that the existence of the alternative paths in FSU_{agent} resolves the lock-in without eventual impact on the overall performance of the FSU_{agent} structure. Even though the current lock-in can be resolved via the alternative path, the originally affected path is left inoperative. Thus, there is still some damage for the company to expect. Applying this logic to the case at hand, one could infer that while the probability of potential lock-ins increases with the number of concurrent relationships, these lock-ins can be resolved due to the existence of alternative paths. With increasing number of simultaneous contracts the lock-ins are less efficient intercepted with alternative paths as the availability of these diminishes.

The issue above is an acute problem many practitioners are not aware of. The way most organisations are structured nowadays is not outsourcing ready. A senior consultant from CONSULTANT1 summarises the aforesaid as follows: "*Same as one would simplify an equation before solving, one should organize the IT structure of the company before going on a sourcing endeavour.*" A suggested pre-process of "tidying up" of the IT structure may produce clarity and eventually mitigate impetuous outsourcing decisions but another source of lock-in potential is coming with the paradigm of multisourcing itself. Figure 7.1-24 depicts average lock-in levels of systems with varying maximum number of skill sets that can be outsourced within a single contract. The averages were built over 30 representative simulation runs with identical parameter settings each. Figure 7.1-24 provides clear evidence for abating level of lock-ins in the system with larger contracts (longer skill set chains from the FSU_{agent}) which contradicts the multisourcing paradigm of smaller and shorter contracts spread over multiple providers.

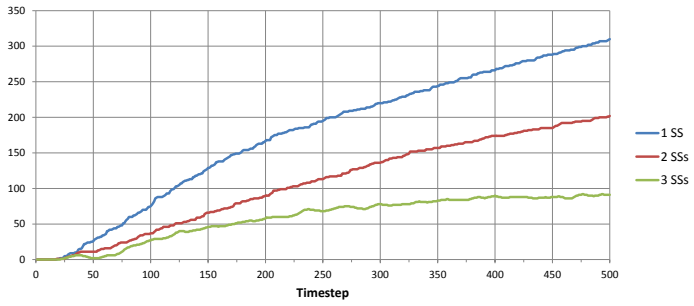


Figure 7.1-24: Affection of the lock-in by the number of skill sets sourced in a single contract.

A possible explanation of the behaviours observed in Figure 7.1-24 can be obtained if one analyses possible constellations that can lead to a lock-in. In EBO Model there are three cases where the structure of the FSU_{agent} can undergo alteration, i.e. cost-saving and acquisition contracts or innovation of a new skill set. In any of these cases either existing skill sets are substituted or another skill set is appended to the FSU_{agent}. In order to discover the impact of these changes on the FSU structure rotational simulation runs were conducted where in each run either cost-saving or acquisition strategy was allowed with alternatively enabled and disabled innovation. Unlike the acquisition modus the cost-saving modus did not produce any lock-ins while innovation was disabled or enabled. These are the only constellations of tested modifications on the FSU_{agent} that did not produce lock-ins in the system as one can see from the Table 7.1-2 below. All remaining configurations resulted in lock-ins.

	Innovation enabled	Innovation disabled	Memory
Cost saving	×	×	✓
Acquisition	✓	✓	✓
Cost saving + Acquisition	✓	✓	✓

(✓ stays for the lock-in afflicted and × for the lock-in free simulation run)

Table 7.1-2: Existence of lock-in with respect to different combinations of the FSU_{agent} modifications.

According to the definition of the lock-in situation above, any skill set in the FSU_{client} resides in the state of lock-in if

- it is not a native skill set (sourced or acquired respectively),
- the contract for this skill set has matured,
- it has to be returned,
- it serves as the parent for another skill set and
- the contract of the child skill set has not matured yet.

In the described case an attempt to return the parent skill set would result in either service disruption (loss of a path to a child skill set by loss of a parent skills set) or a lock-in situation (in case of a retention of the parent skill set). The sequence of possible combinations of the FSU_{client} modifications that bear a potential risk of the lock-in is presented bellow (SS stays for skill set)

[Acquisition SS_n]$_t$+[Acquisition SS_{n+1} | Innovation SS_{n+1}]$_{t+1}$, where **n** is a leaf node.

Hence, one possible explanation for the behavior observed in Figure 7.1-24 might be a decreasing probability of another acquisition on top of some previously acquired skill sets. One could stipulate that any skill set that built upon a previously acquired skill set bears a potential lock-in risk. On the contrary, cost saving contracts do not produce lock-ins since this type of contract only outsources skill sets that are already present in the FSU_{agent}. These skill sets will be retained in the agent's memory during the duration of the contract. Any $skill\ set_{client}$, that is retained in the agent's memory, can replace the corresponding outsourced $skill\ set_{vendor}$ instantly and prevent the potential lock-in. Decupled from other FSU_{agent} transformations, cost-saving deals can be considered as lock-in free unless the memory retention period is introduced (see Table 7.1-2). The memory and time component with their influence of the lock-in condition are discussed in the next section.

7.1.1.6.2 Knowledge Loss

The interviewed subject matter experts argued that they start switching to the multisourcing paradigm mainly out of dependency issue considerations (cf. section 4.5.8). Despite the increase in of vendor management complexities the stakeholders rely on the diversification of vendors. In the context of these discussions the involved practitioners frequently referred to the notion of knowledge loss and considered it as an unpleasant but natural concomitant of every outsourcing endeavour. Since the lock-in accounts for dependency issues in the EBO Model and is positively influenced by the multisourcing approach (cf. section 7.1.1.6.1) the examination of the knowledge component in that context will provide further indications of lock-in pre-conditions.

While investigating the lock-in cases in the previous chapter, much attention was paid to the condition as such and not to the artefacts of the condition regarding the asset specificity notion. Little attention was paid to further underlying causes that might have led to the lock-in. The analysis showed that the lock-in arose due to the sourced skill set being used in the subsequent contracts. Yet, the use of any skill set in another contract cannot be seen as a root cause for a permanent lock-in condition. This condition can promptly be resolved as soon as the contract causing the lock-in matures. Table 7.1-2 provides an indication of a possible root cause. Even in the lock-in free model scenarios the use of the memory (cf. section 6.2.3.3) caused the lock-in state. Consider a case where a client C_1 sources a skill set v_1 from a vendor V_1. Figure 7.1-25 illustrates the example.

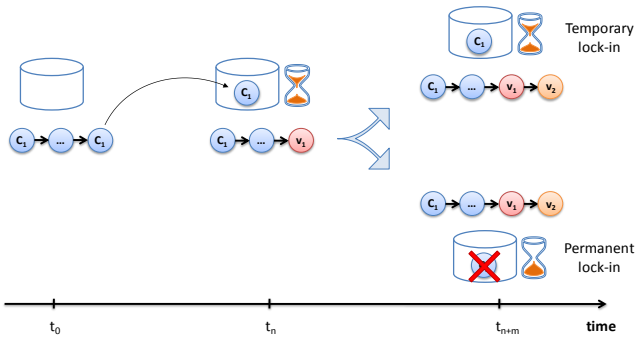


Figure 7.1-25: Lock-in state caused by knowledge loss.

During the skill set transfer process of the skill set v_1 to the agent C_1, his original skill set c_1 is substituted and transferred to the passive part of the agent's knowledge cosmos (cf. section 6.2.3.3). Consequently, this very same client C_1 decides to source further skill set v_2 from another vendor V_2 in terms of an acquisition deal. The newly acquired skill set v_2 builds upon the previously sourced skill set v_1. This situation creates a dependency of the

skill set v_2 on the skill set v_1. It can happen that the contract for the skill set v_1 matures earlier but cannot be terminated due to the dependence of the skill set v_2 on the latter one – a temporary lock-in has been created. However, this lock-in is not considered as permanent as the agent would terminate the contract for the skill set v_2 to the earliest possible date, thus giving skill set v_1 free. The aforementioned lock-in constellation becomes permanent once the memory component comes into play. If the skill set c_1, that has been stored in C_1's passive part of the knowledge cosmos, exceeds the C_1's specific retention time. Thus, the skill set c_1 decays and the bit of knowledge that c_1 accounts for is lost forever for the agent C_1. This expiration of the skill set c_1 accounts for the point of no return regarding the C_1's temporary lock-in condition. From now on, C_1 is forced to subcontract vendor V_1 in order to maintain his base scope of the knowledge cosmos.

Further analysis of the verbal simulation output indicates that the lock-in effect can be a self-fuelling process. The feedback loop between the lock-in and knowledge loss causes a snowballing effect. Due to lock-ins clients are forced to prolong contracts and thus keep their skill sets in their memory. This causes the threat of knowledge decay as any skill set that is kept for too long in agent's passive part of the knowledge cosmos may exceed the maximum retention time (cf. section 6.2.3.3). Greater knowledge loss, obviously, causes greater levels of lock-in in the system. As mentioned above, the issue of knowledge loss did not represent a novelty for the collaboration partners from the industry. The interplay of lock-in and knowledge loss, however, caused heated debates on implications for the operational business.

7.1.1.6.3 Spread of Risk

Under the multisourcing paradigm it is considered best not to outsource all IT functions to one supplier (cf. section 4.5.7). Dependence on one service provider can make costs and risks of moving to another supplier unacceptably high. The ability to switch suppliers can be critical in such circumstances.

If a large fraction of a buyer's purchases are concentrated on a single supplier, then the incremental costs of substituting away from this supplier are relatively high. While it is then at the same time less costly to substitute away from another supplier, whose sales only account for a small fraction of the buyer's total purchases. In EBO Model switching costs are measured as a time without being able to deliver the affected service – idle time. In particular, supply disruption results in excessive downtime of production

resources, upstream and downstream supply chain repercussions, and eventually a loss in the market value of the firm.

In order to investigate how effective the risk can be spread with the multisourcing approach, the population of clients in the EBO Model was exclusively subdivided into two types – clients with single-sourcing strategy (*type I*) and clients with multisourcing strategy (*type II*) respectively. *Type I* clients aim at obtaining all services from a single vendor, whereas, *per contra*, *type II* clients are focused on distributed service delivery from multiple vendors. In the following, some performance indicators for both client types are juxtaposed. Figure 7.1-26 depicts the dispersion of the idle-time each client type – *type I* and *type II* clients – is experiencing in case of a premature transaction termination. The number of clients for each type, grouped by length of idle-time, is calculated as an average over 50 representative simulation runs with identical parameter settings.

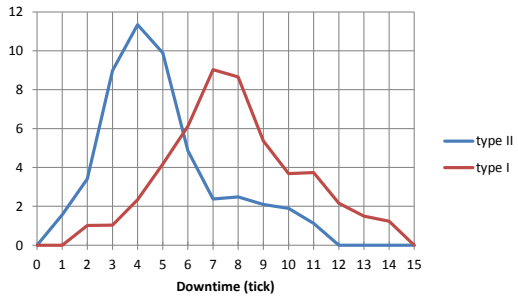


Figure 7.1-26: Down times for multisourcing and singlesourcing client types.

It is evident from the diagram that a majority of *type I* client-agents experience longer down-times than their counterparts of *type II*, who utilize a pool of vendors for necessary service provision tasks.

Clients utilising the multisouricng strategy clearly outperform their counterparts with the singlesourcing approach. Clients with diversified outsourcing delivery recapitalise their strength swiftly after a drop out of a particular vendor. Thus, the finding in this section support stakeholders perception of better risk handling in the multisourcing environment. A recent trend within the global outsourcing industry to shift away from oversized IT contracts and instead outsourcing to more than one vendor indeed proved to be a better alternative for the client-agents in the EBO Model.

7.1.1.6.4 Workload of Multisourcing

In the beginning of section 7.1.1.6 it was mentioned that the modelling process revealed increasing intricacies on the part of the client with growing number of sourced services. At the same time, vendors enjoyed a nearly equivalent burden of logistic tasks while delivering one or several services. This issue was also cited frequently during stakeholder interviews (cf. section 4.5.7). As stated by a consultant from CONSULTANT4: "*As a matter of fact, we tend to see the customer, whose sourcing process we have escorted, more than once. In fact they* (customers) *always approach us when they are about to source additional services – renegotiations and restructuring of services landscape is inevitable.*" The process of developing a successful outsourcing initiative is customized and evolutionary.

Multisourcing has come to the fore and the overall growth is driven by client organisations signing more contracts with more suppliers. However, while mulitsourcing helps clients to access best-of-breed suppliers and mitigates the risks of reliance on a single supplier (cf. section 7.1.1.6.3), it also increases transaction costs for managing more suppliers (Willcocks *et al*., 2009). Instead of a large scale contract that requires an overhead of organisational and bureaucratic oversight one splits that contract into several light-weight transactions distributed over several providers. It is, however, a naive expectation to anticipate less organisational efforts under such new governance structures. The practical difficulties in doing this can easily outweigh the commercial benefits. Although IT outsourcing and business process outsourcing spend is increasing, the average size of individual contracts and the duration of contracts is decreasing (Tisnovsky, 2006). This trend increases the efforts of oversight and renegotiations.

The aforementioned issue can be exhibited by means of the EBO Model if one compares rule activations for both client types – vendors and clients –to the number of concurrent transactions these agents are hosting. Figure 7.1-27 depicts the number of rule-firings for each agent type respectively. Each value was calculated as average over 50 representative simulation runs with identical parameter settings. Since vendor-agents are capable of hosting far greater numbers of concurrent transactions than clients, the abscissa denotes the maximum number of relationships that can be maintained by the client-agent. The comparison of activity overhead from additional contracts of vendor- and client-agents provides a clear picture of the workload that multisourcing paradigm bears for both

parties. The client-agents enjoy steeper increase of activity rather than their contracted providers.

Figure 7.1-27: Average rule activations for clients and vendors with varying maximum number of simultaneous relationships an agent can hold.

The drivers of the observed behaviour are found from the verbal output of the simulation (cf. section 7.2.1). Due to shorter contracts the vendor-agent deals with a moderate rise of requests but his service delivery process remains the same and does not increase the number of activated rules dramatically. In contrast, the increase in concurrent transactions causes a more dramatic increase in the number of activated rules on the part of a client-agent. Various requests for proposals and an overhead of administrative tasks intrinsic to and ongoing relationship (i.e. evaluation of the transaction, renegotiation, etc.) accounts for a high workload a client-agent has to cope with in a multisourcing environment.

Furthermore it can be argued that mulitsourcing implies higher transaction costs for both agent types irrespective of their role in the outsourcing process. Both agent types are involved in the bidding process more frequently because contracts are shorter, suppliers face more competition because smaller deals[115] (more suppliers qualify to bid), and suppliers need to attract more customers in order to meet growth targets. This finding is also echoed in (Willcocks *et al*., 2009).

7.1.1.7 *Opportunism vs. Cooperation*

It was already mentioned in the fieldwork section (cf. section 4.5.9) that vendors tend not to offer price reduction obtained in the course of economies of scale or experience after a contract has been taken off the negotiation table. Also section 7.1.1.2 offered a view on the EBO Model's pricing behaviour that resembled strong similarities with that described in the fieldwork interviews. Sooner or later a clients would discover the discrepancies

[115] A smaller deal in this context means that a chain of skill sets that is transferred within a transaction between agents is shorter. Thus, the number of potential providers, being able to deliver the needed skill set chain, increases.

between the market price and the price they pay for their outsourced services. Then it is up to the clients' evaluation and track record of a particular vendor whether the contract is going to be renegotiated or prematurely terminated. Also, such discovery of overpricing will be noted with a negative endorsement in the agents' track record for that particular provider.

In order to juxtapose the performance of opportunistic and cooperative behaviour strategies two types of vendor-agents were created – opportunistic and cooperative vendor types. Cooperative vendor-agents would offer their contractual partners any price reductions they could achieve due to economies of scale or economies after the contract has been sealed. Contrariwise, opportunistic vendors would not proactively offer any renegotiation of the price after a contract has been initiated. Figure 7.1-28 average cumulative frequencies for both vendor types for 50 representative simulation runs with identical parameter settings. The abscissa denotes the number of time steps while the ordinate denotes the cumulative frequencies of merged agents of each type relative to the total number of that type. The error bars denote the standard deviation ($\sigma = 1$). The horizontal dashed lines denote the 0,5 and 0,8 frequency levels, i.e. the level where 50% and 80% of the vendor-agent population has entered merger relationships of various kinds.

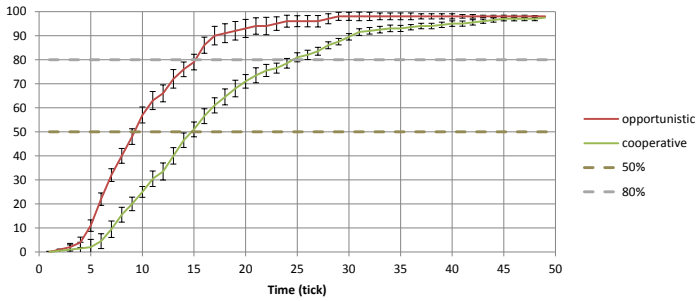


Figure 7.1-28: Average cumulative frequencies for opportunistic and cooperative mergers.

As already mentioned in section 7.1.1.4 the 0,5 level can be used as a proxy for the pace of merger dynamics since the level separates the population in half. It appears for both strategies that the first half of the vendor population is more quickly entering into merger relationships. It is also obvious that this process is taking longer for vendors with cooperative strategy as the curve lies further to the right. In the end nearly the whole vendor population of both types has undergone mergers. This happens for opportunistic vendors within 25 to 30 ticks and for cooperative vendors within 40 to 50 ticks.

Opportunistic vendors reach the cumulative frequency mark of 0,8 at tick 15 and cooperative vendors at tick 25.

Again, the error bars suggest a relatively low volatility at the beginning and in particular at the end of merger activities on the market for both vendor-agent types. It becomes evident that the first half of the vendor population of each type is merged in less time than the second half. The verbal simulation output helps to understand the driving factors of the observed behaviour. Due to discovery of overpricing in the contracts, opportunistic vendors gain a sustainable negative track records which makes them difficult to either prolong existing contracts or acquire new ones. In the long run opportunistic vendors lose their financial power due to lack of clients and become an easy prey for hostile mergers by better performing rivals.

7.1.2 Parameter Exploration

In the following four parameter scenarios are examined. First, the results of the simulation runs are discussed where the ratio of both agent types in the modelled varied. Next, concepts of multiscourcing and singlesourcing are examined with respect to the amount of outsourcing an agent can do. Finally the results form geopolitical events explorations are presented.

7.1.2.1 *Market Constellations*

This parameter exploration for the EBO Model was triggered by the participating stakeholders. After the presentation of main results a question arose *How would the model behave if one varies the vendor-client proportion?* According to stakeholders the real outsourcing market resembles a setup with a much higher proportion of vendors rather than clients. In the following main findings from the statistical analysis in 7.1.1 are reviewed with varying client-vendor proportion.

Parameter exploration runs consisted of 50 simulation runs with identical parameter settings for each market constellation: 75 vendors and 25 clients (v>c), 50 vendors and 50 clients (v=c) and finally 25 vendors and 75 clients (v<c). First the patters of rule firing are examined for vendors in Figure 7.1-29 and for clients in Figure 7.1-30.

Since agents rule firing are mostly reactive in nature (apart from merger and acquisition activities) the pattern in Figure 7.1-29 exhibits an expected result – number of rule activations increases with the number of client-agents in the system. The patter of rule

activation of client-agents, however, resembles a slightly more sophisticated picture. It becomes evident from Figure 7.1-30 that whereas the number of rules fired in the v<c constellation is considerably less than both other constellations, v=c and v>c, there is not much difference between these. Indeed, from tick 200 onwards the rule activation of rules for client-agents for constellations v>c and v=c is comparable.

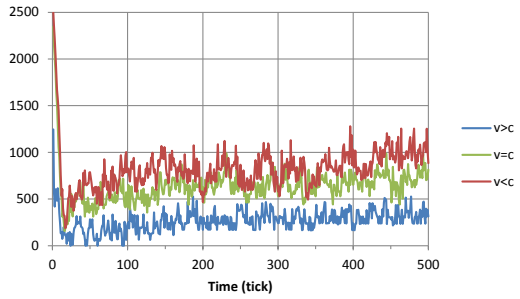


Figure 7.1-29: Number of rules that fired per tick for vendor-agents.

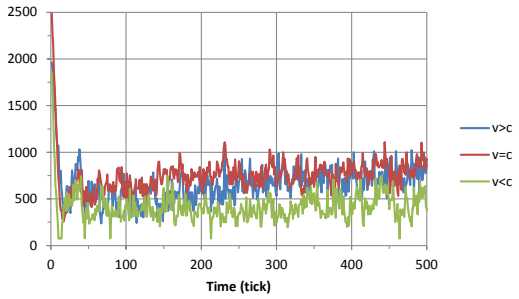


Figure 7.1-30: Number of rules that fired per tick for client-agents.

Analysis of the verbal output provides an explanation of the observed behaviour. The constellation v=c already fully utilises the capacity of simultaneous relationships a client-agent can maintain. Therefore, a dramatic increase of the number of vendor-agents does not change the situation as the bottleneck – number of maximum simultaneous contacts for any client-agent – remains the same.

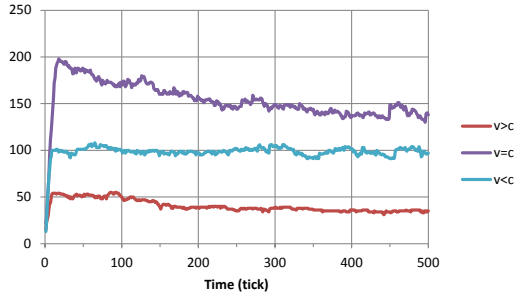


Figure 7.1-31: Total number of contract relationships.

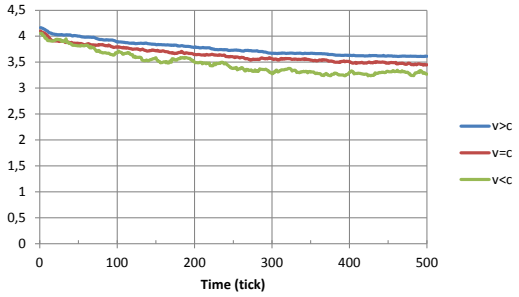


Figure 7.1-32: Development of the average production costs and market price per SS.

Next the total number of contractual relationships is plotted in Figure 7.1-31. The results suggest that the constellation with equal number of vendors and clients is the most fruitful one with the greatest number of contracts. This constellation is followed by v<c where each vendor has a maximum utilisation. Since client-agents can hold less simultaneous contracts than vendor-agents the constellation v>c is lagging in comparison to the previous two.

Figure 7.1-32 depicts the development of the price per skill set on the market. Sound with the expectations of the involved stakeholders the constellations with maximum utilisation of vendor-agents deliver the greatest price reductions – v<c followed by v=c.

Variations of the client-vendor proportion in the system also influenced the number of bids (RfPs issued by clients) as becomes evident from Figure 7.1-33. The graph is obtained via the calculation of the average value for each Skill Set for all vendors and clients. Here, a learning capability of the client-agent plays role. Whereas all three curves have similar characteristics until tick 25, the differences start to occur beginning with tick 45. A client-agent would only send RfPs if these are getting answered. If the response rate diminishes the intention of the client-agent to send out further RfPs diminishes too. Thus, the v=c constellation seems to be the most fruitful for interactions closely followed by the v>c constellation. In the final constellation, v<c, client-agents learn with time that that they are not getting as many responses as RfPs they send out and lessen the number of requests in response.

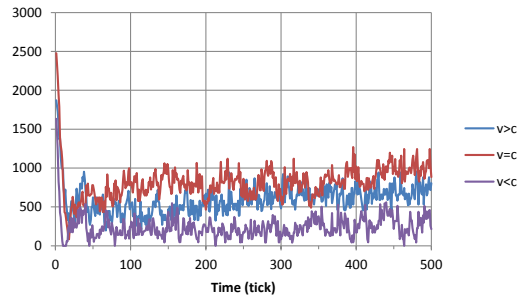


Figure 7.1-33: Total number of bids.

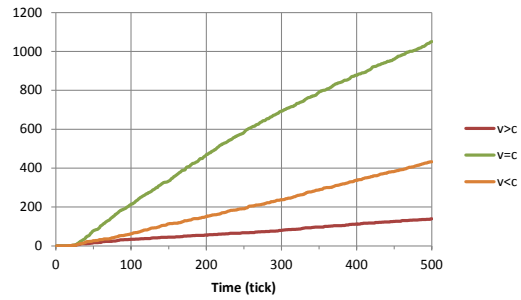


Figure 7.1-34: Number of Lock-in in the system.

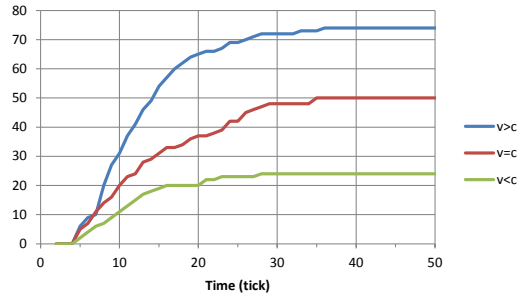


Figure 7.1-35: Total number of mergers in the system.

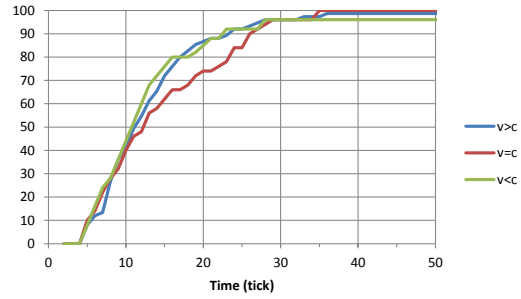


Figure 7.1-36: Average cumulative frequencies for vendor-agent mergers.

The level of lock-in in the system is depicted in Figure 7.1-34. The observed behaviours can be explained while taking into account the results from Figure 7.1-31 into account. With the increased number of contracts in thy system the probability for lock-in situations increases. Therefore, one can observe a pattern in Figure 7.1-34 similar to that in Figure 7.1-31.

Figure 7.1-35 captures a total number of merger and acquisition events in the system. Here, the behaviour of the EBO Model was anticipated by industry experts. A v>c constellation, with an oversaturation of vendor-agents in the system, counts for a greatest number of mergers and the v<c constellation, with an obvious lack of vendor-agents, counts for the least.

Figure 7.1-36 allows for conclusions with respect to the pace of merger and acquisitions events in the system. The constellation with equal number of vendors and agents provides the most stable environment for vendor-agents. It takes 24 tick for v=c constellation to reach the cumulative frequency mark of 0,8 whereas it takes only 15 and 16 ticks for v<c and v>c constellations. the end nearly the whole vendor population has undergone mergers in any of the tested constellations.

7.1.2.2 *Multisourcing*

According to the new paradigm of multisourcing it is generally best not to outsource all IT functions to one supplier. Over dependence on one service provider can make costs and risks of moving to another supplier unacceptably high. The ability to switch suppliers can be critical in such circumstances. Apart from the mentioned strategic advantage the paradigm of multisourcing promises best of breed providers and higher cost savings rather than singlesourcing alternatives. In order to test this hypothesis a set of simulation with varying number of maximum allowed relationships per agent was run. Figure 7.1-37 captures average savings in percent (sum of all skill sets in FSU_{aent} was taken into account) under various relationship constraints. The maximum number of simultaneous relationships varied from 1 to 7. Each constellation consisted of two runs – one where both client types – vendor and agents – were limited in capacity and another run where only clients were limited in capacity.

Figure 7.1-37: Correlation between increasing number of simultaneous relationships of the client with cost savings of the client.

Figure 7.1-37 constantly exhibits a higher savings for simulation runs with higher number of allowed simultaneous relationships. Also, overriding the capacity constrains for vendor-agents delivers higher savings. The less simultaneous contracts a vendor-agent can maintain, the less economies of scale can that vendor-agent experience.

As was already mentioned in the interviews by the industry experts the size and length of the average outsourcing deal has plummeted over the past decade, regardless of the size of the company. There are many reasons for this including the trend toward selective outsourcing and the growth in business process outsourcing deals, which tend to be much smaller than the infrastructure engagement of their predecessors. Figure 7.1-38 provides an array of rule activations for simulation runs with varying contract length [10, 19]. Each dataset was obtained as an average of 20 simulation runs with identical parameter settings.

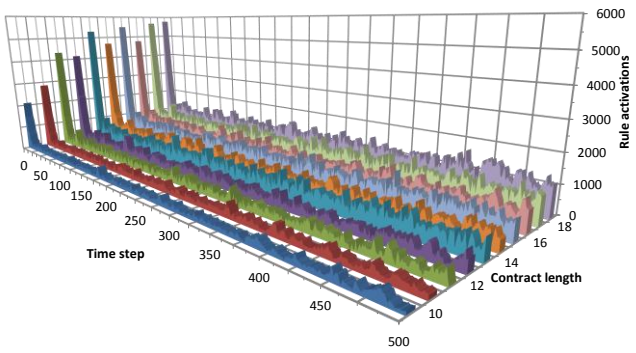


Figure 7.1-38: Correlation of administrative effort and contract length (proxy by number of rule activations).

The number of rule activations in Figure 7.1-38 serves as a proxy for administrative efforts depending on the length of the deal. Even though the curves depict the rule activations of the whole system, in conjunction with analysis of the verbal simulation's output, the increase in activity can be clear attributed to the increase of few rules specific to the issue. Figure 7.1-38 makes it evident that the base level of rule firings increases with the length of the contract. This result was sound with stakeholders experience but in contrary to the author's expectations. The author expected that due to shorter contract duration the number of bids and therefore the number of rule activations overall will increase. However, the analysis of the verbal output provides evidence for stakeholders' statement. The longer contract period entails more frequent re-evaluations of the existing contracts and eventual renegotiations or even premature terminations. These processes are responsible for a great amount of rule activations in the system.

While investigating the financial effect of the multisourcing and singlesourcing on the agents' performance it is not enough to look at the aggregated performance metric but necessary to perform a fine grained analysis with respect to the outsourcing degree[116] of client-agents. While some clients source from multiple suppliers they still can have a smaller outsourcing degree than agents outsourcing from a fewer suppliers. Thus the length of the skill set chain that is obtained from any provider in a single contract is of importance for the consideration here. Figure 7.1-39 provides a correlation between the side of the deal (number of skill sets in a single contract) in a client-agent's RfP and the number of bids (responses from providers). Each values represents an average of 20 simulation runs with identical parameter settings.

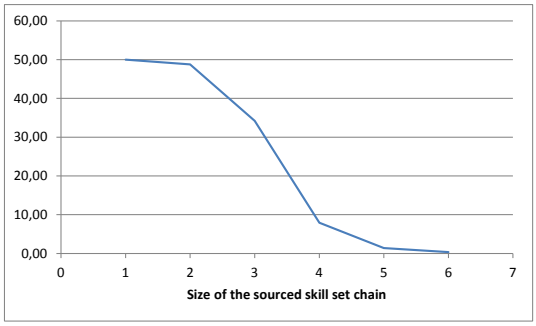


Figure 7.1-39: Correlation of the number of bids for a deal to the deal size.

From Figure 7.1-39 it is obvious that deals consisting of one and two skill sets can be services nearly by the whole vendor-agent population without any difficulty. However, beginning with three and more skill sets in a single contract the number of vendors being able to provide a bid diminishes dramatically. None of vendor-agents cold answer a request of six skill sets in a single contract.

7.1.2.3 *Disasters*

According to industry experts domestic vendors were are affected by geopolitical disasters to a much lesser extent rather their nondomestic rivals. While it is possible to have natural and geopolitical disasters in the developed countries, and it is certainly a fact that some of these events take place on a regular basis – recent flooding in New Orleans, hurricanes Texas, spring floods and recent heat waves in Europe – the amount and the aftermath is however negligible. Partly this is to explain with lesser magnitude and dimension of events and partly with better preparation, infrastructure and disaster prevention and recovery management.

[116] The term outsourcing degree refers in this case to the proportion of the number of sourced skill set by a client in relation the number of his base scope of the FSU_{client}.

The aforementioned statement of interviewed stakeholders was put to a test with a special parameter exploration setup of the EBO Model. A series of simulation runs with varying probability of geopolitical events was conducted. Each series consisted of five settings with *P* being a probability of geopolitical event taking place in the system and $P_1 > P_2 > P_3 > P_4 > P_5$ with 20 simulation runs each. Figure 7.1-40 captures cumulative frequencies for these five parameter settings.

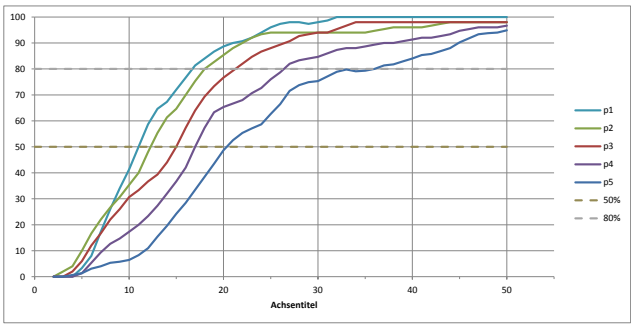


Figure 7.1-40: Cumulative frequencies for mergers with varying probabilities of geopolitical events.

It is evident from Figure 7.1-40 that the pace of merger activities in the system is accelerating with the increasing probability of geopolitical events. The analysis of the verbal output provides an explanation for the behaviour observed. The performance of non-domestic vendors is heavily affected by the geopolitical events. A client-agent leaves a negative endorsement track record for both, a country and a vendor itself if a geopolitical event takes place. With increasing number of such events the track records of client-agents become too negative with respect to either provider-agents or countries of provider-agents origins (which is evaluation-wise equally bad). This weakens the position of non-domestic vendors making them an easy prey for hostile takeovers or acquisitions.

7.2 Micro Perspective

Previous sections have shown that new era of outsourcing shall be considered a risky practice with significant hidden costs and countless traps for some clients. At the fore of this burgeoning trend are multisourcing and vendor consolidation arrangements. The macro perspective view in section 7.1 showed the global effects of micro decisions made by stakeholders on the operational level by discussing the simulation output in relation to aggregated agency. It exemplified the impact of purchasing decisions that are influenced by shared language, culture, history and new paradigm of multisourcing. Current section deals with simulation output on the individual level by analysing simulation excerpts for vendor- and client-agents respectively. The simulation's verbal output for a particular agent can be seen as a story line of that agent during his "life" and allows for inspection

of agents' cognitive processes on the micro level of observation. Thus, the analysis of verbal simulation output unfolds how aforementioned decisions sprout on the micro level. The simulation runs for the micro perspective analysis were conducted with 500 vendor-agents and 1000 client-agents.

In the following, section 7.2.1 deals with an excerpt for a single client-agent exemplifying clients' processes of vendor selection and relationship management in the multisouricng environment. Section 7.2.2 deals with M&A processes of vendor-agents by illustrating excerpts exemplifying M&A drivers and an excerpt demonstrating the M&A process from an acquiree's perspective.

7.2.1 Clients

The excerpt discussed in this section concentrates on a particular stage in *cleint-103*'s life regarding the processes of received RfPs evaluation conducted by that client-agent. For clarity purposes and due to the space constraints an abridged version of the excerpt discussed here is provided in Appendix A (see excerpt 6).

7.2.1.1 *Client's "life"*

Table 7.2-1 depicts *client-103*'s actions during the whole simulation run of 500 time steps[117]. The names of the rules are self-explanatory. It is evident from the table that the rules *select-endorsement-values*, endorse-vendor-above-average-size, *endorse-vendor-internationaly-active*, *endorse-vendor-cheaper-than-own-production*, *endorse-vendor-chepest* and *endorse-vendor-below-market-averagehave* the highest number of activations. These circumstances portray the adaptive calculus of a client-agent and a burden of logistic tasks entailed by the multisourcing environment as was shown in section 7.1.1.6.4 previously. In general, client-agents enjoy steeper increase of activity rather than vendor-agents. The increase in concurrent transactions causes various requests for proposals and an overhead of administrative tasks intrinsic to and ongoing relationship (i.e. evaluation of the transaction, renegotiation, etc.). These activities account for a high workload a client-agent has to cope with in a multisourcing environment. Also, high activation of *renew-contract-matured-inhouse*, renew-contract-matured-acquisition and *renew-contract-matured-cost-saving* mirrors the fact that the client-agent is involved in the bidding process frequently due to shorter contracts (finding which is sound with the mulisourcing paradigm).

[117] The time step does not carry a semantic meaning for the model. It is only used as a notion for the time component.

Rules	Number of activations
renew-contract-matured-inhouse	1138
renew-contract-matured-acquisition	1690
renew-contract-matured-cost-saving	1408
resolve-lock-in	310
endorse-vendor-domestic	656
endorse-vendor-non-domesitc	523
endorse-vendor-contracted-before	930
endorse-vendor-above-average-size	1428
endorse-vendor-internationaly-active	1293
endorse-vendor-cheaper-than-own-production	1185
endorse-vendor-chepest	1878
endorse-vendor-below-market-average	1654
chose-services-4-cost-saving	503
chose-services-4-acquisition	722
calculate-endorsement-values	879
select-endorsement-values	3237
select-contacts-partner-acquisition	305
select-contacts-partner-cost-saving	877
evaluate-contract-offers-acquisition	796
evaluate-contract-offers-cost-saving	167
find-business-partners	545
find-past-business-partners	1627

Table 7.2-1: The set of rules fired for the "client-103" during the simulation run of 500 time steps.

Rules	Number of activations
renew-contract-matured-inhouse	2643
renew-contract-matured-acquisition	2150
renew-contract-matured-cost-saving	2608
resolve-lock-in	6581
endorse-vendor-domestic	741
endorse-vendor-non-domesitc	967
endorse-vendor-contracted-before	902
endorse-vendor-above-average-size	888
endorse-vendor-internationaly-active	657
endorse-vendor-cheaper-than-own-production	808
endorse-vendor-chepest	528
endorse-vendor-below-market-average	208
chose-services-4-cost-saving	736
chose-services-4-acquisition	388
calculate-endorsement-values	1963
select-endorsement-values	1459
select-contacts-partner-acquisition	678
select-contacts-partner-cost-saving	473
evaluate-contract-offers-acquisition	446
evaluate-contract-offers-cost-saving	650
find-business-partners	727
find-past-business-partners	842

Table 7.2-2: The set of rules fired for the "client-217" during the simulation run of 500 time steps.

Exemplarily, Table 7.2-2 depicts the *client-217*'s actions during the same simulation run as the table above. Whereas *cleint-103* can be considered as a representative client-agent for a lock-in fee existence, *client-217*, on the contrary, is representative for client-agents that suffer severe lock-in issues. It is evident from the table that activations of *renew-*

contract-matured-inhouse, *renew-contract-matured-acquisition*, *resolve-lock-in* and *renew-contract-matured-cost-saving* by far outnumber any other rules. These rules are activated as a result of some cognitive processes of alternative considerations and revaluations a client-agent performs in his attempt to escape the lock-in state.

7.2.1.2 *Vendor Selection*

Whereas Table 7.2-1 depicts the *client-103*'s actions during the whole simulation run, the verbal output in excerpt 6 from Appendix A was selected with reference to vendor selection actions and intentions of that client. To begin with, the client-agent undertakes a self-assessment in order to determine which outsourcing strategy to pursue. After the strategy is set to cost saving he evaluates which skill sets shall be outsourced. The scan of the $FSU_{client\text{-}103}$ reveals several skill sets with production costs higher than the market average. In the case at hand *client-103* decides to outsource skill sets SS_{19} and SS_{20} with highest production costs (branches with greatest weighting in $FSU_{client\text{-}103}$). Consequently *client-103* issues an RfP with regard to required skill sets SS_{19} and SS_{20}. The response rate on the issued RfP is rather good with 32 vendors' bids. From that supply base a specific subset of suppliers which will fill the demand for advertised skill sets and, at the same time, fulfil the specific requirements of the client-agent must be determined.

The first purge of the vendor bids is conducted with regard to the price of the service delivery. Vendors with prices above market average are eliminated from the shortlist first. Since all remaining bids meet the objectives regarding the cost other objectives of the firm are considered by the *cleint-103*. While the supplier's price quote is important, buying firms also emphasize criteria related to size, international operations and domestic locations of the vendor. According to the fieldwork evidence client-agents are endowed with rules that favour internationally active vendors (cf. section 7.1.1.4.1). This is the reason why *client-103* ranks *vendor-79*, *vendor-150*, *vendor-24*, *vendor-20*, *vendor-159* and *vendor-282* lower rather than their peers. Besides the preferred requirement of vendors to be active on the international arena, the origins of the company play a pivotal role in the vendor selection process too (cf. section 7.1.1.4.2). The clients' logic is biased towards collaboration with domestic vendors. A client is reluctant to enter into an outsourcing agreement with some non-domestic vendor for fears over language barriers, cultural barriers, and losing intellectual property (cf. chapter 4.5.5). Being a better fit regarding the price, size and international operations *vendor-112*, *vendor-232*, and

vendor-19 are still ranked below domestic *vendor-221* and *vendor-172*. Once the final supplier is determined, *client-103* makes the contract offer and seals the deal with *vendor-211*.

7.2.2 Vendors

This section provides simulation output excerpts that exemplify merging dynamics in the vendors' network. For clarity purposes and due to the space constraints an abridged version of the excerpts discussed here is provided in Appendix A (see excerpts 2, 3 and 4).

7.2.2.1 *Acquisition drivers*

This section provides three excerpts for vendor-37, vendor-53 and vendor-77 that exemplify each of the M&A drivers in the model. From the excerpts presented here it becomes manifest how vendors' gradually build up their "empire" in a natural way, namely through mergers impelled by necessity of service delivery. The M&A strategies in EBO Model can be divided into the three distinct groups:

1. *Same geographies, new services* (excerpt 2 in Appendix A)

   This option is chosen by vendor-agents in case new skill sets are required. With this strategy the acquisition of another competitor with additional skill sets to these of the acquirer has priority. Whether acquiree has additional international operations is subordinate.

2. *New geographies, same services* (excerpt 3 in Appendix A)

   This option is chosen by vendor-agents in case the field of international operations has to be extended. Evaluation of potential acquirees is conducted with regard to additional international operations to these of the acquirer. The strategy can be achieved via the following two operations:

   a. Acquisition of competitors abroad
   b. Acquisition of customer base abroad

3. *New geographies, new services* (excerpt 4 in Appendix A)

   This option is chosen by vendor-agents in case the field of international operations and FSU of the acquirer have to be extended. Evaluation of potential acquirees is conducted with respect to additional international operations and skill sets to these of the acquirer. The strategy can be achieved via the following two operations:

   a. Acquisition of competitors with new skill sets abroad
   b. Acquisition of customer base abroad (partial fulfilment of the strategy goals)

Acquisition of a competitor always entails potential increase of the acquirer's client pool. Customers of the acquired vendor-agent become by default acquirer's clients. The following excerpts make good examples of vendor agents' M&A drivers for their aggressive acquisition behaviour. The acquiring agent decides to make an offer only after a careful evaluation of international operations and service offerings.

The excerpt 2 in Appendix A demonstrates the M&A activities and intentions of *vendor-37* to extend his portfolio of offered services while remaining active in same geographies. The excerpt starts in the setting where *vendor-37*, a vendor-agent with excellent financial track record, is constantly lacking new contracts for several simulation steps. The vendor-agent notices an increased number of RfPs for certain services where he is not able to bid due to absence of required skill sets in the $FSU_{ven\text{-}37}$. Consequently, *vendor-37* decides to obtain lacking skill sets through an acquisition of a competitor. Possession of additional international operations by acquirees is subordinate in this case.

A self-assessment conducted by vendor-37 reveals a strong financial track record that allows him for acquisition of another competitor. The vendor-agent scans the market on available M&A offers. While querying the market *vendor-37* already preselects offers that fulfil the above criteria – vendor-agents with additional skill sets irrespective of additional international operations. Consequently, bids are submitted to all vendor-agents found by the search. Acquirees, in their turn, evaluate *vendor-37*'s bids according to their criteria (cf. section 7.2.1.2) and either agree or reject the bid. Agreed bids are prioritised by *vendor-37* – since all respondents cover the scope of required services already, acquirees are ranked regarding further additional services and international operations. After sealing the deal with vendor-137 the $FSU_{ven\text{-}137}$ is scanned for additional services and cheaper production costs with subsequent update of $FSU_{ven\text{-}37}$ with new information. All updates in $FSU_{ven\text{-}37}$ are inherited by members of the *vendor-37*'s M&A network.

The excerpt 3 in Appendix A demonstrates the M&A activities and intentions of *vendor-53* to expand his geographic footprint without changing his portfolio of offered services. The excerpt starts in the setting where *vendor-53*, a vendor-agent with excellent financial track record, is constantly lacking new contracts for several simulation steps. The vendor-agent notices an increasing number of rejected bids. From the submitted 7 bids on RfPs for skill sets that are contained within $FSU_{ven\text{-}53}$ all bids were rejected. According to the implemented logic *vendor-53* concludes that his international operations are positioned

weakly. Consequently, *vendor-53* decides on expanding his geographic footprint by acquiring a competitor in the foreign geography. Possession of additional skill sets by acquirees is subordinate in this case.

A self-assessment conducted by *vendor-53* reveals a strong financial track record that allows him for acquisition of another competitor. The vendor-agent scans the market on available M&A offers. While querying the market *vendor-53* already preselects offers that fulfil the above criteria – non-domestic competitors irrespective of additional skill sets. Consequently, bids are submitted to all vendor-agents found by the search. Acquirees, in their turn, evaluate *vendor-53*'s bids according to their criteria (cf. section 7.2.1.2) and either agree or reject the bid. Agreed bids are prioritised by *vendor-53*. Since all respondents are already located in foreign geographies the coverage of services in the $FSU_{ven\text{-}53}$ is used for ranking. Additional services of acquirees are rated positive only in case of a full coverage of services in the $FSU_{ven\text{-}53}$. After sealing the deal with *vendor-146* the $FSU_{ven\text{-}146}$ is scanned for additional services and cheaper production costs with subsequent update of $FSU_{ven\text{-}53}$ with new information. All updates in $FSU_{ven\text{-}53}$ are inherited by members of the *vendor-53*'s M&A network.

The excerpt 4 in Appendix A demonstrates the M&A activities and intentions of *vendor-77* to extend his portfolio of offered services while also expanding his geographic footprint. The excerpt starts in the setting where *vendor-77*, a vendor-agent with excellent financial track record, is constantly lacking new contracts for several simulation steps. The vendor-agent notices an increased number of RfPs for certain services where he is not able to bid due to absence of required skill sets in the $FSU_{ven\text{-}77}$ (16 skill sets in total). The situation is aggravated by a constantly increasing number of rejected bids. From the submitted 28 bids on RfPs for skill sets that are contained within $FSU_{ven\text{-}77}$ 25 bids were rejected. According to the implemented logic *vendor-77* concludes that apart from missing skill sets his international operations are positioned weakly. Consequently, *vendor-221* decides on expanding his geographic footprint and services portfolio by acquiring a competitor with additional skill sets in the foreign geography.

A self-assessment conducted by *vendor-77* reveals a strong financial track record that allows him for acquisition of another competitor. The vendor-agent scans the market on available M&A offers. While querying the market *vendor-77* already preselects offers that fulfil the above criteria – non-domestic competitors with additional skill sets.

Consequently, bids are submitted to all vendor-agents found by the search. Acquirees, in their turn, evaluate *vendor-77*'s bids according to their criteria (cf. section 7.2.1.2) and either agree or reject the bid. Agreed bids are prioritised by *vendor-77* regarding the number of additional international operations and skill sets an acquiree possesses. After sealing the deal with *vendor-176* the $FSU_{ven-176}$ is scanned for additional services and cheaper production costs with subsequent update of FSU_{ven-77} with new information. All updates in FSU_{ven-77} are inherited by members of the *vendor-77*'s M&A network.

7.2.2.2 *Merge or not to merge*

In contrary to the previous section, which provides excerpts from the perspective of acquiring vendor-agents, the current section provides an excerpt from the perspective of a vendor-agent that is acquired. The excerpt 5 from Appendix A shall emphasize the M&A activities and intentions of *vendor-221* while trying to improve his financial situation. First, *vendor-221* considers an option to acquire a competitor but after evaluation of own financial situation he decides to be acquired himself.

The excerpt 5 starts in the setting where *vendor-221*, a vendor-agent with mediocre financial track record, is constantly lacking new contracts. The vendor-agent notices an increased number of RfPs for certain services where he is not able to bid due to absence of required skill sets in the $FSU_{ven-221}$. The amount of these RfPs is, however, negligible in comparison to the constantly increasing number of rejected bids. From the submitted 5 bids on RfPs for skill sets that are contained within $FSU_{ven-221}$ all bids were rejected. According to the implemented logic vendor-221 concludes that apart from missing skill sets his international operations are positioned weakly. Consequently, vendor-221 decides on expanding his geographic footprint and services portfolio by acquiring a competitor with additional skill sets in the foreign geography.

First, *vendor-221* conducts a self-assessment with respect to his financial stability. In this step the vendor-agent evaluates whether he can afford an acquisition of another vendor on the basis of his assets. The evaluation reveals that *vendor-221* does not possess the financial power to sustain an acquisition of a competitor. Subsequently, *vender-211* decides for an M&A strategy to be acquired by another competitor. It is a rather passive strategy where *vendor-221* does not proactively seek for potential opportunities but issues an M&A readiness message on the market and waits for incoming bids.

When bids are received, these are ranked according to agent specific criteria like size (M&A and client networks), ethnicity and variety of international operations of the acquiring vendor-agent. The importance of each characteristic is agent specific and is implemented via endorsements. In the case at hand, *vendor-221* rejects the M&A offer of *vendor-291* due to small size and ethnicity of *vendor-291* which is the same as that of *vendor-221*. The M&A process is designed to allow for only one M&A offer to be accepted. Thus, *vendor-221* has to choose between *vendor-119* and *vendor-117*. In that comparison *vendor-119* wins due to bigger size and broader coverage of international operations.

Final stage of the M&A activity is similar to that depicted in section 7.2.2.1. The acquiring vendor-agent scans $FSU_{ven\text{-}119}$ for any additional services and cheaper price transitions to these in $FSU_{ven\text{-}221}$. In case new and cheaper skill sets are found, the $FSU_{ven\text{-}119}$ is updated accordingly. After the transfer of new skill sets to $FSU_{ven\text{-}119}$ is completed, new changes are inherited to all members of the *vendor-119*'s M&A network. In that backward update *vendor-221* inherits 8 new skill sets and 17 transitions from the $FSU_{ven\text{-}119}$.

7.3 Conclusion

This chapter investigates simulation results – model behaviour patterns and model results – of the EBO Model described in chapter 6 of this thesis. Some of the research questions were best addressed through a statistical analysis of simulation's quantitative output whereas others were best addressed through an interpretative analysis of the simulation's verbal output. In the simulation experiments reported in this chapter, a focus lied on the socioeconomic stressors on vendors and clients in the context of multisourcing environment. The results strongly demonstrate how agent-based models like the one presented can assist in better understanding the interplay of processes representing multiple dimensions of the investigated system. These include concomitants of multisourcing, geopolitical factors and effects of clients' strategies regarding vendor selection, namely favourisation of domestic and internationally active vendors, on M&A dynamics of the suppliers' network and monopolisation issues in that network. Further, the revert impact of M&A activities in the vendors' network on clients in the simulated population was explored.

It was shown that even the simple framework, namely that of two interacting agent types, can already give rise to a rich set of behaviour patterns. It is surprising how much

of the real world artefacts have been reproduced by the EBO Model's artificial society (see Figure 7.3-1). From a limited amount of rules for both agent types arose a society with complex behaviour of actors resembling characteristic templates of their counterparts in the real world. Simulation results have closely replicated the behavioural patterns recognized by the involved practitioners and the stylized facts that came from the fieldwork. Figure 7.3-1 builds a thematic interconnection of EBO Model's simulation results with corresponding sections of the current chapter.

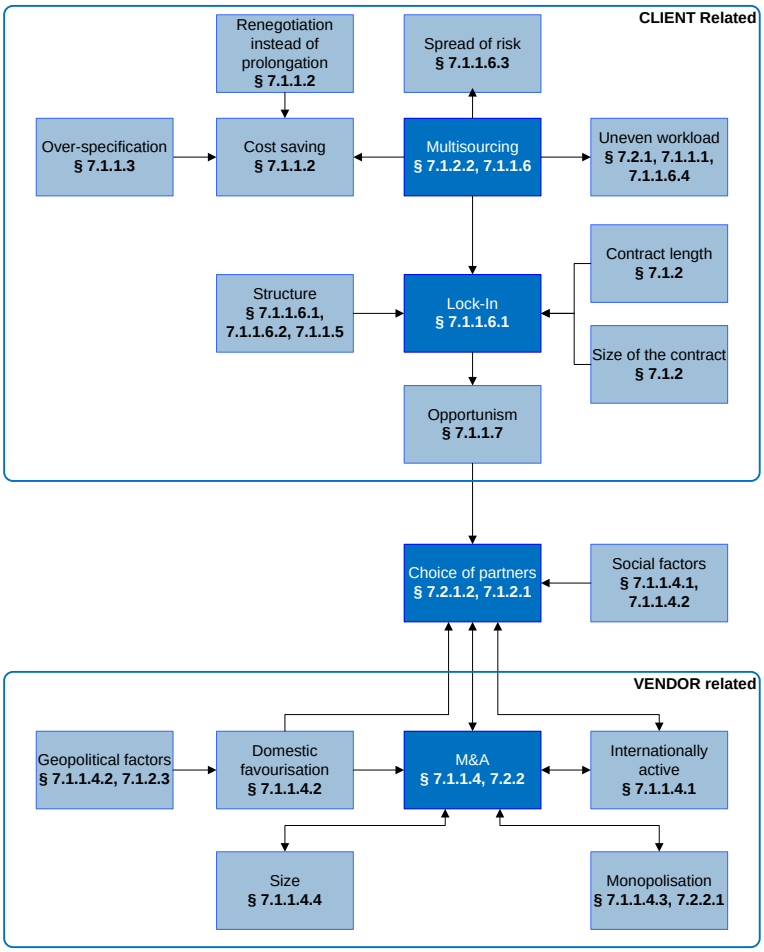


Figure 7.3-1: Coherence graph of topics from the investigated domain covered by the EBO Model.

The analytic and numerical analysis of the EBO Model provides several managerial insights. These were described together with the appending findings in the corresponding chapters (see Figure 7.3-1). There are several directions for future research that stem from the results presented in this chapter. Some contributions of the conceptual nature together with directions for further research are discussed in chapter 8 at length.

8 Reflections and Directions for Further Research

"By three methods we may learn wisdom: first, by reflection, which is noblest; second, by imitation, which is easiest; and third, by experience, which is the most bitter."

Confucius

Chinese philosopher (551-479 BC)

The simulation results of the TCT and EBO Models and implications of these results regarding the outsourcing policies were discussed directly in the chapters 5 and 7. Thus, the current chapter deals with reflections on the data collection methodology outlined in chapter 3 and presents implications for evidence driven ABSS with respect to modelling of complex systems. This draws on research conducted with both models and indicates the limitations as well as possible extensions of the current research.

The chapter is organized as follows. Section 8.2 contextualizes issues the project encountered in the collaboration with involved stakeholders whilst eliciting evidence and translating the qualitative and quantitative data into both models. Furthermore, the section reflects on the outcomes of the stakeholder involvement, and positions the contribution to knowledge of this research in terms of participatory methodology outlined in chapter 3. The section puts forward some recommendations regarding the implications for the methodology of the participatory approach. Section 8.3 enlightens particular strengths and weaknesses of the chosen evidence driven ABSS approach outlined in chapter 3 that came to daylight in the course of the model development. This section also reviews implications of the current research for evidence driven ABSS with respect to the relationship between declarative and procedural paradigms and their interoperability. Section 8.4 discusses the limitations of the research arising from collaborative research with stakeholders and tools deployed for modelling. Section 8.5 examines possible extensions of the EBO Model regarding areas deserving further investigations. Finally, section 8.6 concludes with a summary of the main contributions of the thesis at hand reflecting on the research aims outlined in chapter 1.

8.1 Reflection on the Contributions of Research

As stated at the beginning of this thesis the overarching vision of the research at hand is to contribute to the development of research methods for understanding uncertainty in

IT outsourcing projects – in particular those that arise from social interactions, or within organizational contexts of financial institutions. The thesis has produced a constructive demonstration of modelling procedures for the formation of social policy in conditions of uncertainty due to complexity. The author offers the case study of his research as an example of a generalised approach that can be utilized to examine different aspects of organisational change. In retrospect, the thesis contributed to the fields of economic theory, research methods and methodological tools for practitioners:

Theory

- This thesis increased rigor in theory by introducing a new approach to characterising the term asset specificity. This crucial for the concept of TCT but ill-defined construct received precise statements trough formalism of ABSS models. At first, the issue of asset specificity was investigated through fieldwork interviews. These interviews made evident that involved practitioners were talking about asset specificity as a kind of metric using the language of TCT but without deep understanding of the underlying concept. Consequently, the issue of asset specificity was investigated by means of modelling. The models developed in the course of the thesis helped to formalize what stakeholders really meant by referring to the equivocal term of asset specificity. Thus, the suggested approach grounds on and relates better to how practitioners make decisions as to IT outsourcing and avoids the issue of subjective valuation that is inherent to the term of asset specificity within the TCT context.
- Both models developed in this thesis helped to identify potential disconnections between formal theory and real world. Asset specificity, being the central indicator for dependency issue between buyer and provider of services in TCT, was scrutinised by means of models stemming from evidence. It was found out that low asset specificity does not indicate fewer dependencies and thus fails as a sole indicator to predict dependency issues. This points to difficulties in the use of specificity measures within TCT for predicting whether IT outsourcing might be straightforward.

Research method

- In the course of the thesis a method was developed that facilitates stakeholders' participation in all stages of modelling. A tight link with involved domain experts was maintained beginning with data collection stage trough the design stage and finally until programming and validation stages. As a result, models were developed where

stakeholders could relate to agents. That made the simulation results credible for practitioners, who came to participate in this research with sceptical views. The virtue of such models is that they are not giving answers but, what is more important, produce further questions that have not been considered by stakeholders or researchers before. The EBO Model demonstrated the aforementioned effect by heated debates between subject matter experts during the presentation of simulation results.

- Further, it is shown that rapid prototyping of agent-based "mock-up" models can greatly improve the elicitation of evidence. This, in turn, increases the level of realism of final models in the corresponding domain. The research method suggested by this thesis is not simply applying the evidence based ABSS methodology to the issue but, what is qualitatively different, creates a tight link between developed models and involved stakeholders. Stakeholders, being able to closely follow how their feedback was incorporated into the agents' reasoning (via discussions upon "mock-up" models), could relate closer to the model than otherwise.

Tools

- The EBO Model provides a decent view of the various social elements in the problem setting of outsourcing. So far the tools deployed by practitioners fail to explore and capture important sources of complexity such as heterogeneity and interdependencies. The involved practitioners unequivocally rated these factors of paramount importance for success of outsourcing. The thesis presents a tool that allows practitioners to explore possible decision rules and outcomes regarding IT outsourcing domain.

The research also provided an ample evaluation of ABSS effectiveness for business use. The evaluation made very clear that, from stakeholder's point of view, despite achieving desired results the processes of model development and extraction of results are still tedious, theoretical and slow. Thus, stakeholders do not feel comfortable yet with the kind of model handling the ABSS offers. The thesis suggests several improvements in the model development process that seek to mitigate this issue. However, all suggested improvements will bring their potential to bear only under a strong academic supervision and guidance.

8.2 Reflection on the Stakeholder Participation

The two shining beacons of success in the stakeholder participation are retention of stakeholder's interest and involvement throughout the whole span of the modelling activities and achieved advancements in the formalisation technique of anecdotal evidence. As a result of these achievements a simulation agent entity could be designed that involved stakeholders could relate to. This section provides a constructive demonstration of modelling procedures for the formation of social policy in conditions of uncertainty due to complexity. The demonstration entails the discussion of modelling procedures used in the development of the TCT and EBO Models regarding the stakeholder interactions.

8.2.1 Clarification of Expectations

One factor that influenced stakeholders' participation degree is the author's affiliation with a consulting house in the final phase of the PhD research. The researcher took up a role of a business consultant with emphasis on outsourcing strategy. Surprisingly, this circumstance of the fact did not harm the collaboration with subject matter experts from other companies due to possible competition issues as was anticipated by the author. On the contrary, the affiliation with a consulting house made the researcher appear in stakeholders' eyes less as a "foreign body" but rather added substantially to fruitful collaboration in the validation phase of the fieldwork. The author attributes this reaction to the initial practitioners' anticipation of a discrepancy in their expectations and goals with these of researchers coming from an academic background. Stakeholders are not interested in theoretical contributions of the study or in possible advancements in ways how social phenomena can be modelled, but rather in the potential pragmatic contributions to their day-to-day activities.

Reflecting on the data collection stage, it can be stated that a substantial difference laid in the initial expectations and objectives of involved subject matter experts on the one hand and these of the researcher on the other. The author was not aware of the extent of that issue until the final presentation of the TCT Model results. The aforementioned dichotomy of interests becomes evident while recalling the stakeholders' feedback on the model results, as outlined in chapter 5. The TCT Model failed to take stakeholders' objectives into account despite fully meeting the academic research concerns of the author. Namely, the model reproduced the behaviour of agents that was sound with

theoretic postulates of TCT and offered an alternative measurement of the ill-defined term asset specificity. However, the behaviour of agents observed was not sound with that of involved stakeholders and the model failed to produce output relevant for policy makers in the outsourcing area, which was their main objective. An inconvenient side effect of that mismatch of goals was a strong fading of interest among involved subject matter experts.

The clash of expectations between the researcher and involved stakeholders was aggravated by the fact that the term “simulation” has a distorted meaning in the area of financial services. Vast majority of the interviewed stakeholders, independent of their particular job function, were all active in the financial sector. The world of finance makes an extensive use of forecasting software for financial markets analysis and alike and reserves the term “simulation” in that context. Thus, the author had to counter the initial stakeholders’ prejudice that models developed within the scope of the current research were able to forecast, not to mention, predict the future of particular outsourcing scenarios or policies.

In retrospective, a major issue that needs to be resolved in the forefront to any collaborative action is the consensus on common objectives between the researcher and involved stakeholders. Of course, the resolution needs to follow the project’s wider aims but shall lead to the satisfaction for both parties involved. Neglect of stakeholders’ concerns will certainly result in peril of losing valuable experts. After thorough consideration of desirable objectives from all involved parties a set of commonly agreed essential points of interest was established. Thus the EBO Model was set to explore the implications of the current tendencies in the outsourcing market – multisourcing and vendors’ consolidation efforts – on possible outcomes. This would produce policy implications on how to cope with rising challenges in the new outsourcing environment. The EBO Model aims to put outsourcing issues firmly on the policy makers’ “radar” by offering a tool that translates behaviour rules defined by the very same stakeholders into possible trajectories of outcomes. Lucas (2009) argues that normally agent-based models do not go beyond illustrative purposes. In the case of EBO Model exactly that illustrative character of the model was helpful for involved stakeholders to understand the links between the meso-level actions and macro level effects of these actions.

If involved stakeholders cannot identify themselves with the model, only findings from analysing empirical evidence are usually trusted as useful. This issue is well documented by juxtaposing the development process of the TCT and EBO Models. As described above the former model failed to capture the agents' behaviour in a way familiar to involved stakeholders and therefore caused identification problems among stakeholders with the model. This result not only showed that TCT does not picture the facets of decision making in the outsourcing context to the full extent but also revealed the reaction of stakeholders on the model that they could not relate to. The main focus of stakeholders' attention shifted to the empirical evidence being gathered during the fieldwork instantaneously. This state of affairs turned upside down during the development of the EBO Model. The interest in statistical analysis of empirical data was still present but faded into the background in comparison to the interest in simulation results. The author believes that the aforementioned identification issue can be alleviated to a great extent via strategically well setup participatory approach. The benefits of this cooperation include the closer linkage of domain experts to the model itself and the qualitative validation of the model at a micro level.

8.2.2 Circumventing the scepticism

The researcher's intention was to validate both models developed in this thesis qualitatively at a micro level. The micro level validation amounted to confirmation by stakeholders and domain experts that events emerging during simulation runs as described by narrative traces were plausible. This type of validation is not uncommon in the evidence based modelling (cf. CAVES, 2006a, 2007b, 2008b). Novel, however, is the fact that the validation of the EBO Model was taken to an even further level via direct engagement of stakeholders in model development process. After numerous interview sessions with industry representatives the researcher is of a strong opinion, that a standard approach of interviews with subsequent presentation of models incorporating translated evidence from these interviews is not capable of spurring a sustainable interest level of stakeholders. This approach simply misses a crucial chain link in the participatory approach of model development – involved stakeholders cannot observe and follow how information supplied by them gets incorporated and translated into the model. If one cannot control and understand how one's information is getting processed, the simulation outcomes automatically loose on trustworthiness.

It was hard to get an “open ear” on the side of subject matter experts at the beginning of the fieldwork. A great hurdle was composed by the scepticism toward the deployed research tools – despite the wide use of the notion of simulation in the financial sector, simulations as such didn’t seem to belong to an arsenal of versant tools used by the interviewed peer groups. Being used to traditional approaches like spreadsheet regression analysis or even system dynamics (and other derivates of business modelling techniques relying on sets of differential equations) involved stakeholders were first reluctant to accept the bottom up approach of individual and interacting agents. That approach represented an unusual take for the stakeholders’ world of global equations with the top down thinking. As indicated at the beginning of this section a great progress in stakeholders’ acceptance of the ABM technique could be achieved with hands-on experience of experts during the design of simulation agents’ behaviour. It was an insightful experience for involved domain experts to witness how rules defined in the interview sessions are translated into the simulation and lead consequently to the aggregated behaviour patterns they were familiar with. After the researcher has overcome the initial scepticism of interviewed practitioners (chronologically set in the middle and towards the end of the fieldwork) the interest in the research started to increase rapidly. The interviews got longer and the peer groups of involved domain experts were not only retained in size but even increased towards the end of the field work.

One could argue that the intensified interest in the model results towards the end of research is attributed to the recent market turmoil. However, it shall be distinguished between the overall panicking of the finance world in the face of the recent events and the longstanding interests of the stakeholders. In retrospective, the author cannot confirm any dramatic changes in the zones of stakeholders' interests before or after the recession in 2008. It is evident, however, that the course of events changed the intensity altitude stakeholders devote to the investigation of their issues. This metamorphosis in thinking was clearly observable from the reaction of stakeholders, who remained in the peer group until the end of research. After described initial scepticism, a deeper reflection on the topic and final presentation of results made the stakeholders consider the issue of multisourcing from a different perspective. In conclusion, concentration on the following main areas helped to succeed in regard on stakeholder participation:

- *Identification with the model*

  Recognizing own behaviour patterns in these of actors in the model strengthened the link between the stakeholders and the model.

- *Emphasis on relevant areas*

  Understanding that the emphasis of the model touches own issues spurred further interest and participation of involved practitioners.

- *Qualitative evidence*

  It can be hardly neglected that the research that comprises data elicitation from several companies being active in the same field stimulates interest in the gathered qualitative data in terms of a possible insight into "competitor's head".

Next sections outline the modelling techniques and the approach that contributed to the fruitful collaboration with peer groups of experts involved in the research and development of both models presented in this thesis.

8.2.3 Iterative Interview Approach

Knowledge engineering doesn't necessarily end when development begins. Soon after initial interviews it was realized that in order to design a profound representation of the target system the modeller would need repeated interviews with the same stakeholder group, if feasible. This task, however, posed a great hurdle due to initial scepticism encountered in the experts' peer group (cf. 8.2.2). In order to stimulate a steady interaction with subject matter experts and reinforce their link to the developed models the author developed an interview schedule that satisfied both parties involved. An approach of the stepwise interview sessions proved to mitigate the aforementioned issues and made a virtue of necessity. This approach provided a steady supply of the researcher with new evidence by involving subject matter experts with preliminary results as the modelling advanced.

The author believes that an iterative approach to modelling is essential when modelling complex organisational or social structures. The process that has been utilized in the current thesis is a combination of agent-based social simulation and empirical research with iterative elements (cf. section 3.4). The iterative development of the prototype model (cf. section 8.2.6) allowed the analysis of preliminary results "on the go" and feeding the feedback of the analysis into the data collection for the development of more

elaborated model versions. However, it shall be acknowledged that subsequent stages of data collection may still fail to capture all the relevant information, resulting in further data collection and refinement of the model. During the development of the model, the limitations of existing data force the modeller to make assumptions, and these assumptions must be noted and addressed during the ongoing development. Thus, it is natural to adopt an iterative approach with respect to both modelling and data collection methodology. In a collaborative and iterative abstraction process with domain experts and stakeholders the researcher identified the decision dynamics regarding the maintenance of existing and acquisition of new contractual relationships on both sides of the negotiation table – vendors and clients respectively.

In terms of model development the iterative interview approach provided an important opportunity to test assumptions built into the models. Thus, the validation process could incorporate stakeholder interaction at a stage early enough to allow for valuable feedback to inform the model development. In the case of both models presented, the stakeholder interaction resulted in a revision of endorsements and elicited knowledge about vendor selection and management strategies. The declarative component, which focused on the contractual aspects (vendor selection, vendor management, contract negotiation, etc.), has been extended considerably in every subsequent interview. Through the confrontation of stakeholders with their own rules developed in previous interview sessions the process of knowledge elicitation was accelerated. Exemplarily, Figure 8.2-1 provides a rough sketch for the process of iterative interviews for the three hypothetic stakeholders. In the chosen approach there is a certain amount of blurring of data collection and analysis which do not have to be regarded as separate or chronologically ordered stages.

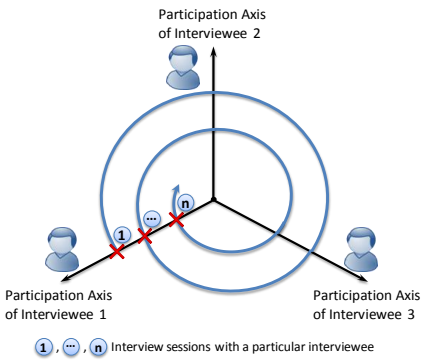


Figure 8.2-1: Iterative knowledge elicitation with three interviewees.

The first step has been to compile a list of all assumptions that have been applied in building the models. In the case of the TCT Model these were mostly theoretical assumptions and in the case of the EBO Model the assumptions stemmed mostly from various available case studies and researcher's suppositions. These lists were then discussed by all involved domain experts in subsequent interviews and enriched with comments and suggestions of what to change. The surveys and interviews undertaken provided ample evidence for realistic modelling of behaviour. Before the next iteration round could start, the refined assumptions had to be realized and implemented. This activity would close the first twine of the spiral in Figure 8.2-1. Moving further on the stakeholder's participation axis means repeated discussions of the results with the domain experts. The verification is conducted with the very same stakeholders that supplied the rules in previous interviews. It is argued that this iterative process of model development supported the identification of gaps in the available empirical data and thus guided the knowledge elicitation process in general and in an efficient manner.

Soon after initial interviews have been conducted it became evident that the information supplied by stakeholders exhibits a high degree of fuzziness and needs to be canalized and formalized not as a follow up but directly during the interview sessions. The fieldwork for knowledge elicitation was done in parallel with model development. This facilitated formalization of evidence with direct involvement of experts prior to computational implementation and inevitably shortened the number and the length of interviews that were necessary. Sections 8.2.4 and 8.2.5 outline that it was natural, convenient and effective for purposes of validation (Moss and Edmonds, 2005), elicitation of information and stakeholder interaction to model agents' behaviour declaratively with use of the endorsements concept (cf. section 3.2.5). It has to be admitted that the approach of iterative interviews worked well in the presence of an executable version of a mock-up prototype of a final model. Chapter 8.2.6 deals with advantages of early model prototypes that foster participative approach.

8.2.4 Declarative Approach

The interpretative analysis of the qualitative data by the researcher represents an *Achilles heel* in an evidence based ABM. It is difficult to analyse large amounts of non-standard

data produced by qualitative studies not being a subject matter expert[118]. The method of the content analysis studying the frequency of occurrence of key phrases in interview recording[119] delivers some viable results. However, this method still relies largely on the interpretative skill of the researcher. Also, one has to account for cases where transcripts or any recordings of the interviews are prohibited by the company's confidentiality policy. This was the case in majority of the interviews conducted within the scope of this thesis. Thus the stage of interpretative identification of key concepts and the relations between them bears danger of adding too much researcher's bias into the model. In the presented research it is believed to have alleviated the aforementioned issues to some extent due to the elicitation of qualitative data inspired by the declarative paradigm. Declarative paradigm is not presented as panacea but is discussed with respect to its advantages and disadvantages in terms of stakeholder interactions and model validation which became evident during the development of both models presented in this thesis.

The author concentrates on the assumed major advantage of declarative ABSSs, namely that they take the "narratives" of particular social situation more adequate into account than procedural implementations of the same social situation. The knowledge in the model is represented in a syntactical form which is easier to communicate directly with stakeholders and the results can be stored in a similar "narrative" format. This being the case would also justify a loss in computability efficiency (cf. section 8.4). In the course of the research the aforesaid assumption was tested on two different levels. First, the author scrutinised if social reality can be implemented less ambiguously (i.e. more evidence-oriented) and more straightforward (i.e. with less assumption laden constructs) by relying on declarative rather than on imperative programming. Second, the author investigated whether the suggested approach facilitates stakeholders' interactions.

The declarative storage of elicited information considerably mitigated difficulties in terms of information preparation and presentation, as the information stored in these systems is closer to natural description used by people[120]. This fact makes it easier for non-

[118] Admittedly, this issue gradually lost on importance as the author himself slowly become an expert in the field. Also the affiliation with a consulting house certainly added to diminishing importance of the issue. These reasons, however, are a particular artifact of the presented research and therefore are not considered in the argumentation.

[119] Widely used method in qualitative research.

[120] Here the term "declarative storage" refers to the rule like repository (*if-then-else* statements) of information. The translation of these rules into tool specific programming language is left out of

programmers and modellers to identify themselves with the model. Indeed, stakeholders could quickly adopt to rule design procedure as the vocabulary used stemmed from TCT and interviews. Noticeably, the involved subject matter expert found it more natural to think of agent behaviour, thus about their own behaviour, in terms of statements, conditions and consequents formulated in *if-then-else* rules than in terms of procedural blocks. Whereas procedural blocks required the experts to relate fragments of knowledge to each other, declarative representation relies on atomicity of each rule that allowed stakeholders to review rules independently. Figure 8.2-2 represents the symbiotic interplay of a declarative rule as implemented in JESS and as used on the stack cards during the interview discussions.

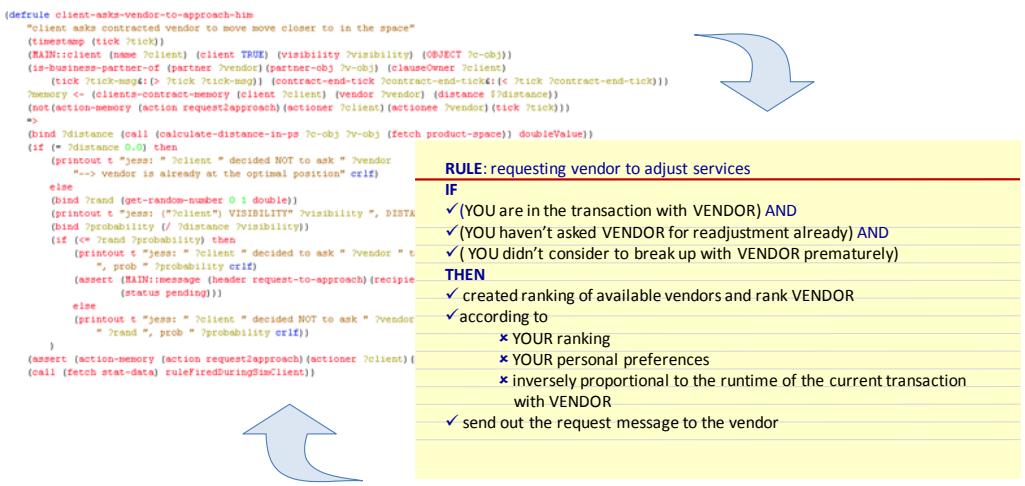


Figure 8.2-2: Stack card versus JESS rule.

Also in terms of capturing the social reality in an evidence-oriented way with less assumption laden constructs the declarative paradigm demonstrated superiority over imperative approaches. Information gathering and presentation of the rule-based systems (also referred to as expert systems in this context) is a well-studied topic. The implementation of the subject matter experts' knowledge in the TCT and EBO Model was efficiently translated into rules. Furthermore, the extraction and arrangement of the clients' and vendors' reasoning in the rule form simplified discussions about the model with people not familiar with it. This trait came to advantage at advanced stages of the field work since the stakeholder pool was subject to fluctuations and expended towards the end of field research (cf. section 8.2.1). It is believed to have contributed to minimize the ambiguity in the implementation of the social reality through the use of the modelling

consideration. This is a legitimate assumption since only the modeler deals with the technical translation of stakeholders' rule statements (this step is transparent for stakeholders).

technique that allowed for stakeholders' identification with agents in the model and constant re-evaluation of agents' behaviour rules developed together with the very same stakeholders.

Rule-like presentations of the cognitive aspects of the model increase comprehensibility and acceptance of the model by non-scientists. In each interview session stakeholders were confronted with an advanced version of the model they have been working before (cf. Figure 8.2-1). Thus each interview session was accompanied by a "warm-up" period where stakeholders had to understand and familiarize themselves with the enhancements of the model. The author argues that the obligatory warm-up period of each interview session could be limited to the minimum due to the rule-like presentation of information.

Having exposed the advantages attained with the declarative approach on the field of stakeholder interactions and evidence formalization it shall be mentioned that the computational implementation of interview materials was accompanied by an extra technical efforts involved in integrating the knowledge with the procedural (Repast agent framework) and declarative (JESS) tools. The deployed expert system for the declarative part of the implementation provides a powerful framework for building models and collecting and analysing results, but has a steep learning curve. The author does not consider this issue as an artefact of the presented research but sees roots of this issue in a wider area. Every declarative tool, known to the author, brings an own language that has to be cumbersome learned by the modeller. It should be added that a programming paradigm that rule-based systems varies significantly from any known imperative programming styles (i.e. structured, modular or object-oriented programming).

8.2.5 Endorsements

This section exemplifies the virtues of the used endorsement concept in conjunction with the declarative paradigm. While the latter allowed for faster and efficient agglomeration of rules, as indicated in the preceding chapter, another hurdle in the process of evidence formalisation laid ahead. Evidence denotes information about the target system that allows developing a representative model of reality that has to be somehow formalized. Like majority of agent-based models, same as in the case of TCT as well as EBO Model, interactions between at least two actors play a pivotal role for the simulation results.

Both models nourish their information demand on these interactions out of theories, case studies from the literature and interviews with experts and stakeholders. The conceptual and computational implementation of a process of reasoning about preferences and the establishment of a preferential ordering must be based on certain grounds. In the following it will be argued that endorsements represented an intuitive way of conceptually formalising reasoning about this knowledge or experience.

The technical advantage and limitations of endorsements are articulated in (Alam *et al.*, 2009). Here a methodical added value regarding the stakeholders' interaction is outlined. In the TCT and EBO Models the implementation of client- and vendor-agents as adequate representations of real world actors is enhanced by designing agents to perceive events specified by qualitative descriptions, maintain the qualitative terms during processing these qualitative perceptions and then act in ways that can be characterized qualitatively. Thus, the advantage in applying the idea of endorsements lies in the fact that they allow for combining the efficiency properties of numerical measures (that are relevant for technical implementation) with the richness and subtleties of non-numerical measures of interest or belief (cf. section 3.2.5). The interviews showed repeatedly, *exempli gratia*, that interview partners felt convenient to designate which property of the potential vendor they cared the most but were reluctant to put the number tag on it to express the importance.

The nexus between declarative representation of knowledge and endorsements as a representation of differentiated agents' behaviour offered a formalization medium of evidence supplied by involved experts. Especially the feedback obtained by the researcher on topics like choice of the contractual partner and contract performance evaluation entailed lots of fuzziness. To start with, all information on preferential ordering of stakeholders was widely scattered and had to be canalized in flowing interviews. The concept of Endorsements demonstrated its usefulness for conceptualizing the cognitive dimensional framework experts apply to reason about their environment and other agents. Endorsements have been used as a differentiated dimensional representation of agent behaviour in the presented models and allowed for homologue modelling. Since computational realization of endorsement concept implies a definition of the evidence-based reasoning endorsement schemes together with endorsement tokens, this process offered a systematic and efficient way of further structuring evidence from fieldwork

interviews. The process of developing a realistic endorsement scheme forced involved stakeholders to devise a portfolio of key features that they took into consideration in their decision-making procedure. Later these features represented the endorsement tokens.

Whereas a declarative type of modelling enabled easier implementation of evidence-based qualitative data into both models, endorsements provided a natural way to computationally capture the manner agents reason about this rich narrative qualitative data. The declarative representation relied on an endorsements mechanism (cf. section 3.2.5) in which tokens representing considerations of importance to stakeholders and their agent representations are partially ordered and then used to make choices. As mentioned earlier in the methodology chapter, unlike other simulation approaches, evidence-based modelling pursues constructive validity. Therefore it was highly prioritised in the modelling process that the structures and processes modelled resemble the processes and structures identified in the target system. The intensive use of the endorsements entailed a positive feedback not only for stakeholder interactions but for the enhancement of the endorsement concept on its own. In the course of the research, the original concept of endorsements was further developed and refined in collaboration with other researchers from Centre For Policy Modelling (cf. section 3.2.5). The suggested enhancements mitigate inconsistencies of the endorsement concept which became evident during the interview and modelling process, namely the lack of temporal dimension in data formalization and homogeneity of agents.

The author critically concedes that endorsements have limitations as representation of real world actor cognition (Werth et al., 2009). However, he strongly supports their efficiency in the analysis of emergent socialites in a variety of socio-economic contexts. As a concluding remark, endorsements in general provided a means for incorporating temporal and social aspects into the purely economic TCT Model and elaborated the social context of the EBO Model. The model representing a pure theory in *statu nascendi*, would not lend any insight into actors' reasoning process, whereas the use of endorsements helped to implement a reasoning process, which is close to the evidence provided by the interviewed stakeholders. In summary, endorsements in the models do not only provide a means to overcome statistical data scarcity, but in fact, offered a formalization medium for evidence from the simulated system and provided a basis for

the implementation of evidence-based reasoning schemes. Thus, it can be stipulated that endorsements formed a virtue of necessity for both models presented in the thesis. To conclude, endorsements shape the decisions on which the client- and vendor-agents base their actions. Therefore, the model's dynamics and structural outcome are to be seen as a direct result of the implemented endorsement schemes.

8.2.6 Prototype or not to prototype

The initial stage of the model development, prior to fieldwork interviews, has been affected by a lack of necessary data. This issue was inherent to the theory driven TCT Model as well as evidence driven EBO Model. This is an unavoidable complication when modelling complex social systems. These systems are not fully understood and, therefore, pose difficulties while building a model. Despite EBO Model being developed after TCT Model, the evidence requirements were different and therefore not all data was interchangeable between both models. The author took a decision to start with a fairly abstract model that captures the basic processes, nevertheless. In retrospective, the decision to formalize the interview results in form of rules with endorsements and incorporate these straightaway into mock-up models strongly defined the pathway taken by the research.

Defining the behavioural rules of the model actors during the interview sessions was definitely an unusual task for stakeholders with regard to interview techniques they were used to. However the initial curiosity about the interviewing technique was followed by dwindling of interest. The discussion and refinement of the behavioural rules by means of the simulation model with a live illustration of the consequences of these rules abode the interest levels and served as an additional "door opener" for further collaboration. Because of technical difficulties with the first version of the EBO mock-up Model the researcher was required to conduct some interview sessions without being able to present a running version of the model. During these sessions the rules were discussed only on the basis of a stack of cards with rules (see Figure 8.2-2). Juxtaposing these interview sessions with these accompanied by the running version of a mock-up model makes evident that the latter exposed a much higher level of active participation of the interviewed subject matter experts.

During the interviews a frequent stakeholders' expectation was the interviewer to tell the involved subject matter experts the kind of data that was needed. In the early stages of research the modeller, however, usually did not have a good answer to this question. Prior to the fieldwork the researcher was supplied with volumes of case study reports and various surveys on the comparable topics of investigation. It was expected to extract the initial knowledge autonomously. This task bears dangers of resulting in a waste of precious time as the information is widely scattered, disaggregated and does not directly help conceptualizing models. In the case of the TCT Model this issue was smoothed due to the theoretically driven approach. The initial batch of required knowledge could be extracted from the theory.

On the one hand any chosen theory constrains model design and implementation, therefore facilitating modelling and making it easier – recall the use of mock-up models based on the theoretic postulates of the TCT that could be developed speedily (cf. chapter 3.4). On the other hand the deployment of a theory can distort or ignore some important empirical evidence and therefore miss objectives – recall the objections of stakeholders with respect to the results of the TCT Model (cf. section 5.5). Though the model depicted a single point of researcher's interest but failed to capture stakeholders' objectives. However, the use of mock-up models helped to improve the acceptance of the research methodology by involved stakeholders. It can be argued that in cases where the field of investigation is unfamiliar it is beneficial to start with a theory, be it an own or adopted theory, and to substitute the parts of missing knowledge with the evidence as it becomes available along the way.

The author is of opinion that a significant improvements in the evidence driven modelling can be achieved if a regular interaction and feedback process between the involved parties can be established. For modellers it is a way forward to keep engaged in the fieldwork research already at early stages of model development, look at the problem with a breadth-first approach and develop an own general understanding of issues. A *quick-and-dirty* prototype model shall be developed at the earliest possible stage and then accompany the continual evidence gathering until an executable version of the proper model is at disposal. A running prototype not only can provide the fieldwork research with the answers of what is to be supplied for the modelling process, it also helps in mitigating the level of scepticism shown towards social simulation methods as

indicated in 8.2.2. The author advocates more effort from the social simulation community regarding novel approaches in engaging stakeholders in interaction if the community is to seriously pursue the goal of evidence-based modelling. The antediluvian survey techniques, as widespread as they are, do not engage the involved experts into cooperation to the level sufficient for modelling demands. The concept of stakeholder participation introduced in the preceding sections lead to some ramifications on the methods and percipience of the ABSS by both the researcher and the involved practitioners. These implications are discussed in detail in the next section 8.3.

8.3 Implications for Evidence-Driven ABSS

The model presented in this thesis makes several important contributions in social simulation. The term of ABM represents an umbrella concept which encompasses many different developments that have been going on under its slogan in variety of disciplines like complexity science, AI, game theory, etc. Still, the area lacks on universally accepted definitions and researchers' debate on properties an agent has to have. This thesis is not going to add to plethora of already existing definitions but would like to stress out the features of the modelling approach with decentralized entities that were of benefit while investigating the target system, namely the outsourcing market. In the conventional model design researchers try to identify universal principles and processes of the investigated system which they formalize in the form of models first. Consequently, the models attained, are in turn used within the simulation process in order to receive new cognitions (Becker *et al*., 2005). Deployment of the evidence driven modelling approach requires constant cross-validation with stakeholders and domain experts in both aforementioned stages. Thus, having a tool which will enable better cross-validation will increase model credibility. The current section suggests how ABSS can be useful to achieve that goal.

One of the objectives for the research was to investigate the theoretic concept of TCT and produce some findings that would be useful to stakeholders. This section reflects upon the implications of the model results, in terms of the modelling methodology, on the ABSS. Section 8.3.1 discusses the methodological fit of ABSS for outsourcing research. Whereas section 8.3.2 deals with limitations and shortcoming of the social simulation regarding the stakeholders' expectations. Section 8.3.3 outlines how the ABSS concept can be utilized for formalization purposes and thus enhances the participatory research.

Finally section 8.3.4 provides an overview of the concept that makes use of both, procedural and declarative modelling techniques.

8.3.1 ABSS and Outsourcing Research

Relationship Management is steadily becoming recognized as the holy grail in outsourcing. There is a need of a new benchmark critical to the success of providers and buyers alike – a benchmark that can take the social and economic factors into account. The field research clearly showed that it is impossible to neglect the so called "soft factors" in the decision making process. Furthermore, the effects that arise from decision making in actual organisations are non-linear in nature and emergence of consequences can most likely be explained in terms of complexity. The direct consequence of that non-linearity is that the researchers can hardly use traditional equation based models to investigate organisational behaviour. This means that the analytical solution does not always exist or may be hard to find. In (López-Paredes *et al*., 2002) it is argued, that both, social sciences and economics need a laboratory if these are seen as experimental sciences. The lack of such a laboratory constitutes the missing link in the contemporary outsourcing research. Majority of authors propose various approaches, constructs and frameworks that have been either inspired or produced partly from qualitative research. They fail, however, in making a "test drive" putting their pioneering works to the test on a real system in an open heart surgery manner. An interposition of a laboratory with a test-bed function will mitigate or eventually avert possible dangers. Analytic insights into intricacies of the system enable agency leaders to assess potential issues, detects trends and problems and commence actions needed at an early stage.

In methodology section 3.2 described characteristics of ABSS suggest that particular strengths of the introduced approach are obvious in the context of heterogeneous environments with interacting agents. The interviewed stakeholders put a great emphasis on the relationship management of outsourcing contracts. These circumstances suggest the aforementioned advantage of ABSS as useful with respect to outsourcing research. The intention of the presented research was to study the affection of the macro level processes by the action at the micro level. The macro behaviour emerges from the micro decisions of the individual agents. It is not possible to model all the decisions inherent to the system. Moreover it is not possible to fully capture the uncertainty inherent in these decisions. Therefore it is illusive to expect the quantitative performance measures of the

simulation model to exactly reflect the quantitative performance of the real system. It is sometimes possible to get close to reproduce real system performance output values if the observed system can be properly generalised and if the resources to develop sophisticated simulation models are available. The author argues that the more one abstracts the less likely one is to match the performance of the real system in qualitative and quantitative terms. However, one will still be able to observe the system's evolution process over time. Especially in cases where one deals with human interactions there is a lot of behavioural uncertainty that has to be considered in the development process. It would be difficult to consider all possibilities for irrational and counterintuitive behaviour and the occasions when they appear, but often these are important to consider when investigating the evolution of a human centred system. ABSS offers a tool that facilitates the consideration and validation of that qualitative data already during the data gathering process (cf. section 8.2.4).

In retrospective, it is instructive to reflect on the question "*Why to use ABSS in the economic context?*" to get an indication whether there is a paradigm shift regarding the reasons provided earlier by the researcher in the methodology chapter 3. The proposition listed below provides a summary of justifiable facts that served and still serve as a motivation for the author to favour ABM over a variety of other modelling paradigms available for social simulation research:

- *Formal informality*
    - Ability to encompass emergence and natural description into models.
    - Ability to encompass "local" (non-aggregated) description of decision-making.
    - Formalisation of assumptions is facilitated during the whole development process (ABSS fosters formalism regarding loose theory/anecdotal definitions).
    - Qualitative as well as quantitative validation is facilitated.
    - Emergent properties result from interactions among agents (full knowledge about the system is not required for model development).
- *Flexibility*
    - The level of complexity of the agents can be tuned dynamically (adaptability, learning, evolution).
    - The number and type of characteristics of each agent can be tuned.
    - The number of agents can be tuned.

- The environment of agents can be tuned.

- *Interactiveness*
  - Participatory qualities of research by proper alignment of activities are facilitated.
  - Ability to incorporate stakeholders into the modelling process at the earliest possible stage.
  - Users can more easily connect and relate to the model and simulation results (self-assessment).
  - The approach involves stakeholders in the process of formalisation.
  - Narrative strength of ABSS results and output.

The virtue of the TCT and the EBO Models is twofold. First, these models produced simulations, which highlight different aspects of, and provide valuable insights into the outsourcing process. Second, they also showed with a high level of confidence that the chosen modelling approach of ABSS meets the standard acceptance criteria for building appropriate simulations with practicability for outsourcing research: function, performance, usability, features and capabilities. ABM is a practicable means of incorporating micro-level observational evidence into those social sciences that have heretofore validated their models only by classical and econometric statistical means. A wide range of economic exchange activities well beyond the financial markets alone can usefully be investigated using techniques developed in the course of the research presented in the thesis at hand. However, as any technique, there are some shortcomings that one has to be aware of before adopting the approach. In the next section these are pointed out.

8.3.2 Mature Immaturity

Social simulation in business has not been very successful so far and the outlook is bleak if the ABM community will continue to abstain from putting some attention to issues highlighted in this section. The author identified two main reasons that hindered and still continue to hinder the advancement of ABSS in business – wrong expectations and immature model development processes. Figuratively, the bar was set too high and the emphasis was on using models as a predictive tool rather than as a tool for learning and investigation. This trend was underestimating one of the biggest advantages provided by ABSS, namely the explanatory and illustrative qualities about the system itself. This

chapter deals with the two prejudices regarding social simulation within business context. Finally, some consideration points are outlined that have to be taken into account in every project that aims at providing simulation models useful for practitioners.

Within any financial institution there is an inherent tension between conservative instincts and progressive thinking. To guide their strategic decisions and optimise the balance, financial institutions increasingly deploy predictive analytics and risk models (Vozian, 2010). The estimation of minimum equity that a financial institution holds is influenced by a range of various insurance, credit, market and fraud risk models. Banks use statistical risk rating models extensively to guide a wide range of decision processes associated with portfolio performance analysis. The increasing sophistication of these modelling techniques and the broader application of aforementioned models form a distorted perception of the modelling concept by stakeholders (cf. section 8.2.1) – it creates an expectation of a proverbial "crystal ball" ability from tools that are concerned with modelling. According to author's experience from the fieldwork this is the greatest prejudice ABSS has to counter while establishing itself as a valid tool for policy making support (cf. section 8.2.2).

Policy decisions have generally been viewed as the prerogative of few individuals (i.e. senior executives). The processes employed, the information used and the logic relied on, have been left up to this exclusive executives circle, in something of a black box. The errors in these policies can have a broad impact that affects solvency, profitability and even the macro economy or society as a whole. Hence, what might be a worthy alternative to long established processes? If majority of strategic decisions of financial institutions are governed by predictive analytics and risk models, why not to use social simulation to support policy making activities. Knowledge obtained through this kind of simulations provides deep insights into the underlying processes that are needed for a profound policy making. Stakeholders want to get a better sense of where leads come from via global market sentiments. They want to better understand the plethora of market trends and explore their impact on the company's policy. ABSS represents a good fit for that kind of a task. With ABSS stakeholders have a framework in place, which allows them to bring an enterprise approach to the problem. It is possible to collect and analyse data, both structured and unstructured (cf. sections 8.2.4 and 8.3.3) from internal and external sources. Investigating trends with ABSS helps companies not just explain what

happened, but to also explore what might happen, or create "*what-if*" scenarios. Also the ABM paradigm allows for construction of models with scarce data about the global interdependencies – in that context one has to recall the case of the EBO Model – the only knowledge about the affection of objects at the aggregate level was the fact of vendor consolidation and the proliferating trend of multisourcing. Thus, the researcher knew very little about the sequence of operations on the aggregate level.

In order to make ABSS an auxiliary tool for practitioners' decision support a modelling technique must be put in place to produce simulation results in a timely manner or on short notice. Stakeholders are ready to invest time and effort into development of the initial models but want, in return, the follow-up adjustments of the model and simulation results be available ad hoc. The aforementioned issues suggest two general pathways for ABSS approach that the modelling community should consider, in case practical applications of models are desired:

- *Overarching models*

  Development of coarse grained models with overarching architecture. These models can be broadly applied to the area under investigation. If required, these models shall be extended via embedding of the silo models (see below) that concentrate on particular niches of the investigated system. Overarching models have to be understood as general frameworks of particular systems that can be utilised to plug & play any silo models that look at a specific area of that system.

- *Silo models*

  These models put their emphasis on some particular and encapsulated areas of the system under investigation. They are more detailed rather than overarching models and can be "recycled" while building extensive simulations. This approach helps to cut the time it takes to produce models and mitigates the issue of one-off simulation models.

Judging on the stakeholders' feedback it can be articulated that ABM delivers desired results, however the tedious process of results' extraction valuable for stakeholders is still theoretical and slow. Practitioners consider academia as too inert and unable to come up for preposterous demands of predicting the future in an ad hoc manner. ABSS will not fulfil these surrealistic demands. Instead it will help to gain deeper understanding of

underlying processes and support policy makers as an illustrative tool or a test bed for their policies. The author suggests that while ABM is a valid tool for investigation of economic theories, it lacks on maturity to fully fulfil stakeholders' expectations. An interviewed strategic consultant from CONSULTANT4 summarised the aforesaid as follows: "*If we decide to make some sand table exercises, then I do not expect to spend months on build my sand castle.*"

In conclusion, the author suggests to consider the following key points in the forefront of building a model:

- *Interpretability*

  If the involved stakeholders see the model as a "black box" and do not understand the underlying logic, they will be reluctant to trust the results. Instead, a "white box" model, where agents' agendas are easy to comprehend, will likely make sense to most involved participants of the study.

- *Justifiability*

  Admittedly, it is a subjective but crucial factor. If the intended model lacks defensibility (i.e. regarding the assumptions made, structure used or tools deployed), few will use it or believe its output. Same as above, such models will be seen as "black box" models and account for lower adaptation rates since they are hard to justify. ABSS on its own represents already an intrusion in the conventional stakeholder's mentality. Consequently, one should refrain from nourishing any lurking doubts with missing justifications and elements used in the simulation process.

- *Validation*

  To the author's opinion validation strongly correlates with the former factors – justifiability and interpretability. In the evidence-based ABSS it is rarely possible to validate the model from the quantitative perspective and, *a fortiori*, it is pivotal to validate the model from a qualitative perspective regarding aspects such as data quality and model design. Unlike other simulation approaches, evidence-based modelling pursues validity already in the simulation setup (the participatory approach can contribute here, cf. section 8.2). Stakeholders serve not only as primary data resources but are also vital in the model validation process. A model is evidence-based if the rules according to which agents behave are not derived and reified from theory. Rather they are modelled directly from qualitative insight into the target

system gained from case-studies or conversations with experts and stakeholders. Only case-studies that give concrete information of the behaviour of (real world) actors in particular social circumstances are of direct use for evidence-based modelling.

- *Effort*

  A factor frequently underestimated in the context of participatory approach. The researcher has to become aware of how much effort is needed to compile, monitor and evaluate the model. Getting access to stakeholders is not the main hurdle that increases model development efforts. Getting the right data and making that data usable by the model will claim far more exercise than originally anticipated. Thus, the modeller has to get a clear sense of the total cost to construct and run the model by creating and constantly reviewing the model development plan. In retrospective, it was not possible for the author to descry the project phase with the most miscalculation of time and effort since the unforeseen circumstances and development difficulties have impacted the research continuously.

The stakeholders do not feel comfortable yet with the kind of model handling the ABSS offers. The process of model development as well as results evaluation and model maintenance requires strong academic assistance. Despite the multiple ways of interaction with the information incorporated into the model, the timely constraints with regard to model development process put the ABSS approach out of contention for the time being. Despite these shortcomings ABSS bears some potential that can be put into effect by simply adopting the agent-based mind-set on the operational level in an organisation. The advantages of this symbiosis are enlightened in the next section.

8.3.3 From the Tool to the Mind-set

Section 8.2 clearly showed that the agent approach brings great advantages for the participatory approach not only as a mere modelling technique but rather as a mind-set. The author is convinced that a consistent use of this mind-set can also create sustainable added value for the institutions participating in the research. Both presented models account for the paradigms of ABM, endorsements and evidence based approach. These paradigms, applied together, in many aspects provided a powerful toolbox with respect to academic and business intentions. In the following the author argues that, in particular, the issues of *(i)* knowledge formalisation, *(ii)* theory examination, *(iii)* theory formation

and *(iv)* dealing with conflicting opinions can be considerably enhanced by adopting the agent-based mind-set into enterprise's solutions apparatus.

The problem of tacit knowledge is known to every organisation. Tacit knowledge is not easily shared and is neither formalized nor documented. Mostly the root cause lies is the origin of that knowledge – it comes either from the very operational level or stems from various decision processes as a subjective data. In both cases companies lack on apparatus that can capture that information. Here an agent-based paradigm can help already at the data collection stage by forcing the stakeholders to define the formal grounds for their decisions while still maintaining a highly qualitative context. Central to all modelling research is the issue of power of expression and descriptiveness of models on the one hand, and clarity of expression and precision of formal methods on the other. The former are epitomized by qualitative approaches such as ethnography and the latter are epitomized by quantitative approaches such as mathematical modelling. Moss argues in (Moss, 1999) that ABM occupies a middle ground combining the rigor of formal logic with the descriptiveness of the agent paradigm for representing social elements. This approach allows for shifting out the "trade-off" (Moss 2000) between relevance and rigour in models of social components and facilitates the formalisation of institution's tacit knowledge. As proposed by (Edmonds, 2001) a modelling methodology can be split along stages of abstraction[121], design[122], inference/execution[123], analysis[124] and conclusion[125] with no claim on consequent order of these stages. The use of micro-level observational evidence to constrain and inform the design and implementation of social simulation models is a standard practice in the field of agent-based social simulation. Thus, each of the stages offers an appropriate alignment for formalization of theoretical or practical knowledge and a deepening of understanding about a target system.

Theory examination is another area where agent-based mindset can be instrumentalised. Practitioners tend to use mainstream theories without really questioning the hidden

[121] Abstraction of the target system and development of the conceptual model incorporating the relevant aspects of the target system relevant to the study.
[122] Formalization of the abstraction developed in the previous step in accordance to some theoretical framework(s) chosen and consequent development of the computer model.
[123] Execution of the model and exploration of the results.
[124] Analysis/Interpretation of the results obtained during the previous inference step; enhancement/clarification of model understanding.
[125] Round up with discussion of possible inferences about the investigated target system from the analysis of the simulation.

agenda or ideas imparted by these theories. Therefore, one needs a more critical observation of theories borrowed from different disciplines before these can be established. The example of the TCT and EBO Models showed that ABSS can be utilized as an appropriate tool for theory examination. The methodology utilized in this thesis did not claim to criticize concepts of TCT as such, but succeeded in pointing out obscurities where the theory is not clear enough and brought to light clearly the shortcomings in the operationalisation of the theory. Before theories can be examined the aforementioned formalization ability of ABSS shows to advantage. ABSS compensates for the lack of precision in the IT research and uses models to devise precise statement about these theoretical points which are not clear in the theory a priori.

Since ABSS models are formal representations of social processes, they can be utilized not only for purposes of theory examination but formation too. ABSS models are, in effect, low level theories of the processes they are used to simulate. The generalisations of such models are effectively higher level theories as they are more general and apply in a wider set of conditions than each of the case study models individually. The formation of the asset specificity concept, beginning with the initial adaptation in the TCT Model and gradual evolution in the EBO Model, demonstrated how theory formation by means of ABSS can be instrumentalised within outsourcing context. Meanwhile, many practitioners are aware of the fact that social factors seem to influence the outcomes of their strategic plans of action to greater extent than anticipated. In addition, the apparatus of conventional management frameworks does not allow them to deal with social component at the desired scope. The primary theoretical approach to IT outsourcing is economic, followed closely by a strategic perspective (Dibbern *et al*., 2004). ABSS allow for formation of theories in the outsourcing research that include nonlinear social behaviour.

Strategic decisions have generally been viewed as the prerogative of few individuals (i.e. senior executives) in the institution. The processes employed, the information used and the logic relied on, have been left up to these individuals, in a black box – same applies for majority of outsourcing decisions in the past. However, the high failure rate of outsourcing projects and public pressure urged practitioners to bring some transparency into the decision process. While it has been addressed by many academics and practitioners in a variety of ways, it is still a challenge for most organisations to identify

what to outsource and what to retain in-house. In such highly subjective context, where even the terms used in the decision making process are imprecise, it is unsurprising to encounter multiple conflicting opinions. Field research brought forward variety of opinions with respect to global and local outsourcing dynamics making it impossible to capture the global system behaviour in a centralized and analytical manner. Subject matter experts exhibited a high level of opinion discrepancies on the aggregated and individual system behaviour. The virtue of ABSS that shows to advantage in such context is the fact that modeller defines behaviour at individual level and the global behaviour emerges as a totality of many interacting individuals. Hence, this technique allows for work even with conflicting opinions on the stakeholders' side. Moss and Edmonds showed (1997) that appropriately specified models can be deployed to assist domain experts in identifying and amending dissonance between their own qualitative judgements or opinions drawn from theory. Such examination helps an organisation understand which decisions need improvement and what processes might make them more effective, while establishing a common language for discussing decision making.

8.3.4 Procedural Declarativeness

For many reasons, researchers frequently focus too narrowly on one type of modelling technique. The modelling approach used in this thesis tries to find the middle ground in adopting the best of two worlds – imperative and declarative modelling (cf. section 3.3.3). For reasons long rehearsed elsewhere, e.g. (Moss, 1998), cognition is best represented declaratively by logic-like rules. At the same time, physical processes are most naturally represented procedurally. This architecture uses both declarative and procedural knowledge at different times, taking advantage of their different strengths. In the ABM it is important to choose the right tool for the right job and this thesis presents a promising alternative to the conventional agent-based method.

It was discussed in the methodology chapter (cf. section 3.2.4) that declarative models of social simulation, are able to take social evidence into account more capacious than procedural models and allow for ease of readjustment when new evidence becomes available. Furthermore declarative approach allows for iterative development which comes handy at stages of research where the field study is not complete yet and researchers do not possess an extensive information portfolio needed for the simulation. The reason for this lies in the nature of the declarative programming language, which

allows for work with incomplete information. This rule-based structure makes it effortless[126] to edit, add or exchange the underlying logic incorporated into rationale of agents. However, these models lag in performance and are more time consuming in the development process rather than their procedural counterparts. Section 8.3.4.1 explores the proportion of JESS versus Java for the implementation of a model. Whereas section 8.3.4.2 provides an overview of some lessons learned on the integration of JESS with Repast.

8.3.4.1 *Mixture Balance*

In previous sections, it has been shown how models incorporate different types of evidence in reflecting the salient features of the case study for this research. For the development of the TCT and EBO Models the researcher had to find a balance between the expressiveness of declarative modelling in JESS and the faster execution of Java code. From the technical point of view any computation can be regarded as an assemblage of concatenated *if-then-else* statements, in Java or in any other language. Though, a rule engine like JESS assists in writing interrelated logical statements separately, leading to clearer code not only from the technical but conceptual and logical perspectives too.

Therefore, the focus of work in the first months of the research has been on modelling tools, in particular tools that enable declarative modelling. It is the author's understanding that declarative modelling is often the most appropriate technique to capture social phenomena, whereas many physical or biological processes are best described by numerically based formalisms (Moss and Edmonds, 2005). Procedural programming is well suited to the implementation of algorithms that essentially impose the process of solution on a model. Declarative programming is rule-based and is well suited for capturing the emergence of process in a model. Since the TCT and EBO Models had to represent both, social (interactions between outsourcing market players) and physical (sourcing market itself) processes, it was therefore important that a modelling architecture supports declarative as well as imperative modelling and allows for easy calibration of the modelling mixture. The cognitive control structure and decision making of vendors and clients is modelled using rules implemented in JESS. This is consistent with a long-standing rule-based representation of problem solving and cognition (Anderson, 1983).

[126] Provided, models have been developed with appropriate software architecture.

In the design of both presented models, it has been a guiding assumption that it is fruitful to model on a medium level of abstraction, thus, to keep balance just between too much detail and too much abstraction. On one hand, there has to be a certain amount of recognisable empirical characteristics of the IT outsourcing domain being modelled. On the other hand, it has to be made sure that the model is not overloaded with too many details and remains still interpretable in terms of investigated issues. In order to model the above mentioned characteristics, core features of the case study has to be abstracted. The modeller has to follow a rather strict distinction between physical and social environment of agents. The modelling approach of "procedural declarativeness", as coined by the author in section 3.3.3, focuses on a separation between physical and social spaces both in terms of semantics and techniques used for their representation. Thus, the framework helps the modeller to separate social and physical aspects of the domain under investigation by a sheer use the modelling technique – the modeller is forced to make a distinction between physical and social evidence by the tool. Knowing the best way of employing JESS, a modeller still has to decide how much of the model is to be implemented declaratively and how exactly the declarative part is to be translated into facts and rules. With the TCT Model the researcher started with a declarative implementation and added procedural components gradually. Whereas, EBO Model was already initially designed for keeping the major part in Java and shifted only the cognitive elements to JESS.

For future developments, the author suggests to follow the approach of extending Java-based modelling frameworks, such as Repast or Swarm, to include declarative features in otherwise conventional procedural models. Since JESS is written in Java and integrates well with any ABSS software, as long as it provides appropriate Java interfaces, it allows for faster adjustments of the procedural and declarative proportion of implementation in the model. This approach proved to be effective in the development of the two agent-based models and the implementation intricacies are discussed in the next section.

8.3.4.2 *Integration of Tools*

Deploying imperative and declarative modelling techniques requires a development of an architecture that allows for seamless integration of various modelling tools. These considerations led to the conclusion that combining JESS with Repast was the route of choice to pursue for the thesis at hand (cf. section 3.3). Thus, another focus of work has

been JESS and its integration with Repast, one of the standard agent-based modelling environments comprising a set of Java libraries. Section 3.3 describes the choice of tools as well as the proposed architecture in detail. During the project initiation phase the aforementioned combination of tools was identified as the most promising candidate to integrate declarative features with ABSS software (cf. section 3.3.3). To further investigate the compatibility of JESS and Repast the researcher modified an example model in the scope of a default Repast installation to work with JESS (cf. section 3.3.2). While the results of these initial experiments have been promising, further work on the TCT and EBO Models with growing number of agents unveiled some unforeseen implementation difficulties in terms of the simulation performance. This section provides a list of best practices regarding the use of both tools in a collaborative architecture.

In the initial version of the TCT Model the original approach has been to let each agent have its own rule interpreter. This architecture allows the rules describing the behaviour of particular agents to be specified in the respective agents' classes which provide each agent with a separate cognitive unit. In such architecture, all global facts (i.e. the state of the agents' environment), however, have to be copied for each rule engine. Initial experiments with JESS and Repast did not reveal the high memory requirements of this approach due to less sophisticated agents' implementations and smaller agent numbers. At later stages of development with a constantly increasing sophistication degree of agents' implementation and increasing numbers of agents in the simulation some dramatic performance issues came to daylight. The dramatic memory issues (cf. section 8.4.1) also experienced by other researchers deploying JESS and Repast (CAVES, 2006a, 2006b, 2007a, 2007b, 2008a, 2008b) urged to explore possibilities of performance tuning like sharing one rule engine amongst all agents and invoking of generic Java functions.

For the TCT and EBO Model it was imperative to find a balance between the expressiveness of declarative modelling in JESS and the faster execution of Java code with Repast (cf. section 8.3.4.1). In the following, six options to achieve this goal, with different advantages and disadvantages, are introduced[127]:

[127] For further performance tweaks regarding integration of JESS with Repast read CAVES reports (2006a, 2006b, 2007a, 2007b, 2008a, 2008b).

Option	⊕	⊖
Structuring the joint rule base into modules for each agent. This allows agents to share facts while using rules specific to a particular agent.	Conceptual clarity, agents do not have an own rule engine but are solely responsible for the execution of their own rules.	Performance advantage is minimal. Since a large part of the rule base is made up of more or less identical rules, the number of rules in the Rete network is still high.
Building a model class by collecting rules defined per agent type. Agents are declared as shadow facts to allow for referring to individual agents from rules. The engine has to be run only once per time-step to update all agents since each rule will fire once per matching agent fact.	This approach overcomes the shortcomings of the option above and keeps the rule base as small as possible. It is ensured that there is only one copy of each rule in the rule base.	Big gap between conceptual model (rules describe an agent's behaviour and therefore belong to an agent) and implementation (rules belong to the model and are shared between agents).
Differentiating rules by adding an identifier (i.e. agent ID) to rules' name. One has still a joint rule base but each agent has its own set of rules.	Each agents can be seen as a "semi-separate" cognitive unit and the engine is run only once per time step.	Same problem as in the first option – depending on the number of agents and rules per agent, the rule base can become oversized.
Reducing the number of facts in JESS' memory by removing facts when they are no longer needed during the runtime of the simulation.	Model shadow facts can be removed from the left hand side of the majority of rules. Better performance as the complete Rete network does not have to be rebuilt at every model tick.	Extensive programming required.
Supplying JESS with direct access to model functionality by implementing user functions instead of relying on calls on the model object.	Despite a detour invoking functions in this manner delivers higher performance.	
Forcing the garbage collector to run more often by invoking it directly or indirectly via reduction of the heap size. JESS is a memory intensive application and its performance is sensitive to the behaviour of the Java garbage collector	Performance improvement.	Too frequent invoking of the garbage collector clogs the overall Java performance.

Table 8.3-1: Lessons learned with respect to performance issues while integrating JESS with Repast.

As evident from Table 8.3-1, there are several options how to tackle performance issues. These range from using one rule engine per agent to sharing not only the rule engine but the complete rule base amongst all agents within a model. In retrospective, the experience showed that the latter approach is the most efficient and feasible one. Agents are represented as shadow facts, and rules are collected in the model class ensuring that there is only one copy of a rule in the joint rule base.

However, with the options above one has to consider that the advantages of JESS in terms of rules-interchangeability vanishes. Section 3.3.2 suggested that agents' reasoning,

implemented with rules, can be exported and transferred into another model, eventually written with a different simulation framework, without great effort. This certain degree of rule-independence from the model implementation gradually deteriorates with increased use of suggested performance tweaks as these atrophy the sharp borders between procedural and declarative parts of the model. The root cause for this behaviour is the increased abdication of interfaces and interference into the computing operations by the modeller. Inevitably, some of the implementation difficulties encountered during the model development process imposed technical restrictions for the research. The next section, *inter alia*, sheds light on the limitations of the research arising from these difficulties.

8.4 Limitations of the Research

The fundamental limitation of the current research is the limited time and constraints posed by technical architecture of the software. Evidence-driven modelling of complex problems such as the one addressed in this thesis requires enormous resources concerning steps involved in the evidence-gathering, model development and validation processes. In the following, the limitations of the current research regarding the aforementioned steps of model development are discussed. Section 8.4.1 deals with limitations arising from technical constraints of the modelling tools used. Sections 8.4.2 describes issues concerning the choice of the stakeholder sample and validation of assumptions.

8.4.1 Technical Limitations

Despite the promise of the JESS creator, Ernest Fridman-Hill (2003), in his book that the rule-based programming is especially useful whenever complex criteria must be applied to large quantities of information, the performance lag of declarative agent-based models compared to imperative models is evident. The author argues that it is not a design flaw since other researchers, working on integration of JESS with Repast, reported similar problems. Moreover it is the agent-based structure that is posing difficulties to rule-based systems since it is fathoming the limits of applying JESS for declarative modelling in a complex agent-based simulation environment. In fact, JESS's rule compiler is quick and capable of compiling hundreds of rules in a fraction of a second – pattern matching, however, is time consuming. If working memory is full of facts, then reloading rules can take a long time because all the pattern matching has to be repeated. This behaviour is

especially dramatic when new facts and rules are constantly added to and retracted form the system. This is not the case in the domains that JESS was originally developed for but is a frequent encounter in agent-based models.

These circumstances offer a good test bed for validating the declarative approach described in section 3.3.3, as the model contains great amount of agents with social links and interactions which may bring the simulation tool to the upper limits of computational capacity. At quite an early stage in the prototype development process one encountered a considerable slow-down in the model execution even for small numbers of agents. This made the original software architecture unfeasible to run for the necessary larger numbers of market players (at least 1000 agents). From the architectural point of view JESS provided a design limitation that did not allow for encapsulated architecture of agents due to unacceptable performance losses. Therefore, it was not possible to provide each agent entity with a separate cognitive unit in form of an encapsulated JESS instance (cf. section 8.3.4.2). Instead a workaround was chosen where one JESS instance was subdivided into separate modules for each agent. This implementation did not violate the agent paradigm since agents, from a semantic point of view, remain autonomous entities that, from a technical point of view, share a single Rete instance.

Repast passes the command and information to JESS through strings as well as through direct access of the Rete engine. Both, TCT and EBO Models struggle with performance issues towards the end of simulation runs. There is still a long way to go in terms of optimization issues. However the speed of the simulation decreases exponentially with the growing number of agents from a certain level. This issue is definitely an artefact of the model to some extent. However, similar issues have been reported by other modellers too (CAVES, 2006a, 2006b, 2007a, 2007b, 2008a, 2008b). The bottleneck of the model is the exchange of the state information between JESS and Repast, which happens at regular intervals. This issue as well as possible design workarounds have to be investigated in further work.

There was no significant performance and speed difference noticeable while using Windows and UNIX OS. Figure 8.4-1 plots runtimes for a comparison run with varying number of agents on a Microsoft and UNIX platforms respectively. Polynomial trend lines are fitted to both curves and extended for further 250 agents. The infliction point as well as the

steepness of the Microsoft OS curve indicates a slightly better performance of the UNIX system, probably due to better memory allocation. For marginal numbers of agents simulation runtimes on both operating systems are nearly identical.

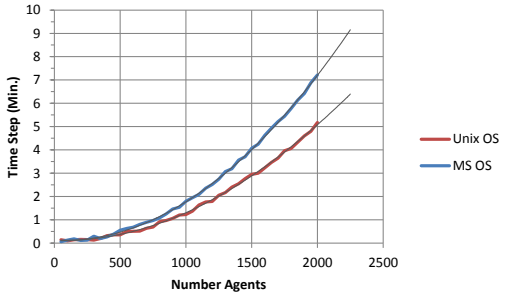


Figure 8.4-1: OS performance regarding the number of simulated agents.

The profiling tool JProbe[128] has been applied to find the performance bottlenecks. The examination revealed JESS causing the performance gap. Surprising was the fact, that JASS slowed down the simulation not it terms of memory usage but processing power. JESS uses the Rete network for facts matching to allow for a fast execution of rules. The Rete network is recalculated each time whenever a fact is added to or removed from the network (held in the working memory). Agents in both, TCT and EBO Models have been designed to produce a large number of new facts during the simulation run. This caused a frequent recalculation of the Rete network which took a long time. The number of agents that could be implemented after all optimisation efforts is acceptable for a fine grain model – on the order of maximum of 2000 agents. Due to technical limitations, it remains open how the simulation would behave if the number of agents can be increased beyond 2000.

After the rules that severely affect the execution time have been identified, it was attempted to reduce the number of facts and rules respectively to achieve a speed-up. Since the number of vendors and clients is constant at any time during a simulation run there was no significant impact on the runtime of a simulation to observe. Apart from facts that agents produce during the simulation run, all agents have to be represented as shadow facts in the working memory of JESS to allow for declarative modelling of individual behaviour. As mentioned above, this circumstance has slowed down the execution speed considerably and allowed for simulation runs with maximum of 2000

[128] Toolkit from Quest Software for diagnosing and eliminating inefficiencies, performance problems and code errors in Java applications (www.quest.com/jprobe).

agents. Several simulation runs that have been conducted on SUN servers did achieve a faster execution but failed in increasing the number of agents due to heap size issues.

8.4.2 Evidence Limitations

The lack of information is an omnipresent issue of the evidence-driven modelling and leaves a number of model assumptions that are less well validated than they might have been. As discussed in the methodology chapter 3.4, the model has undergone numerous changes, as further evidence from different sources became available during the course of this research. Developing an evidence-driven model of a complex social problem with a participatory modelling approach is a costly and resource hungry task that involves a steady collaboration with domain experts (cf. section 8.2.3). Incorporating actors' behaviour into a simulation model requires that rules are presented to experts and stakeholders in order to confirm their views (cf. section 8.2.4). Both models reported in this thesis contain several assumptions that are either considered as vaguely plausible or are yet to be validated due to resource limitations. Model assumptions that remain without validation due to lack of evidence should be tested for their sensitivity to model outputs. The research is limited in the sense that the time spent on the development and reporting results did not permit detailed exploration of these assumptions. It is hoped that the assumptions are replaced with further evidence in research built upon this thesis.

The author argues that with the participatory approach it is impossible to perform the necessary activities for the creation of a model, which include abstraction, design, approximation and coding, in a monolithic way. Model verification and debugging go side by side with model development. While it is costly to develop evidence-driven models, an endeavour of their verification and detailed exploration requires almost similar efforts. The modelling is limited in the sense that it is not feasible to explore every possible parameter setting. However, even for less complicated models, one cannot guarantee a bug-free programme code. These circumstances of the case have to be compensated through rigorous testing of the results and repeated simulation runs. Due to time and resources constraints it can be argued that these activities could be conducted on a more elaborate basis for both models reported here.

8.4.3 Stakeholder's Peer group Limitation

The research is limited in sense that there were no conflicts apparent in the views of majority of stakeholders involved in the interviews and model validation process. The

initial stage of the fieldwork is distinguished by a strong heterogeneity of involved stakeholders – subject matter experts form vendor, client and consulting organisations participated in the initial interviews. However, with progressing research and time the basis of involved experts became more homogeneous and tilted towards stakeholders from consulting companies. Since consultants encompassed the "lion part" of the interviewed practitioners the evidence obtained has an unbiased and neutral flavour. Consultants represented both groups under investigation – clients and vendors – objectivising the knowledge incorporated into the model. A higher fraction of vendors and clients in the interview sample would have added more subjective flavour to the evidence which could significantly complicate the research. On the one hand, it is fortunate that majority of interviewed stakeholders shared same view because this fact made the formalisation process of evidence easier. On the other hand, conflicting opinions amongst stakeholders raise issues that can be made explicit and understood through the model development process (cf. section 8.3.3).

Descriptive models are able to capture a wide range of issues, since an integral part of the model development process is interaction with stakeholder. For instance, by incorporating the practitioners' perceptions about asset specificity, the development of TCT and EBO Models engaged stakeholders into discussions related to exact meaning of the term. In this context, the role of evidence-driven agent-based modelling is to offer the stakeholders formal scenarios for discussing alternative social policies or strategies (Moss, 2008). Negotiating upon conflicting views of the participants could therefore be a possible test bed for application of the agent-based mindset in such scenarios as described in section 8.3.3. An explanation for the lack of conflicting opinions among interviewed stakeholders is a result of consultants being the major group in the interview sample. It is not uncommon to discover essentially unified views among consultants working in the same domain since they represent a neutral party in the client-vendor dyad. The study had an essentially singular perspective of consultants at the current dynamics of the outsourcing market.

Although this research adopts an interdisciplinary framework, it should be acknowledged that a more wide-range and long-term fieldwork study with stronger involvement of vendors and clients is worth conducting in the future. In completion to the fragmented nature of qualitative evidence from the interviews, an extensive survey could provide

additional statistical evidence about the outsourcing market. The author believes that at this stage both models presented in the thesis represent a starting point towards understanding the impact of micro level decisions on the macro level of the outsourcing market and serve as a tool for policy analysis. Moreover, the author hopes that the model development, verification and validation process would continue in future, as more resources become available. The possible areas for further investigation that arise from the current research are discussed in the next section.

8.5 Reflection on the Areas Deserving Further Work

The current EBO Model is by no means complete. The author offers it with the intention of spurring further research. Based on examination of results from TCT and EBO Models, fieldwork evidence as well as stakeholders' feedback several extensions are apparent. These extensions are described in the sections 8.5.1 to 8.5.6.

8.5.1 Sourcing Location

In the presented research the highly emotional question "*Where should the sourced service be performed?*" has been neglected. There is plethora of literature investigating this question. The author argues that both presented models do not take into account the particular facets of the outsourced service. The research identifies key facts that make certain destinations more appealing and lucrative for IT services procurement than others. Farrell (2006) identifies cost, skills, quality of infrastructure, risk profiles, business and living environment and market potential as the key attractors for IT outsourcing destinations. Indeed, while these factors are proved to be attractive to clients it is wrong to weight these factors equally attractive for all services a potential customer wants to outsource. What is missing is the multi-dimensional consideration of location attractiveness with regard to the attributes of a potential service to be outsourced.

The growth of global outsourcing has been based primarily on lower labour costs arbitrage for commensurable personnel. While low labour cost is not the only reason to consider offshoring, it is a significant part of the equation. However, the equation formula started to crumble as the cost difference between offshoring hotspots and industrialized countries started to diminish. "*... roughly speaking, the Indian IT employee makes an average salary jump of about 15%-25% year in and year out. For the last decade of Wipro and Infosys hype salaries have gone up by more than 5 times and the attrition rate is on an all-time high,*" so an interviewed IT analyst from VENDOR3. Furthermore, one needs to

consider the impact of automation on the labour intensiveness of a service. Just because a process is people intensive today does not mean that it will be so tomorrow. Going for a low-wage alternative due to people costs may bring benefits in a short run but may have disadvantages in a long run since the cost of entering into an outsourcing relationship will already have been spent.

When the parties in the relationship are geographically distant, building mutual relationships takes more time and effort. When service inputs are “tangible”, communication between the involved parties tends to be much easier and requires less up-front relationship building. Cost savings have become less advantageous as wages and operating costs have been rising rapidly in the offshoring centres of China, India and elsewhere. So far the cost attractiveness represented a main incitement in earlier outsourcing deals to move offshore. Since this inducement is vanishing slowly, clients start rethinking their regional preferences. It is considered to be a common wisdom in the era of globalization to eliminate people intensive processes in the home location and move them to the low-wage countries.

The evidence above suggests an enhancement of the current service implementation as an assemblage of nodes in the FSU_{client} (cf. section 6.2.2). In order to capture the matter of the case it is sensible to enrich the skill sets with further attributes like people intensiveness of the service, skill level of the service, “tangibility” of the service and sensibility of data needed for the service delivery. The interviewed stakeholders suggested these attributes as they account for the choice of service delivery location. Also, the implementation of locations in the current model has to be reified. Further extension of the model might be the dynamics of the labour force in the outsourcing destinations.

Apart from cultural affinity, historical bonds provide a strong influence of the choice of potential outsourcing destinations. Being a former US colony Philippines enjoys a status of a favoured location for call centre services in English for US companies. Analogous, Morocco, Tunisia and Egypt service predominantly French and Spanish clients, whereas India and China become prevalent outsourcing destination for UK clients. It is therefore intended to introduce historical bonds between countries and investigate the emergence of cross-country outsourcing behaviour patterns of agents. There is no single outsourcing

destination that suits every client company. All locations have their advantages and disadvantages and much depends on the client's country of origin, the services required and the time period intended. Language and cultural barriers as well as fears over losing intellectual property remain significant obstacles for many newcomers on the outsourcing market. Which makes it a natural extension of the model to incorporate these "soft" factors into the agents' interaction rules on a stronger basis rather than in the current version of the EBO Model. These cultural effects on the agents' behaviours are discussed in the next section in depth.

8.5.2 Beyond the BRIC

The EBO Model does not offer a distance notion of the offshore concept. In its current version the model accounts for domestic and non-domestic attributes the vendors' origin. This distinction is, however, a too strong simplifications if one is interested in the offshore vs. near-shore comparison. Section 2.1.2 described various forms of outsourcing and boiled them down to the in-house and outsourcing service delivery only – the distinction of the location for the service delivery is absent. Such a distinction, however, is crucial if one seeks to understand the interplay of near-shoring and offshoring. Near-shoring is defined as outsourcing of service delivery to a provider from a low-wage country close in distance and/or time zone to the customer. Therefore, offshoring is defined as the same type of outsourcing but to a provider far in distance and/or time zone to the customer.

The examination of the motives for an offshore or nearshore choice can bears enlightening insights for policy makers. These insights become even of higher topicality in spite of the terroristic threat. India, as well as other Asian outsourcing destinations, are increasingly considered to be a riskier alternatives rather than European options. "*The Satyam scandal combined with worries of terrorism related to the Mumbai attacks and domestic political concerns has led the* (outsourcing) *industry to eye this option* (outsourcing to non-domestic providers) *with somewhat less favour* (...)," suggests an interviewed CIO of CLIENT5. He implies further that: "(…) *there is a more dramatic pullback in the European Union with regard to offshore use, fostered by political concerns* (…) *as well as concerns about the security of data from a terrorism perspective.*" In Western Europe, organisations will increasingly outsource IT and business services to providers located in Central and Eastern Europe. Countries like Czech Republic, Hungary,

Poland, and Slovakia offer Western European firms closer proximity, less time zone differences, and lower transaction costs than Asian alternatives (Willcocks *et al*., 2009).

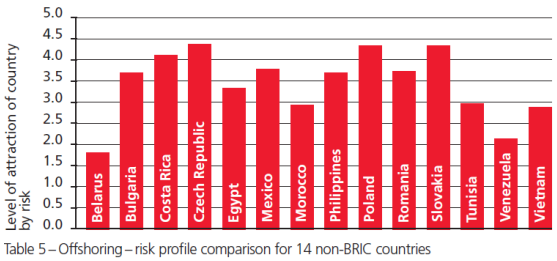


Table 5 – Offshoring – risk profile comparison for 14 non-BRIC countries

Figure 8.5-1: Offshoring risk profile for 14 non-BRIC countries (Source Willcocks *et al*., 2009).

The so-called BRIC[129] bloc of countries are frequently referred to as the inheritors of globalisation due to their share of global offshore outsourcing market for IT and business services. However, beyond these countries the developing nations such as Egypt, Vietnam and Romania are emerging as sources of offshore labour (Willcocks *et al*., 2009). The investigation of this topic has to be conducted not only with regard to clients tapping into further locations but also with regard to vendors from BRIC countries turning to non-BRIC locations to secure low cost and labour availability. Tata Consulting, Wipro and Infosys have established operations in Mexico to ride the nearshore trend. The competition from the Central and Eastern Europe is not insubstantial. According to the research conducted by EquaTerra (2008) the latter exported over $3,6 billion of IT market whereas Central and Eastern Europe exceeded the $3,5 billion mark. These facts lead western companies to evaluate non-BRIC countries with a higher attraction level rather than in the past (see Figure 8.5-1). Between 1992 and 2004 imports of IT services from Central and Eastern Europe to Western Europe increased an average of 13% p.a. which is nearly comparable to the import of IT services from India that averaged 14% p.a. in the same time span (Willcocks *et al*., 2009).

Asian non-BRIC countries suffer from a negative perception and belief that these countries are targeted by terrorists on a regular basis (ibid). Whereas the history of terroristic activities in some of these counties is impossible to neglect (i.e. Egypt) one should stress that some other, more favourable, countries have had more terroristic events in the recent times. In particular one has to remember the Bombay and Mumbay

[129] Common grouping acronym in the IT literature that refers to the related countries of Brazil, Russia, India and China. Recently the acronym was extended to BRICM to account for an emerging outsourcing market of Mexico. The acronym was coined by Jim O'Neal, head of global economic research at Goldman Sachs (Wilson and Purushothaman, 2003).

attacks in 1993 (BBC, 1993; Chadha, 2006), 2003 (BBC, 2003) and 2008 (BBC, 2008). While these events hit the economy temporarily, it did not stop companies from outsourcing to India. The work at delivery centres of foreign companies, located at least 30 km from the epicentre of the recent terrorist outbreak, continues unhindered – Microsoft, Dell and Oracle still run large software development and call centre operations in India.

It is suggested, therefore, to supplement the current binary implementation (domestic / non-domestic) of the geographic continuum by adding a nearshore location type. This alteration of the continuum will allow for further refinement of investigation of the locality choice. India, and to a lesser extent China, Brazil and Russia are already experiencing upward pressure on wages, combined with rising labour turnover rates – a process which has been coined in professional literature as the "war for talent" is escalating in BRIC countries. For example, both India and China are increasing their own offshoring of IT and BPO work to other countries (Williamson *et al*., 2009). For the EBO Model the outsourcing geography was simplified into high cost countries and non-high cost countries with all clients being from high cost countries and vendors being predominantly from non-high cost countries. Further extensions of the EBOM could be used in order to investigate the geographic dynamics of the outsourcing marker.

8.5.3 Another Type of Consolidation

One company does not have the sufficient scale internally to compete with external providers. A group of companies, however, can move to the same IT landscape and thus solve the issue (Cohen and Young, 2005). This type of service delivery is common for post-merger integration scenarios, since mergers deliver the large enough structures to create economies of scale within own operations. The scope of merger projects can be used to get to a mutual agreement about the IT landscape, thus enforcing some level of standardization and leverage of an appealing cost profile of standardized services. Field research revealed that many smaller organisations consider the latter option, thus setting up a customised infrastructure provision service at anticipated low cost. Small organisations cannot bring the leverage to the negotiation table as big once do and therefore have to seek for alternatives. In spite of the aforementioned, the influence of consolidation among clients on the distribution of power in the outsourcing market inevitably deserves further attention. Whereas the issue of vendor consolidation is slowly

starting to be addressed by practitioners and academics, the consolidation of clients is entirely neglected.

Williamson assumes that vendors possess inherent economies of scale that allow them to incur lower average costs through mass production efficiencies and labour specialization (Lacity and Willcocks, 1995). Third parties that specialize in an activity are likely to be lower cost and more effective, given their focus and scale. Thus, clients have to deliver the scale to come for the vendor in order to enjoy these efficiencies of scale. In settings with multiple mid-sized and boutique banks, like i.e. Germany, scenarios are possible where multiple banks move onto a common IT landscape to produce a higher volume of required services and thus capitalise on economies of scale of a vendor. A possible implementation of this evidence into the current EBO Model is depicted in Figure 8.5-2.

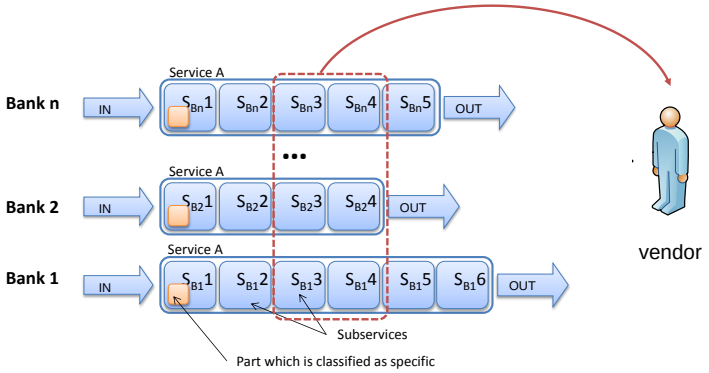


Figure 8.5-2: Joint outsourcing venture of multiple clients to a single vendor.

According to involved industry experts, consolidation is not only a phenomenon that can be discovered on the vendors' parquet floor but it becomes a tool for anybody who wants to optimize and reduce its IT costs. In the face of increasing power of vendors smaller clients loose gradually on negotiation power. Thus, in industrialized nations like Germany or US that are characterized by myriad of smaller to midsized financial institutions clients compensate for the lack of own scale with consolidated contracts. Figure 8.5-2 depicts a possible scenario where multiple clients agree on a common denominator of services that are going to be delivered by a single contracted vendor. This strategy becomes increasingly popular and is further facilitated by the advancing trend of standardization (cf. section 4.5.2). All actors in Figure 8.5-2 possess services S1 to S4 in their services portfolios and decide to build a package consisting of services S3 and S4 that is considered for outsourcing.

Scenarios as described above are absent in EBO and TCT Models. The author argues that inclusion of the concept of consolidated contracts is of benefit for further studies of lock-in issues in the outsourcing market. The EBO Model, endowed with aforementioned behaviour of clients, will produce new lock-in constellations that could not be modelled before. It is possible to imagine scenarios in Figure 8.5-2 where at the end of the contractual term some of the consolidated clients will get into lock-in. Thus, the lock-in situation now encompasses not a single client but a group of clients. Various group dynamics that might evolve our of such scenarios can further elaborate the investigation of the lock-in issue in section 7.1.1.6.1.

8.5.4 Finger Pointing Conundrum

So far the EBO Model accounts only for a cultural impact within transaction between vendors and clients (cf. section 6.2.4.1). On a multisourcing terrain, however, a cultural issue within cooperation between vendors is coming increasingly to the fore. In a multisourcing setting vendors are enforced to collaborate with each other if they deliver services to the same customer. Any constellation where *vendor A* and *vendor B* both provide service delivery for *client C* bears a possibility that *vendor A* is only able to provide seamless service delivery for his customer if he relies on unprecedented service delivered by *vendor B* and vice versa. With decreasing service levels these cascading environments, as described before, entail much of finger pointing that is hard to reconcile once started. *Vendor A* is missing his SLAs and identifies the root cause as *vendor B*'s performance while *vendor B* argues the converse.

For an interwoven service delivery, as it is in the multisourcing setting, uncovering the root cause can be a challenging task. An aggravating factor is that some of these services could be provided in-house and some of them are provided by different outsourcing service providers. Any of these constellations that results in a dispute impact materially the customer. Therefore, it is beneficial to investigate the social implications of cultural disputes on the intra-vendor relationships regarding the impact on the delivery of customer's services. Simulating the cultural discrepancies and resulting frictions on the social level between providers may provide a pathway for the emergence of conflict hubs and highlight critical conditions one should be aware of while engaging into cross-cultural outsourcing.

The author suggests to extend the current EBO Model by scenarios where vendors have to cooperate with each other while delivering skill sets from FSU_{client} of the shared client. This setting will allow for emergence of social frictions in the customer's cross-cultural vendor portfolio. The statistical analysis of the simulation results and verbal outputs make the observation of repercussions of these modelled cultural clashes possible. This extension goes hand in hand with the elaboration of the model suggested in section 8.5.1 by adding historical bonds between countries that are active on the outsourcing market.

8.5.5 Relationship Management

The current model touches the management issues of a client-vendor relationship on an aggregated level. In order to achieve practical advice for operational level of business the aforementioned relationship has to be refined and enriched with further components. Also a stronger emphasis has to be put on the negotiation process with various kinds of pricing models currently available on the outsourcing market.

One could argue that the aspect of opportunistic behaviour could have been examined better if some elaborate incentives to minimise opportunistic potential on vendors' side were introduced by clients. Nowadays common praxis is to scare the vendor with horrendous penalties. Instead one should think about developing a proper partnership with the supplier and include bony payments for over performing of SLAs. One should incorporate the issue of penalties vs. extraordinary cancelation into model since both controlling tools are widely used in the investigated domain. The simulation might increase stakeholders' understanding of advantages and disadvantages of each strategy by juxtaposing different agent types applying these controlling techniques.

In order to test management incentives one shall introduce service levels for service delivery. Naturally, vendors would deliver the minimal service levels that will be just sufficient to keep the contract going. One could investigate whether incentives to over-perform are more advantageous rather than penalty fees for underperforming.

8.5.6 Transfer of Assets

So far the model allows outsourcing to a particular vendor only if that vendor is able to deliver the service that is needed. That means that *client A* will outsource (acquisition or cost saving) his skill sets from $FSU_{client\ A}$ to a particular *vendor B* only if $FSU_{vendor\ B}$ contains the needed skill sets. Another widespread type of the cost saving outsourcing is the so

called “hollowing out” of the existing in-house IT to the vendor with a take-over of the client’s resources. Mostly this instrument is in place in cases where the services that are transferred to the vendor have not been offered by that vendor before. This operation resembles the analogy of M&A activities in the V2V network. A vendor is enriching his services portfolio through a merger with or an acquisition of a rival company. Figure 8.5-3 depicts this process in terms of possible implementation for the EBO model.

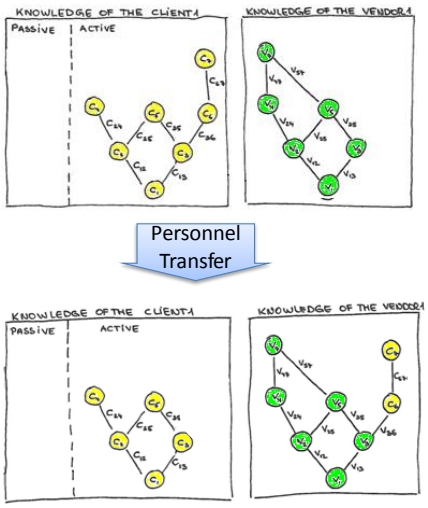


Figure 8.5-3: Translation of personnel transfer into suggested EBO Model implementation.

This type of relationship also bears some potential hazards for the client. In hypothetical scenarios where the provider takes over the whole IT landscape and replaces by his hardware a threat of potential lock-in issues is imminent. In such scenario, the option of insourcing is impossible due to the lack of resources. In contrary to cost saving deals (cf. section 6.2.3.1) the passive knowledge cosmos of the client remains empty. While the logistics of the aforementioned operations are similar to the aftermath of M&A activities of the V2V network, these deals impose a completely different social framework between the involved vendor and a client on the V2C network. On the operational level this change is nearly transparent. Apart from the change of the company name on the business cards of the personnel that was transferred to the vendor nothing changes.

8.6 Closing Words

The overarching vision and the primary aim of this thesis is to contribute to the development of research methods for understanding uncertainty in IT Outsourcing projects – in particular those that arise from social interactions, or within organizational contexts of financial institutions. The thesis has produced a constructive demonstration of modelling procedures for the formation of social policy in conditions of uncertainty due to

complexity. The demonstration entailed the development of both theory and evidence grounded agent-based models. ABSS provides researchers with a tool for examining the implications of various social and organisational choices within environments of interacting entities. This thesis examines how this can be done in the case of choosing to outsource (or not) the information technology needs within large financial organisations. Based upon survey data collected from a number of financial institutions several prototype models have been developed. These models provided some initial findings but, more importantly, have allowed the researcher to identify the gaps in the data set that need to be filled in order to develop a more informative model. The researcher presented this particular case study as an example of a generalised approach that can be used to examine different aspect of organisational change. Consequently, the thesis contributed to the fields of economic theory, research methods and practitioners' tools.

In terms of contributions to the economic theory two aspects have to be highlighted. First, this thesis increased rigor through formalism and added precision to an ill-defined theoretic construct by offering a new approach to characterising asset specificity. The issue of asset specificity was investigated in two ways – by means of modelling and through fieldwork interviews. Stakeholders were talking about asset specificity as a kind of metric using the language of TCT and relying on the language of the theoretical apparatus. Thus, practitioners used words of TCT without deep understanding of what the concept really is. One of the reached objectives of the model is that the model helped to formalize what stakeholders really meant by referring to the equivocal term of asset specificity. The modelling process helped to give a more precise definition of the term which is either ill-defined or not defined precisely. Second, the models developed in this thesis helped to identify potential disconnections between formal theory and real world data and represent a first step towards formalization of some TCT aspects. The TCT Model went beyond characterising asset specificity in a non-subjective way and showed that asset specificity is not central for the notion of dependence between buyer and provider of services. This fact clearly shows that asset specificity cannot be used as a sole indicator for dependency issues as is conveyed by TCT literature.

The research at hand has also implications for ABSS as it demonstrates the value of the agent-based modelling with the evidence driven approach. In particular it demonstrates how evidence-driven modelling can be applied to a complex problem based on a real case

study. A core feature of this thesis is that it departs from both ends of the evidence spectrum – on the one end there is the TCT Model which is entirely theory driven and on the other end there is the EBO Model which incorporates evidence as specified by stakeholders independently of any prior theoretical constraints. In the end, the thesis arrives at the point of the evidence spectrum that is closer to evidence but incorporates some meaningful theoretic elements. This is arguably a different approach from that pursued in the complexity and social simulation literature that usually tackles issues from one end of the aforementioned evidence spectrum only. As a result, models were developed where stakeholders could relate to agents. The EBO Models represented the behaviour of outsourcing market protagonists in the way that stakeholders recognized. This clearly highlighted the difference between the evidence based and theory driven approach as involved practitioners could not identify with the TCT Model. Theory driven approach provided the terminology but not the course of action. Despite capturing the relevant characteristic from the theory the results of the model has not been convincing for involved industry experts. As mentioned previously the crucial difference between the evidence based and theory driven approach is the fact that models represent behaviour in a way that stakeholders can recognize and relate to respectively. Inducing models from data has the virtue of looking at the data afresh, not constrained by old hypotheses. However, judging on the stakeholders' feedback it can be articulated that though ABSS delivers desired results, the process of results' extraction is still theoretical and slow. Thus, stakeholders do not feel comfortable yet with the kind of model handling the ABSS offers. The thesis offers several improvements in the model development process that seek to mitigate this issue.

The thesis also contributed to the area of practitioners' tools by developing a model that provides a decent view of the various social elements in the problem setting of outsourcing. The outsourcing market contains important sources of complexity such as heterogeneity and interdependencies which are difficult to explore with statistical apparatus at practitioners' disposal. With the extension of the ABSS approach as proposed in the thesis stakeholders have a framework in place, which allows them to bring an enterprise approach to the problem. It is possible to collect and analyse data, both structured and unstructured from internal and external sources. By investigating trends over time the EBO Model helps practitioners not just to explain what happened,

but also to explore what might have happen, or creates “what-if” scenarios. Also the model gives a lot of process consideration and provides many ways to interact with the information. With the EBO Model one has real data that one can drill down into and see exactly why agents are acting in particular way regarding some specific aspects of the outsourcing business. After analysing the simulation one has identified an issue that one can fix – the institution can be alerted to this trend, examine it at a very granular level, then put an action plan into place. With such tools agencies can uncover and detect improper policies and get cautions of suspicious market trends for further investigation.

The research method suggested by this thesis is not simply applying the evidence based ABSS methodology to the issue but, what is qualitatively different, creates a tighter link between developed models and involved stakeholders. As a result, models are created that stakeholders can identify with, which, in turn, increased the trustworthiness of simulation results. The virtue of such models is that they are not giving answers but, what is more important, produces further questions that have not been considered by stakeholders or researchers before. It has to be emphasised that it is not “just” the model it is the process that makes a difference. The EBO Model demonstrated the aforementioned effect by heated debates between subject matter experts during the presentation of simulation results. Thus, a model that started under the premise to undertake a clarification of Williamson’s TCT evolved in an attempt to develop a full-fledged model of the outsourcing market that seeks to support policy makers within outsourcing context.

In retrospective, another purpose in writing this thesis is to stimulate a debate so that organizations begin to enhance their capability for executing the business strategy. The author would like to conclude this thesis suggesting that the most exciting phase in research is not the triumphal “*Aha!*” moment of discovery, but the bewilderment of “*That’s odd!*” moment since it spurs for further studies. The models presented achieved the latter on multiple occasions for both the researcher and stakeholders.

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Appendix A

The excerpt can be seen as a story line of the agent during his 'life' in the simulation run. In the excerpts bellow clients are coded with a token `cli` and vendors are coded with a token `ven`. In the textual simulation output of excerpts new lines start with `ven-n:` for vendor related output, `cli-n:` for client related output and `market:` for general simulation output with *n* staying for agents' ID. Simulation output is formatted and shortened on several places due to space constraints and for clarity reasons. Explanations and comments to the simulation output are provided below the corresponding lines.

Excerpt 1: Selfish Life of a vendor 7

Excerpt from one of the simulation runs for a vendor-agent 7. The excerpt below shall emphasize the selfish intentions of the vendor-agent 7 during the simulation run.

```
ven-7: <18> contract offers received (cli-88, cli-33, cli-6, cli-96, cli-34, cli-
17, cli-77, cli-32, cli-10, cli-17, cli-74, cli-49, cli-76, cli-54, cli-85, cli-
51, cli-90, cli-57)
ven-7: evaluation of requests -> cli-33 is best fit
```

[... vendor-7 seals a contract with client-33. Client-33 was evaluated as the best suitable due to his location in the production space ...]

```
ven-7: <3> request(s) to adjust service levels received (cli-33, cli-53, cli-94)
       --- <3> request(s) ---------
       <client>     <evaluation>
        cli-33       no harm
        cli-53       no harm
        cli-94       no adjustments (loss of potential partners cli-8, cli-28)
[...]
ven-7: <1> request(s) to adjust service levels received (cli-33)
       --- <1> request(s) ---------
       <client>     <evaluation>
        cli-33       no harm
[...]
ven-7: <4> request(s) to adjust service levels received (cli-4, cli-53, cli-33,
cli-62)
       --- <4> request(s) ---------
       <client>     <evaluation>
        cli-4  no adjustments (loss of potential partners cli-8, cli-13)
        cli-53       no harm
        cli-33       no harm
        cli-62       no harm
[...]
ven-7: <1> request(s) to adjust service levels received (cli-33)
       --- <1> request(s) ---------
       <client>     <evaluation>
        cli-33       no harm
[...]
ven-7: <3> request(s) to adjust service levels received (cli-62, cli-33, cli-69)
       --- <3> request(s) ---------
       <client>     <evaluation>
        cli-62       no harm
        cli-33       no harm
        cli-69       no adjustments (loss of potential partners cli-8)
[...]
```

[... Repeated requests of vendor-7's contractual partners to adjust his service levels due to contract compliance. Vendor-7 agrees not to all requested adjustments but only to these where his evaluation did not result in any harm of his situation ...]

```
ven-7: <3> request(s) to adjust service levels received (cli-33, cli-95, cli-87)
       --- <3> request(s) ---------
       <client>      <evaluation>
        cli-33        no adjustments (loss of potential partners cli-10, cli-21)
        cli-95        no harm
        cli-87        no harm
[...]
ven-7: <3> request(s) to adjust service levels received (cli-21, cli-33, cli-14)
       --- <3> request(s) ---------
       <client>      <evaluation>
        cli-21        no harm
        cli-33        no adjustments (loss of potential partners cli-10, cli-21)
        cli-14        no harm
[...]
ven-7: <3> request(s) to adjust service levels received (cli-65, cli-39, cli-33)
       --- <3> request(s) ---------
       <client>      <evaluation>
        cli-65        no harm
        cli-39        no harm
        cli-33        no adjustments (loss of potential partners cli-10, cli-21)
[...]
```

[... Repeated requests of vendor-7's contractual partners to adjust his service levels due to contract compliance. Vendor-7 repeatedly refuses to comply with client-33's requests since vendor-7's evaluation results in threat of loss of potential contractual partners client-10 and cleint-21. Thus, vendor-7 concludes that any readjustments required by client-33 will alter his services portfolio in a way that is less appealing to client-10 and client-21 ...]

```
ven-7: <2> request(s) to adjust service levels received (cli-33, cli-11)
       --- <3> request(s) ---------
       <client>      <evaluation>
        cli-33        no adjustments (loss of contractual partners cli-18, cli-43)
        cli-11        no harm
[...]
ven-7: <1> request(s) to adjust service levels received (cli-65, cli-39, cli-33)
       --- <3> request(s) ---------
       <client>      <evaluation>
        cli-33        no adjustments (loss of contractual partners cli-18, cli-43)
[...]
ven-7: premature termination cli-33 (potential loss of existing clients)
```

[... Client-33 continues on requesting vendor-7 to comply with service adjustments. Evaluation of vendor-7 regarding client-33's requests results in potential loss of already existing contractual partners client-18 and client-43. Consequently, vendor-7 decides on terminating the contractual relationship with client-33 ...]

Excerpt 2: M&A Activities – Same Geographies, New Services.

Excerpt from a simulation run for a vendor-agent 37. The excerpt below shall emphasize the M&A activities and intentions of the vendor-agent 37 to extend his portfolio of offered services while remaining active in the same geographies.

```
ven-37: received RfP (from cli-127; services required SS-7, SS-8; runtime 36
ticks)
ven-37: received RfP (from cli-215; services required SS-13, SS-14, SS-15;
runtime 48 ticks)
ven-37: received RfP (from cli-258; services required SS-11; runtime 24 ticks)
ven-37: received RfP (from cli-12; services required SS-29, SS-30; runtime 60
ticks)
ven-37: received RfP (from cli-397; services required SS-27; runtime 36 ticks)
[...]
ven-37: received RfP (from cli-72; services required SS-9, SS-10; runtime 36
ticks)
[...]
ven-37: evaluation of RfPs:
       --- <1 of 32> bids submitted ---------
       <client>     <reason>
        cli-127      required SS not present in FSU
        cli-215      not all required SS not present in FSU
        cli-258      not all required SS not present in FSU
        cli-12       required SS not present in FSU
        cli-397      required SS not present in FSU
[...]
        cli-72       bid submitted, awaiting response
```

[... vendor-37 notices an increased number of RfPs for certain services (SS-7, SS-8, SS-11, SS-13, SS-14, SS-15, SS-27, SS-29, SS-30) where he is not able to bid due to lack of the services, required by the client, in the $FSU_{ven\text{-}37}$ ...]

```
ven-37: M&A activity (1): self-assessment --> financially strong enough for
acquisition
ven-37: M&A activity (2): strategy choice --> new SSs needed (type 1)
ven-37: M&A activity (3): availability check (type 1):
       --- <24> M&A offers available --------
       <vendor>     <geography>  <additional services>
        ven-125     2             SS-7, SS-8, SS-11, SS-12, SS-31, SS-32, SS-33
        ven-137     3             SS-7, SS-11, SS-13, SS-14, SS-15
        ven-339     1             SS-27, SS-29, SS-30
        ven-353     1             SS-29, SS-30
        ven-247     4             SS-11, SS-13, SS-27
        ven-197     3             SS-13, SS-14, SS-15
        ven-149     2             SS-13,SS-27
        ven-443     1             SS-7, SS-8, SS-11, SS-13, SS-14, SS-15, SS-27
[...]
        ven-91       SS-29, SS-30,
```

[... First the vendor-37 conducts a self-check with respect to his financial situation. In this step the vendor agent assesses whether his financial situation allows him to acquire a rival agent. Before vendor-37 can evaluate the market for M&A offers he has to decide on his M&A strategy. Vender agent decides for M&A strategy to acquire new SSs. In the EBO model this strategy is coded as `type 1` strategy. Under this strategy the availability check scans the M&A offers on the market with regard to domestic vendors with services additional to these of vendor-37 (the M&A acquiree). The locations of the M&A acquiree is set for domestic. The list of vendors available for M&A was shorted due to clarity reasons ...]

```
ven-37: M&A activity (4): evaluation of available M&A partners --> <14 of 24> M&A
offers fulfil the criteria
ven-37: M&A activity (5): evaluation of available M&A partners --> best fit (ven-
443, ven-137, ven-134, ven-339, ven-247, ven-197, ven-149, ven-353, ven-91 [...]
)
ven-37: M&A activity (6): submit bids (ven-443, ven-137, ven-134, ven-339, ven-
247, ven-197, ven-149, ven-353, ven-91 [...] )
```

[... Before acquisition bids can be submitted all vendors found by the availability check have to be prioritized with respect to the additional services they bring and to the number of these services. Bids are submitted to all vendors found by the availability check ...]

```
ven-37: M&A activity (7): evaluation of M&A bid responses <5 of 14> --> best fit
(ven-137, ven-339, ven-247, ven-149, ven-353)
ven-37: M&A activity (8): contract signing with (ven-137)
```

[... After receiving requests on the M&A bids vendor-37 prioritizes positive answers with regard to the best match. Not all vendors, who received an M&A bid from vendor-37 agreed on merger and replied ...]

```
ven-37: M&A activity (9): conduct adjustment FSU(ven-37) SSs --> new (SS-7, SS-8,
SS-11, SS-13, SS-14, SS-15, SS-27)
ven-37: M&A activity (10): conduct adjustment FSU(ven-37) price --> cheaper (SS-
2/SS-4, SS-2/SS-5, SS-3/SS-7, SS-6/SS-7, SS-5/SS-7, SS-7/SS-8, SS7/SS-11, SS-
8/SS-13, SS-8/SS-11, SS-8/SS-14, SS-11/SS-15, SS-15/SS-27)
ven-37: M&A activity (11): inherit changes FSU(ven-37) --> (ven-66, ven-92, ven-
21, ven-48, ven-39, ven-5, ven-68, ven-22 )
```

[... Conduct and wrap-up of the M&A deal: update all members of the vendor-37's M&A network with new inherited prices and skill sets from $FSU_{ven\text{-}37}$ ...]

Excerpt 3: M&A Activities – New Geographies, Same Services.

Excerpt from a simulation run for a vendor-agent 53. The excerpt below shall emphasize the M&A activities and intentions of the vendor-agent 53 to expand his geographic footprint without changing his portfolio of offered services.

```
ven-53: received RfP (from cli-14; services required SS-13, SS-14; runtime 45
ticks)
ven-53: received RfP (from cli-321; services required SS-10; runtime 68 ticks)
ven-53: received RfP (from cli-83; services required SS-15; runtime 32 ticks)
ven-53: received RfP (from cli-143; services required SS-10, SS-11; runtime 59
ticks)
ven-53: received RfP (from cli-51; services required SS-19; runtime 22 ticks)
[...]
ven-53: evaluation of submitted bids: <0 of 7> bids accepted, <7 of 7> bids
rejected
```

[... vendor-53 notices an increased number of rejected bids (7 out of 7 submitted bids) on RfPs for cervices that are within vendor-53's services portfolio (that is, are present in the $FSU_{ven\text{-}53}$). Consequently, vendor-53 decides on expanding his geographic footprint by acquiring a rival in the foreign geography ...]

```
ven-53: M&A activity (1): self-assessment --> financially strong enough for
acquisition
ven-53: M&A activity (2): strategy choice --> new geographies needed (type 2)
ven-53: M&A activity (3): availability check (type 2):
       --- <47> M&A offers available --------
       <vendor>     <geography>
        ven-144     1
        ven-256     2
        ven-187     4
        ven-310     2
```

```
        ven-130     4
        ven-146     2
        ven-89      1
        ven-34      2
        ven-433     2
        ven-141     4
        ven-317     2
        ven-236     1
        ven-382     3
        ven-37      2
        ven-440     2
        ven-223     1
        ven-479     4
[...]
        ven-363     3
```

[... First the vendor-53 conducts a self-check with respect to his financial situation. In this step the vendor agent assesses whether his financial situation allows him to acquire a rival agent. Before vendor-53 can evaluate the market for M&A offers he has to decide on his M&A strategy. Vender agent decides for M&A strategy to acquire a rival company in the foreign location. In the EBO model this strategy is coded as `type 2` strategy. Under this strategy the availability check scans the M&A offers on the market with regard to non-domestic vendors irrespective of services additional to these of the acquirer-vendor. The locations of the M&A acquiree is set for non-domestic. The list of vendors available for M&A was shorted due to clarity reasons ...]

```
ven-53: M&A activity (4): evaluation of available M&A partners --> <18 of 47> M&A
offers fulfil the criteria
ven-53: M&A activity (5): evaluation of M&A partners --> best fit (ven-144, ven-
146, ven-130, ven-89, ven-440, ven-141, ven-236, ven-433, ven-317, ven-256, ven-
223, ven-187, ven-34, ven-37, ven-479, ven-363, ven-310, ven-382)
ven-53: M&A activity (6): submit bids (ven-144, ven-146, ven-130, ven-89, ven-
440, ven-141, ven-236, ven-433, ven-317, ven-256, ven-223, ven-187, [...])
```

[... Before acquisition bids can be submitted all vendors found by the availability check have to be prioritized. Since all shortlisted vendors are already located in foreign geographies the prioritization is done with respect to the coverage of services in the $FSU_{ven\text{-}53}$. Additional services are rated as positive only in case of a full coverage of services in the $FSU_{ven\text{-}53}$ by M&A acquiree. Bids are submitted to all vendors found by the availability check ...]

```
ven-53: M&A activity (7): evaluation of M&A bid responses <10 of 18> --> best fit
(ven-146, ven-130, ven-433, ven-317, ven-256, ven-223, ven-187, ven-37, ven-363,
ven-310)
ven-53: M&A activity (8): contract signing with (ven-146)
```

[... After receiving requests on the M&A bids vendor-53 prioritizes positive answers with regard to the best match. Not all vendors, who received an M&A bid from vendor-53 agreed on merger and replied ...]

```
ven-53: M&A activity (9): (1) compare FSU(ven-53) and FSU(ven-146) --> no
additional services found
ven-53: M&A activity (10): (2) compare FSU(ven-53) and FSU(ven-146) --> <5>
cheaper transitions found
```

```
ven-53: M&A activity (8): conduct adjustment FSU(ven-53) SSs --> new (no
additional services to transfer)
ven-53: M&A activity (11): conduct adjustment FSU(ven-37) price --> cheaper (SS-
3/SS-9, SS-4/SS-6, SS-8/SS-9, SS-15/SS-17, SS-8/SS-13)
ven-53: M&A activity (12): inherit changes FSU(ven-53) --> (ven-131, ven-69, ven-
168, ven-224, ven-201, ven-92, ven-345, ven-243)
```

[... Conduct and wrap-up of the M&A deal: $FSU_{ven-146}$ is scanned for any additional services (in case found, these are duplicated to FSU_{ven-53}) and cheaper price transitions (in case found, FSU_{ven-53} is updated accordingly). After updating FSU_{ven-53} the new changes are inherited to all members of the vendor-53's M&A network ...]

Excerpt 4: M&A Activities – New Geographies, New Services.

Excerpt from a simulation run for a vendor-agent 77. The excerpt below shall emphasize the M&A activities and intentions of the vendor-agent 77 to extend his portfolio of offered services while also expanding his geographic footprint.

```
ven-77: received RfP (from cli-329; services required SS-15, SS-16; runtime 37
ticks)
ven-77: received RfP (from cli-450; services required SS-23; runtime 30 ticks)
ven-77: received RfP (from cli-96; services required SS-28, SS-29; runtime 44
ticks)
ven-77: received RfP (from cli-41; services required SS-29; runtime 26 ticks)
ven-77: received RfP (from cli-89; services required SS-14, SS-27; runtime 43
ticks)
ven-77: received RfP (from cli-68; services required SS-14; runtime 34 ticks)
ven-77: received RfP (from cli-241; services required SS-17, SS-18, SS-19;
runtime 48 ticks)
ven-77: received RfP (from cli-389; services required SS-6; runtime 59 ticks)
ven-77: received RfP (from cli-736; services required SS-8, SS-12; runtime 63
ticks)
ven-77: received RfP (from cli-121; services required SS-10, SS-11; runtime 48
ticks)
ven-77: received RfP (from cli-65; services required SS-4, SS-9; runtime 55
ticks)
[...]
ven-77: evaluation of RfPs:
       --- <28 of 63> bids submitted ---------
       <client>     <reason>
        cli-329      not all required SS not present in FSU
        cli-450      required SS not present in FSU
        cli-96       not all required SS not present in FSU
        cli-41       required SS not present in FSU
        cli-89       not all required SS not present in FSU
        cli-68       required SS not present in FSU
        cli-241      not all required SS not present in FSU
        cli-389      required SS not present in FSU
        cli-736      not all required SS not present in FSU
        cli-121      not all required SS not present in FSU
[...]
        cli-65       bid submitted, awaiting response
[...]
ven-77: evaluation of submitted bids: <3 of 28> bids accepted, <25 of 28> bids
rejected
```

[... vendor-77 notices an increased number of RfPs for certain services (SS-6, SS-8, SS-10, SS-11, SS-12, SS-14, SS-15, SS-16, SS-16, SS-17, S-18, SS-19, SS-23, SS-27, SS-28, SS-29) where he is not able to bid due to lack of the services, required by the client, in the FSU_{ven-77}. At the same time vendor-77 notices an increased number of rejected bids (25 out of 28 submitted bids) on RfPs for certain services that are within vendor-77's services

portfolio (that is, are present in the FSU_{ven-77}). Consequently, vendor-77 decides on expanding his geographic footprint and services portfolio by acquiring a rival in the foreign geography ...]

```
ven-53: M&A activity (1): self-assessment --> financially strong enough for
acquisition
ven-53: M&A activity (2): strategy choice --> new SSs & geographies needed (type
3)
ven-53: M&A activity (3): availability check (type 3):
      --- <31> M&A offers available --------
      <vendor>     <geography>  <additional services>
       ven-119     1            SS-6, SS-8, SS-11, SS-12, SS-14, SS-31, SS-32
       ven-291     2            SS-15, SS-16, SS-19, SS-23, SS-27, SS-29, SS-31,
SS-32
       ven-43      4            SS-6, SS-8, SS-10, SS-11, SS-12, SS-14, SS-15,
SS-16, SS-31, SS-32
       ven-81      2            SS-17, SS-18, SS-19, SS-23
       ven-49      4            SS-23, SS-27, SS-28, SS-29, SS-31, SS-32
       ven-184     2            SS-6, SS-12, SS-14, SS-16, SS-19, SS-23, SS-27,
SS-28, SS-29
       ven-251     1            SS-12, SS-14, SS-15, SS-16
       ven-97      2            SS-16, SS-17, SS-18, SS-19, SS-27, SS-28, SS-29
       ven-182     2            SS-6, SS-8, SS-10, SS-16, SS-17, SS-18, SS-19,
SS-23
       ven-288     4            SS-27, SS-28, SS-29, SS-32
       ven-176     2            SS-6, SS-11, SS-12, SS-14, SS-15, SS-16, SS-17,
SS-18, SS-27, SS-28, SS-29, SS-32
[...]
       ven-117     3            SS-6, SS-8, SS-8, SS-, SS-19, SS-23
```

[... First the vendor-77 conducts a self-check with respect to his financial situation. In this step the vendor agent assesses whether his financial situation allows him to acquire a rival agent. Before vendor-77 can evaluate the market for M&A offers he has to decide on his M&A strategy. Vender agent decides for M&A strategy to acquire new SSs and a rival company in the foreign location. In the EBO model this strategy is coded as `type 3` strategy. Under this strategy the availability check scans the M&A offers on the market with regard to non-domestic vendors with services additional to these of vendor-77 (the M&A acquiree). The locations of the M&A acquiree is set for non-domestic. The list of vendors available for M&A was shorted due to clarity reasons ...]

```
ven-77: M&A activity (4): evaluation of available M&A partners --> <23 of 31> M&A
offers fulfil the criteria
ven-77: M&A activity (5): evaluation of M&A partners --> best fit (ven-176, ven-
184, ven-43, ven-81, ven-49, ven-119, ven-291, ven-288, ven-117, ven-251, ven-97,
ven-182 [...] )
ven-77: M&A activity (6): submit bids (ven-176, ven-184, ven-43, ven-81, ven-49,
ven-119, ven-291, ven-288, ven-117 ven-251, ven-97, ven-182 [...])
```

[... Before acquisition bids can be submitted all vendors found by the availability check have to be prioritized. Since all shortlisted vendors are already located in foreign geographies the prioritization is done with respect to services additional to these in FSU_{ven-53}. Bids are submitted to all vendors found by the availability check ...]

```
ven-77: M&A activity (7): evaluation of M&A bid responses <16 of 23> --> best fit
(ven-176, ven-81, ven-49, ven-291, ven-288, ven-117, ven-182 [...])
ven-77: M&A activity (8): contract signing with (ven-176)
```

[... After receiving requests on the M&A bids vendor-77 prioritizes positive answers with regard to the best match. Not all vendors, who received an M&A bid from vendor-77 agreed on merger and replied ...]

```
ven-53: M&A activity (9): (1) compare FSU(ven-77) and FSU(ven-176) --> <12> new
SSs found
ven-53: M&A activity (10): (2) compare FSU(ven-77) and FSU(ven-176) --> <>
cheaper transitions found
ven-37: M&A activity (11): conduct adjustment FSU(ven-53) SSs --> new (SS-6, SS-
11, SS-12, SS-14, SS-15, SS-16, SS-17, SS-18, SS-27, SS-28, SS-29, SS-32)
ven-53: M&A activity (12): conduct adjustment FSU(ven-37) price --> cheaper (SS-
3/SS-6, SS-4/SS-6, SS-3/SS-11, SS-11/SS-12, SS-14/SS-15, SS-15/SS-16, SS-16/SS-
17, SS-17/SS-18, SS-25/SS-27, SS-27/SS-28, SS-28/SS-29, SS-31/SS-32)
ven-53: M&A activity (13): inherit changes FSU(ven-53) --> (ven-204, ven-165,
ven-90, ven-227, ven-39, ven-16, ven-175, ven-207, ven-2, ven-221, ven-204, ven-
134, ven-204, ven-4)
```

[... Conduct and wrap-up of the M&A deal: $FSU_{ven-176}$ is scanned for any additional services (in case found, these are duplicated to FSU_{ven-77}) and cheaper price transitions (in case found, FSU_{ven-77} is updated accordingly). After updating FSU_{ven-77} the new changes are inherited to all members of the vendor-77's M&A network ...]

Excerpt 5: M&A Activities – Acquiree's View.

Excerpt from a simulation run for a vendor-agent 221. The excerpt below shall emphasize the M&A activities and intentions of the vendor-agent 221 while trying to improve his financial situation. First vendor-agent 221 considers an option to acquire a rival but after evaluation of own financial situation he decides to be acquired by another rival.

```
ven-221: received RfP (from cli-309; services required SS-12; runtime 48 ticks)
ven-221: received RfP (from cli-107; services required SS-9, SS-10; runtime 39
ticks)
ven-221: received RfP (from cli-15; services required SS-29; runtime 57 ticks)
[...]
ven-221: received RfP (from cli-273; services required SS-11; runtime 61 ticks)
[...]
ven-221: evaluation of RfPs:
       --- <5 of 32> bids submitted ---------
       <client>     <reason>
        cli-107      not all required SS not present in FSU
        cli-15       required SS not present in FSU
        cli-309      bid submitted, awaiting response
        cli-273      bid submitted, awaiting response
[...]
ven-221: evaluation of submitted bids: <0 of 5> bids accepted, <5 of 5> bids
rejected
```

[... vendor-221 notices an increased number of RfPs for certain services where he is not able to bid due to lack of the services, required by the client, in the $FSU_{ven-221}$. At the same time vendor-221 notices an increased number of rejected bids (5 out of 5 submitted bids) on RfPs for certain services that are within vendor-221's services portfolio (that is, are present in the $FSU_{ven-221}$). Consequently, vendor-221 decides on expanding his geographic footprint and services portfolio by acquiring a rival in the foreign geography ...]

```
ven-221: M&A activity (1): self-assessment --> financial stability does not allow
for acquisition
ven-221: M&A activity (2): strategy choice --> advertise as available for M&A
(type 4)
ven-221: M&A activity (3): market announcement (type 4) made
```

[... First the vendor-221 conducts a self-check with respect to his financial situation. In this step the vendor agent assesses whether his financial situation allows him to acquire a rival agent. The self-check reveals that vendor-221 does not possess the financial stability to sustain an acquisition of a competitor. Consequently, vender-211 agent decides for M&A strategy to be acquired by another competitor. In the EBO model this strategy is coded as `type 4` strategy. Strategy of the `type 4` is a passive strategy where vendor-221 does not proactively scan the environment for potential opportunities but waits for bids ...]

```
ven-221: M&A activity (4): <3> M&A bid(s) received (type 4):
       --- <3> M&A offers available --------
       <vendor>     <geography>  <international>     <size>
        ven-119     1            4                  0.61
        ven-291     2            1                  0.37
        ven-117     1            3                  0.46
ven-221: M&A activity (5): evaluation of available M&A offers --> <2 of 3> M&A
offers fulfil the criteria
ven-221: M&A activity (6): evaluation of M&A partners --> best fit (ven-119, ven-
117)
ven-221: M&A activity (7): submit bid (ven-119)
```

[... When bids are received, these are analysed according to agent specific criteria (size of the acquirer, internationalisation, ethnicity, etc.). The importance of each characteristic is also agent specific and is implemented via endorsements. In the case at hand, vendor-221 rejects the M&A offer of vendor-291 due to small size and ethnicity of vendor-291. Since the M&A process is designed the way that only one offer can be accepted, vendor-221 prefers the biggest vendor-119 with the highest coverage of international operations ...]

```
ven-221: M&A activity (8): list of SSs & transitions from FSU(ven-221) sent to
ven-119
ven-221: M&A activity (9): inherit FSU(ven-119) --> <8> new SSs, <17> new/updated
transitions
ven-221: M&A activity (10): conduct adjustment FSU(ven-221) SSs --> new (SS-5,
SS-7, [...] )
ven-221: M&A activity (11): conduct adjustment FSU(ven-221) price --> cheaper
(SS-4/SS-5, SS-5/SS-7 [...] )
```

[... Conduct and wrap-up of the M&A deal: $FSU_{ven\text{-}221}$ is scanned for any additional services to these in $FSU_{ven\text{-}119}$ (in case found, these are duplicated to $FSU_{ven\text{-}119}$) and cheaper price transitions (in case found, $FSU_{ven\text{-}119}$ is updated accordingly). After updating $FSU_{ven\text{-}119}$ the new changes are inherited to all members of the vendor-119's M&A network, including vendor-221. In the case at hand vendor-221 inherits 8 new skill sets and 17 transitions ...]

Excerpt 6: Vendor Selection by client 103.

Excerpt from a simulation run for a client-agent 103. The excerpt below shall emphasize client-agent 103's selection routine for a contractual partner.

```
cli-103: self-assessment (1) --> quote (0.8) of needed SSs is met
cli-103: strategy choice --> cost saving (type 2)
cli-103: skillset choice (1) --> SSs over market avg. (SS-8, SS-21, SS-19, SS-9,
SS-3, SS-20, SS-11, SS-15, SS-7, SS-18, SS-17, SS-5)
cli-103: skillset choice (2) --> non-specific SSs (SS-21, SS-19, SS-20, SS-11,
SS-15, SS-18, SS-17)
cli-103: skillset choice (3) --> most expensive SSs (SS-19, SS-20)
cli-103: issue <2>RfPs (SS-19, SS-20)
```

[... First the client-103 conducts a self-check with respect to the state of his $FSU_{client\text{-}103}$ and needed skill sets. This evaluation allows client-103 to decide for the outsourcing strategy which fits best his business goal. Client agent decides for cost saving strategy since he meets his personal requirements with respect to $FSU_{client\text{-}103}$-completion (80% of FSU_{system}). In the EBO model this strategy is coded as `type 2` strategy. The client-agent conducts a second evaluation to determine skill sets that are non-specific which production costs over the market average. Consequently client-103 determines three skill sets for which he issues three RfPs ...]

```
cli-103: received <32> RfP answers (type 2):
       --- <32> offers available --------
       <vendor>      <geography>   <cost>
        ven-79       5             0.48
        ven-150      3             0.63
        ven-24       1             1.41
        ven-172      2             1.54
        ven-20       2             0.49
        ven-282      2             0.83
        ven-112      5             0.42
        ven-232      3             0.61
        ven-19       1             1.43
        ven-221      2             0.94

[...]
        ven-159      1             0.58
cli-103: order bids (cost): (ven-112, ven-79, ven-20, ven-159, ven-232, ven-150,
ven-282, ven-221, ven-24, ven-19, ven-172)
cli-103: order bids (international operations): (ven-112, ven-232, ven-221, ven-
19, ven-172 ven-79 ven-150, ven-24, ven-20, ven-159, ven-282)
cli-103: order bids (domestic): (ven-221, ven-172 ven-79 ven-112ven-150, ven-232,
ven-24, ven-19, ven-20, ven-159, ven-282)
cli-103: order bids (cumulative): (ven-221, ven-172)
cli-103: contract signing with (ven-221)
```

[... All bidding vendors meet the criteria with regard to needed skills. In order to build a preferential ordering client-103 has several evaluation stages. First, client evaluates the production costs of vendors. Next, international operations of the bidding vendors are compared. Clients, prefer internationally active vendors. Consequently, an ordering with regard to domestic and non-domestic origins of the vendors as made. Finally, an overall ordering is produced. Being not the cheapest bids, vendor-221 and vensdor-172 land on the final short list and vendor-221 is awarded the contract ...]

```
cli-103: move (SS-19) to passive FSU part
cli-103: start retention ticker (SS-19)
cli-103: swap (SS-19) in FSU(cli-103) with FSU(ven-221)
cli-103: swap production cost(SS-16/SS-19, SS-6/SS-19, SS-10/SS-19, SS-14/SS-19)
in FSU(cli-103) with FSU(ven-221)
```

[... Conduct and wrap-up of the skill set transfer of outsourced skill sets in $FSU_{client\text{-}103}$ to the passive part and substitution of these by skill sets from $FSU_{vendor\text{-}221}$. ...]

Appendix B

Score Cards

This section contains two anonymised scorecards – weighted and non-weighted. Similar structure of scorecards has been reported by remaining client participants of the study.

Vendor Selection Weighted Checklist

Due to confidentiality reasons the questions in the list as well as the weightings had to be disguised.

Question	Weighting	Vendor *1*	Vendor *2*	…	Vendor *n*
Experience and expertise. How long has this vendor been in this business, and what similar project experience does this vendor have?	0.15	N	Y	...	N
Track record, part 1. Past performance, customer focus, and reputation as disclosed by sales staff.	0.05	N	N	...	Y
Track record, part 2. Past performance, customer focus, and reputation as disclosed through independent research.	0.07	N	Y	...	Y
Site visit. Do the facilities meet your requirements?	0.1	Y	N	...	Y
Financial strength. Do the vendor's financial standing, creditworthiness, and stability support the significant investment you will make, or is it a start-up or thinly capitalized?	0.1	N	Y	...	N
Flexibility. Business model, contract, and scalability.	0.15	Y	Y	...	N
Integrity. Confidentiality, security, intellectual	0.17	Y	N	...	Y
People. Real, active employees; legitimate education and certifications.	0.12	Y	N	...	N
Price and margin.	0.09	N	Y	...	Y

Table B-1: Weighted checklist for vendor selection.

Vendor Selection Non-Weighted Y/N-Checklist

A more rudimentary vendor checklist with only binary possibilities of information input.

YES	NO	CHECKLIST
		Complete a thorough vendor background check.
		Are they financially stable? (check credit reports and bank references)
		Do they have a good leasing track record?
		Verify vendor qualification.
		Do they have the quality and quantity of staff needed to carry out the contract?
		Do they have the ability to carry out the administration requirements specifically related to your agency needs (i.e., billing)?
		Do they have the ability to manage their own risks?
		Do they have experience with providing the equipment you need?
		Do they have experience handling the type or size of contract you need?
		If contracting for multiple locations, particularly over a wide geographic area, does vendor have the ability to meet needs at all locations?
		Do they describe how they handle equipment disposal at the end of the lease?

	Is the end-of-lease purchase price determined?
	Does the vendor allow substitution of like items for lost or damaged equipment?
	Does the vendor provide end-of-lease notification?
	Does the vendor provide notification of lease transference?
	Have life cycle scenario costs been considered for early termination?
	Have life cycle scenario costs been considered for return to lessor?
	Have life cycle scenario costs been considered for extension of lease?
	Have life cycle scenario costs been considered for a purchase option at end of lease?
	Has the vendor specified the estimated residual value? (A higher residual value can mean lower lease payments since the vendor can make money on the asset resale.)
	Have standards of equipment usage been verified for moves, changes, reassignments, and upgrades without vendor permission?
	Does the lessor define the appropriate environment for the equipment—i.e., voltage, operational environmental requirements?
	Have service level agreements been verified for installation—full, partial, minimum?
	Have service level agreements been verified for maintenance requirements, including acceptable downtime (if any)?
	Have service level agreements been verified for asset management requirements—i.e., what type of software is included, will the vendor provide tracking reports?
	Have service level agreements been verified for upgrade flexibility options?

Table B-2: Non-weighted yes/no-checklist for vendor selection.

Spider Diagrams

Interviewed stakeholders used terms *spider (web) charts*, *radar charts*, *web charts* and *star plots* interchangebly referring to the same type of graphs. Spider charts are used for graphical representation of multivariate data on a two-dimensional chart. These charts offer an adequate visual representation for small to moderate sized multivariate data sets. With large data sets spider charts become convoluted.

Spider chart for provider assessment

Spider charts are applied for strikingly showing outliers that are obscured in the score cards. For this purpose key performance indicators (usually performance metrics from scorecards are aggregated to a moderate sized data sample) are plotted on the spokes of the spider chart with each spoke representing one of the key performance indicators from the score card.

Spider chats are applied to discover possible outlayers in the performance of evaluated providers (strengths and weaknesses). Also these charts are used for comparison of several providers regarding the dominance of particular performance indicators. Such comparisons are helpful as a means of visual information representation but are poorly suited for final decision making.

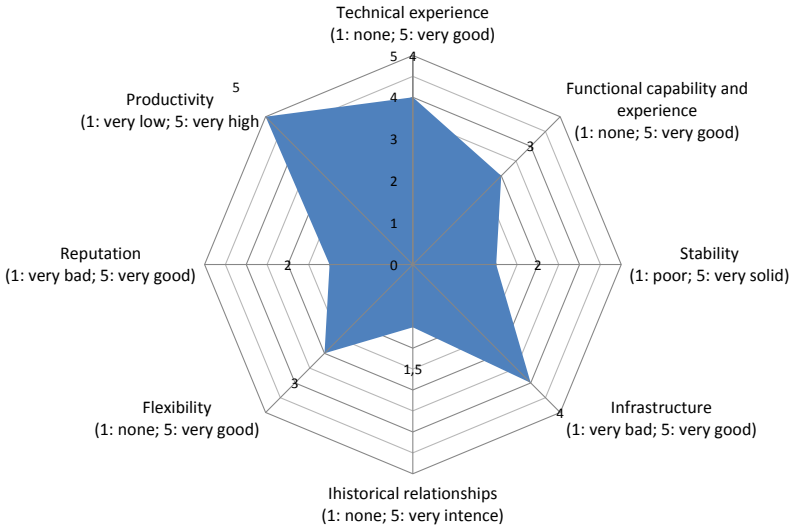

Figure B-1: Spider chart with 8 criteria for provider selection.

Spider chart for provider monitoring

Spider charts are applied for control and display of performance metrics. Spider charts for monitoring purposes are created from a monitoring scorecard that is evaluated at certain, contractually agreed, intervals. Consequently, calculated values from the score card are documented and juxtaposed with reference values. Scorecards in conjunction with spider charts represent a widely spread management instrument deployed by controlling predominantly. A clear visual representation of key metrics allows for easy target performance comparison as well as comparison of various vendors' performances.

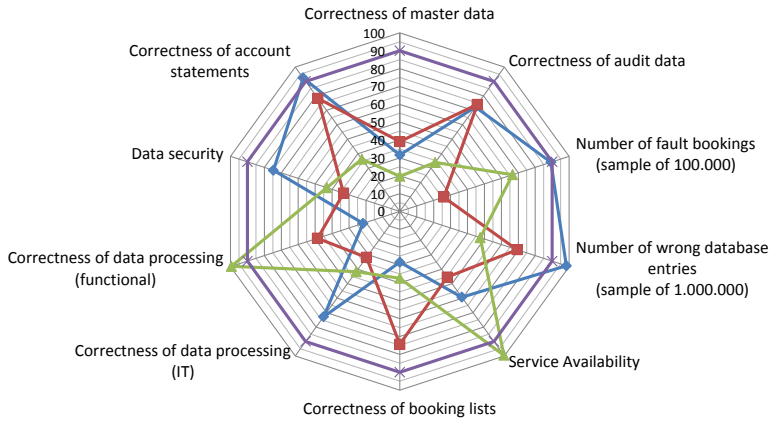

Figure B-2: Spider chart created from a monitoring scorecard for credit card payment processing.

Appendix C

For all interviews the methodology introduced in (Yin 1994) was adopted. All interviews were done face-to-face or in a group setting. The interviews were semi-structured, such that the interviewer had a list of topics that were to be covered, but the interviewer was not forced to strictly adhere to them. The questions were open-ended, giving the interviewees an opportunity to report what they had observed and experienced. In order to allow for a flexible approach to interviewing a fixed list of interview questions bellow served only as a guiding mechanism to give the stimulus for discussions of desired areas. These interviews gave the researcher the opportunity to see the research topic from the view point of the participating stakeholders and to understand how individuals come to have this perspective. The author argues this aspect is of paramount importance for the agent based modellers, who intend to mime the stakeholder's cognitive patterns with agents. However, semi-structured method also bears the limitation of being slightly less reliable because of the difficulty of exactly repeating the interview.

There is a set of general questions on the sentiment of the outsourcing market to get the feeling of the interviewees on the topic. The interviewees are confronted with these questions at the beginning and at the end of the interview. The ulterior motive for such procedure is to get the sense of whether the interviewee's opinion on the topic experienced a shift in the course of the interview discussion while being confronted with provoking questions regarding their organisations. In case the interviewer could detect a shift in opinion, this observation was reviewed with the very same interviewees leading on to further lively discussions.

1. **Sentiment of the Market (*a priory* view)**
   - 1.1. What is your overall sense of Outsourcing activity for the current year as compared to the previous one?
   - 1.2. What is your prediction for the current year, with regard to the quantity of outsourcing deal signings?
   - 1.3. Does your organisation have experience working with an outsourcing provider in general?
   - 1.4. Does your organisation have experience working non-domestic outsourcing providers?
   - 1.5. Does your organisation have experience working with multiple outsourcing providers?
   - 1.6. What is your primary reason for using or considering an outsourcing provider?

1.7. Did your company manage to take advantage of economies of scale or/and experience during your recent outsourcing engagements?

1.8. Does your company consider outsourcing as a viable alternative to gain access to critical skill sets and experiences?

1.9. Did your company manage to focus freed internal resources on core business processes after entering an outsourcing relationship?

2. Failure & Success

2.1. Considering the track record of your company, what are the most significant problems your organisation has experienced with outsourcing? In general, what do you believe are the most common causes of deal failures considering the track record of your organisation?

2.2. Are missed deadlines and delays considered as negative outcomes in your outsourcing projects? What actions has your company taken to address this issue?

2.3. Has your company ever encountered problems in an outsourcing deal because the provider doesn't understand your company's business well? What actions has your company taken to address this issue?

2.4. Did your organisation ever experience staff or end-user resistance in an outsourcing project? What actions has your company taken to address this issue? Do you think low internal customer satisfaction plays role in the success of the outsourcing deal?

2.5. Which factors would you classify as critical to achieving success in outsourcing arrangements?

2.6. Do you consider having an established escalation and conflict management as critical to achieving success in outsourcing arrangements?

2.7. Do you think poor morale of internal staff is a threat to the success of the outsourcing deal?

2.8. Does your company ever experience issues in an outsourcing deal due to lack of clarity of roles and responsibilities? If so, would you say the lack of clarity was on your organisation's or supplier's side? What actions has your company taken to address this issue?

2.9. Sometimes outsourcing deals fail even if everything was done after best practices. What would you attribute to external influences that can cause such failures?

3. Relationship Management

3.1. Do you consider relationship management as a necessity or as a burden?

3.2. Do you generally agree with the statement that a poor working relationship causes poor business results? If so, how does a poor working relationship can cause poor business results?

3.3. Does poor working relationship cause lack of trustworthiness? Does your organisation consider trustworthiness as an indicator at all?

3.4. Do you generally agree with the statement that poor working relationship wastes resources? Which involved party (clients or vendors) incurs most additional efforts?

3.5. Do your think flawed contracts and contractual terms that are not clearly defined can be alleviated via a good working relationship with your provider?

3.6. Does poor working relationship cause frequent conflict escalation and/or slower decision making?

3.7. What measures would your company resort to in in an outsourcing deal with a provider with whom you have a very poor working relationship in order to resolve problems? What measures would your company resort to in in an outsourcing deal with a highly collaborative provider relationship with strong mutual trust and a rare need to refer to the contract to resolve problems?

3.8. How does your organisation invest into building a good working relationship with contracted suppliers?

3.9. Do you believe that customers can fail in their role in enabling providers' success? If so, how can customers enable providers' success?

4. Change Management

4.1. How frequent are changes to expect in an average outsourcing contract?

4.2. Are changes triggered by business or changed customer demands? Are these treated differently by contracted suppliers?

4.3. Is change management harder to enforce in environments with poor working relationship or is it still assured through contractual agreements independent of the working relationship's state?

4.4. Regarding the overall performance of an outsourcing deal, is there a difference in the aftermath of a not effectively managed internal change or external relationship? If so, where does the difference lies in?

5. Cost

5.1. Based on your experience, how much should a provider's better relationship management capability offset a competitor's price advantage by?

5.2. How crucial is the price factor for your final decision?

5.3. What is the time scope you take into consideration while evaluating the price?

5.4. Is it more important for your organisation to obtain the best price of services at the outset of the deal rather than over the whole span of the contract?

5.5. Does your organisation try to ensure that pricing stays at industry-standard levels throughout the course of the deal via benchmarking provisions or re-negotiations? If so, how frequently are these measures enforced?

5.6. Does your organisation consider selecting a provider with the greatest technical expertise or greatest price advantage as a critical success factor of the outsourcing endeavour?

5.7. Is it common to have costs higher than originally expected at the end of the outsourcing deal? How frequently does that happen? What actions has your company taken to address this issue?

5.8. What percentage of the annual contract value depends on having a good working relationship with your provider?

5.9. Do you believe there is such thing as a use of incorrect scope and/or price in an outsourcing deal or is it just another way of saying that the relationship management went wrong?

6. Legal

6.1. Is your organisation satisfied with its outsourcing arrangements in terms of legal safeguards?

6.2. Does your company fall back on legal repercussions for conflict management and/or problem-solving?

6.3. Did change management exhibit an issue for your organisation in past outsourcing deals? If so, what actions has your company taken to address this issue?

6.4. Is crafting and enforcing legal terms and conditions more important for your organisation rather than investing in a quality working relationship with your organisation's provider?

7. Monitoring

7.1. Does your company deploy any methods to monitor the health and quality of the relationship among your organisation or business units affected by outsourcing contract?

7.2. Do you feel that your organisation monitors the work of the outsourcing providers effectively?

7.3. Does your company consider stringent monitoring and enforcing of SLAs more effective rather than investing in a quality working relationship with your organisation's provider?

7.4. Do you feel that your organisation has the power to force the provider to do what is required?

7.5. Do you feel that the power distribution between your company and the contracted suppliers is fair?

7.6. Do you think that increase of monitoring efforts influences the working relationship to better or worse?

7.7. Do you think your company shall invest more into monitoring measures or into building a quality working relationship with concerned providers?

7.8. Does poor working relationship cause greater monitoring and audit efforts?

8. Escalation and Problem Solving

8.1. Does your organisation have a relationship management or governance function that monitors the work of your providers?

8.2. Does your company monitor performance to SLAs defined with the supplier?

8.3. How does your organisation react in case SLAs are not met?

8.4. Do your feel that your organisation deals with underperforming providers in an effective way?

8.5. How problems or issues between your company and outsourcing supplier are solved?

8.6. Does your company have well established escalation paths?

8.7. Does your company have well established conflict management processes?

8.8. On which level of your company problems and issues regarding the outsourcing relationship are dealt with?

8.9. Do you consider established conflict and escalation management as equally important?

9. Vendor Selection

9.1. Do you understand all metrics used by your organisation for vendor selection and monitoring processes?

9.2. How strong is the final decision influenced by the aforementioned metrics?

9.3. Is there something like a notion of soft factors that is considered in the vendor selection process? If so, how important are these for the process of vendor selection in your organisation?

9.4. Do you have the feeling the process of vendor selection in your organisation are transparent to all involved participants? If no, which parts of the process are blurry?

9.5. Did you ever make the choice of a supplier based on the so called “gut feeling” even if he was not the best choice according to deployed metrics?

9.6. How does a provider’s ability to act as a good partner influence your organisation’s provider selection process today compared to the earlier days?

9.7. Is it an informal or formal metric in your evaluation? If it is formally evaluated, how does the weighting look like compared with other factors?

9.8. Do you believe there is such thing as a selection of incorrect provider or is it just another way of saying that the relationship management went wrong?

10. Sentiment of the Market (*a posteriori* view)

10.1. What is your overall sense of Outsourcing activity for the current year as compared to the previous one?

10.2. What is your prediction for the current year, with regard to the quantity of outsourcing deal signings?

10.3. Does your organisation have experience working with an outsourcing provider in general?

10.4. Does your organisation have experience working non-domestic outsourcing providers?

10.5. Does your organisation have experience working with multiple outsourcing providers?

10.6. What is your primary reason for using or considering an outsourcing provider?

10.7. Did your company manage to take advantage of economies of scale or/and experience during your recent outsourcing engagements?

10.8. Does your company consider outsourcing as a viable alternative to gain access to critical skill sets and experiences?

10.9. Did your company manage to focus freed internal resources on core business processes after entering an outsourcing relationship?

Appendix D

Table D-1 summarizes the theories used in outsourcing research together with their supporting literature, basic assumptions deployed and the granularity of analysis.

Theoretical foundation	Level of analysis	Basic assumptions	Main variables / focus	Key authors
Agency theory	Organizational	Asymmetry of information, differences in perceptions of risk, uncertainty	Agent costs, optimal contractual relationships	Jensen and Meckling (1976)
Game theory	Organizational, Individual	Every player under the same conditions, make rational and intelligent decisions to maximize profit, incomplete information	Decisions under certain situations	Kreps et al. (1982); Nash (1953); Spence (1976); Fudenberg & Tirole (1990)
Innovation theories	Organizational, Individual	Innovation occurs in stages, some models not based on stages	Adoption, and diffusion	Daft (1978) ; Rogers (1983); Schroeder et al. (1989); Zaltman et al. (1973)
Power and politics theories	Organizational, Individual	Power, idiosyncratic interests, and politics play major roles in organizational decision-making	Different degrees of power, organizational politics	Pfeffer, (1981; 1982) ; Markus (1983)
Relationship theories	Organizational	Parties in the relationship assume that the outcome of a relationship is greater than achieved by individual parties separately	Cooperation, interactions, social and economic exchanges	Klepper (1995) ; Kern (1997)
Resource theories	Organizational	A firm is a collection of resources, and resources are central to a firm's strategy	Internal resources, resources in the task environment	Barney (1991); Penrose (1959); Pfeffer & Salancik, (1978); hompson, (1967)
Social exchange theory	Organizational, individual	Participation in exchange occurs with the assumption of rewards and obligation to return rewards	Exchange of activities, benefits/costs, reciprocity, balance, cohesion, and power in exchanges	Blau (1964) ; Emerson (1972); Homans (1961)
Strategic management theories	Organizational	Firms have long-term goals, and they plan and allocate resources to achieve these goals	Strategic advantage, strategies, choice of individuals	Chandler, (1962); Miles & Snow (1978); Porter (1985); Quinn, (1980)
Transaction cost theory	Transaction	Limited rationality, opportunism	Transaction costs, production costs	Coase (1937); Williamson (1975; 1981; 1985)

Table D-1: Overview of theoretical foundations and their supporting literature (Dibbern, 2004).

Table D-2 illustrates the risk categorization according to (Lonsdale and Cox, 1998) and the corresponding supporting literature.

Main risk categories (Lonsdale and Cox 1998)	**Main references** (in addition to Lonsdale Cox 1998)
Loss of core activitie	Aron et al., 2005 (Risk of atrophy) Belcourt, 2006 (Risk of reduced value) Kremic et al., 2006 (Risk of loss of core knowledge) Leavy, 2001, 2004 (Risk of losing skills key to competition) Lonsdale, 1999 (Risk of outsourcing critical activities) Lonsdale & Cox, 1998 (Risk of losing core activities) Quelin & Duhamel, 2003 (Risk of loss of competencies) Quinn & Hilmer, 1995 (Risk of loss of critical skills)
Being leveraged by supplier (Risk of dependency / opportunism)	Aron et al., 2005 (Risk of opportunism) Heikkilä & Cordon, 2002 (Risk of dependency and opportunism) Hoecht & Trott, 2006 (Risk of dependency) Leavy, 2001 (Risk of opportunism) Lonsdale, 1999, 2001 (Risk of dependency) Mol, 2007 (Opportunistic behavior) Quelin & Duhamel, 2003 (Risk of dependency)
Loss of strategic flexibility	Chesbrough & Teece, 1996
Interruptions to supply	Aron et al., 2005 (Operational risks) Quelin & Duhamel, 2003 (Risk of suppliers deficient capabilities)
Poor quality of supply	Aron et al, 2005 (Operational risks) Belcourt, 2006 (Service risk) Quelin & Duhamel, 2003 (Risk of suppliers deficient capabilities)
A fall in employee morale	Belcourt, 2006 (Risk of lower employee morale)
A loss of internal coherence	Leavy, 2001 (Risk of losing learning opportunities) Hoecht & Trott, 2006 (Risk of losing innovativeness) Quinn & Hilmer, 1995 (Loss of cross functional skills)
Confidentiality leaks	Beasley et al., 2004 (Risk of revealing confidential information) Hoecht & Trott, 2006 (Risk of losing innovativeness)
Loss of intellectual property rights	Desouza et al, 2004 (Risk of intellectual property theft) Kumar & Eickhoff, 2005 (Intellectual property risk) Power et al., 2004 (Intellectual property risk)

Table D-2: Overview of risks and their supporting literature (Hietalahti and Kuoppala, 2009).

Table D-3 is taken from RTTS[130] website and offers an index of published statistical material with respect to outsourcing. The index is continually maintained.

Source: Statement	Date
Investors.com: More than 1.3 million additional Western jobs will vanish by 2014 due to the accelerated movement of work to India and other offshore locations," says the study released Nov. 15. Hackett doesn't talk of this as good or bad, but as something that will be a reality ? and a challenge ? for more Western businesses. Hackett says the pace of job erosion has nearly doubled this decade."	Dec 2010
Infoworld.com: When you send programming offshore, you're moving it 12 time zones over, to developers with a very different native culture who usually speak English with less than full proficiency. Agile would require them to communicate frequently and informally with business users who don't speak the programmers' native language with any proficiency, through a teleconferencing circuit and maybe a Web conferencing session.	Sep 2010
The Outsource Blog: There is research that proves that many companies that outsource either domestically or internationally don't perform as well as before the outsourcing. In a study, the average user satisfaction deficit was 13 percent. Other criteria, like value for money and company perception by customers, showed similar drops. One has to ask oneself if it's really worth it.	Jul 2010
ComputerWorld UK: [C]ompanies expressed frustration with the quality of work being provided, according to a survey, but most businesses still said they chose the cheapest outsourcing option instead of the best quality. Nearly all businesses - ninety-four percent - admitted that the focus on cost was increasing the likelihood of their projects failing.	Mar 2010
SearchCIO.com: According to a mid-2009 report by AMR Research Inc. on the state of IT outsourcing, roughly 80% of enterprises plan to increase their amount of IT outsourcing or keep it the same.	Feb 2010
CFO: Earlier this year, consultancy BDO Seidman asked technology CFOs where they would expand outsourcing if they were planning to do so. The most popular destination? The United States, at 22%. China was runner-up (16%), with India a close third (13%).	Oct 2009
ComputerWorld: ...At companies with revenues of at least $5 billion, as many as one quarter of IT jobs will be moved offshore by 2010.	May 2009
VNUNet: Compass Management Consulting services director Nigel Hughes argued that companies could see productivity losses of up to 60 percent when the full cycle of application development is outsourced, leading to longer development times.	Apr 2009
Silicon Valley Business Journal: An annual survey by accounting and consulting firm BDO Seidman LLP showed that 22 percent say the United States is the outsourcing destination they are most likely to consider in 2009, compared to 16 percent for China and 13 percent for India.	Mar 2009
Computerworld: The number of H-1B visas that can be issued annually is capped by Congress at 65,000...but while the total of available visas remains constant, the number issued to the major offshoring vendors is rising. The four largest H-1B recipients last year are all based in India: Infosys Technologies Ltd., with 4,559 visas; Wipro Ltd., with 2,678; Satyam Computer Services Ltd., with 1,917; and Tata. The number of visas issued to Infosys was identical to what it received in fiscal 2007, but Wipro, Satyam and Tata all saw increases.	Feb 2009
InformationWeek: Half of the IT pros...surveyed say they have new concerns about Indian IT providers...	Jan 2009
InformationWeek: Sixty-eight percent of IT pros who've worked with Indian outsourcers say they wouldn't work with Satyam based on what they know of the financial scandal...	Jan 2009
InformationWeek: When compared to their beliefs two years ago, 58% of companies said they were less of a believer in the idea that working with Indian IT outsourcers delivers value for their company and its shareholders.	Jan 2009
New York Times: The $50 billion-a-year offshore outsourcing business was growing at a 29 percent annual rate until the credit crisis hit last fall, said Rod Bourgeois, a technology services specialist at Sanford C. Bernstein & Company. But he now forecasts growth in 2009 to be about 10 percent.	Jan 2009

[130] Real-Time Technology Solutions, Inc. – RTTS is the premier professional services organization that specializes in providing software quality for critical business applications (http://www.rttsweb.com)

CFO: The number of outsourcing contracts worth more than $25 million signed by global financial services firms declined by 19 percent last year compared to 2007 and their total value decreased by more than 25 percent.	Jan 2009
CIO: Numerous surveys indicate that anywhere from 17 percent to 53 percent of customers have not realized business value/return on investment from offshore outsourcing.	Nov 2008
Hindustan Times: Three surveys conducted across [India] between January 2007 and March 2008 have shown that three in every ten job seekers make false claims on their CVs while applying for jobs.	Jul 2008
InformationWeek: ...20% of InformationWeek 500 companies say they've taken back offshored work in the past year.	Nov 2007
The Wall Street Journal: In a 2005 study, McKinsey & Co. estimated that just a quarter of India's computer engineers had the language proficiency, cultural fit and practical skills to work at multinational companies. The result is increasing competition for the most skilled Indian computer engineers and a narrowing U.S.-India gap in their compensation. India's software-and-service association puts wage inflation in its industry at 10% to 15% a year. Some tech executives say it's closer to 50%. In the U.S., wage inflation in the software sector is under 3%, according to Moody's Economy.com.	Jun 2007
iHotDesk: Data from law outfit Addleshaw Goddard has found that 60 percent of companies had changed or renegotiated their IT outsourcing contract while a third had opted to return the running of their IT infrastructures to internal employees.	Mar 2007
Yahoo News - UK & Ireland: This research into the potential pitfalls of outsourcing comes just a week after Jean-Marc Lazzari, head of Unisys operations in continental Europe, told us that he knew of up to 10 deals worth between 700m euros ($890m) and 1.5bn euros ($1.9bn) that were already back on the market despite having been signed less than two years ago. These deals were based on the your mess for less principle, said Lazzari, and they are in danger as the supplier often did not get the volume of work expected from the client, and the client didnt get the expected cost savings."	Sep 2006
Newsweek: But the big whoosh of jobs to India never happened. Indeed, that gush slowed to a steady stream once American companies realized it's tough to set up shop in a country with bad roads and a patchy power grid. Lately, American consulting firms that once predicted runaway growth in outsourcing to India have been slashing their estimates by half or more. Now American companies are hanging on to the high-skilled work that requires face-to-face interaction, while everything that can be done over the wire" gets shipped offshore."	Mar 2006
XMG Study: Global revenues on outsourced medical transcription services in 2005 is already estimated to be at 2.2 billion dollars, with the US market accounting for more than 85 percent of global demand...	Jan 2006
Nasscom-McKinsey: The Indian software and services export is estimated at Rs 78,230 crore ($17.2 billion) in 2004-05, as compared to Rs 58,240 crore ($12.8 billion) in 2003-04, an increase of 34 percent.	Nov 2005
Programmers Guild Report: On average, applications for H-1B workers in computer occupations were for wages $13,000 less than Americans in the same occupation and state.	Nov 2005
InformationWeek: ...offshore outsourcing will create more than 337,000 jobs by 2010...	Nov 2005
InformationWeek: Demand for offshore IT services isn't slowing, and that trend is showing up in Indian companies' hiring. Between July and September, Tata Consultancy Services increased its staff by nearly 12% to more than 53,000, while Infosys Technologies' staff grew 15% to more than 46,000.	Oct 2005
Santa Clara University's Leavey School of Business: Outsourced IT services brought in $12 billion for India 2004, leading the world in IT exports.	Oct 2005
ZDNet Research: Only 19% of US businesses have an offshore outsourcing strategy, a study by Ventoro found. However, the percentage skyrockets to 95% if only Fortune 1000 companies are considered.	Oct 2005
IDC: The US IT offshoring market will record a compounded annual growth rate of 14.4% and will nearly double to $14.7 billion by 2009...	Sep 2005
Gartner: U.S. financial service providers (FSPs) are expected to spend $65.7 million on IT services in 2005, however less than 30 percent of FSPs will outsource any strategic projects by the end of 2006.	Aug 2005

LogicaCMG: Business Process Outsourcing will overshadow and incorporate IT outsourcing and mainstream BPO expenditure is likely to grow worldwide by 10 per cent a year from $140 billion in 2005 to over $220 billion by 2010.	Aug 2005
Datamonitor: ...the average size of contracts announced by IT and BPO services vendors in the second quarter of '05 fell to $56m compared to $106m in the year ago period. This means that average deal size has now declined for four consecutive quarters.	Jul 2005
International Monetary Fund: In 2003, Ireland and India were the main beneficiaries of offshoring and the largest exporters of IT services, reaching 14.4 billion dollars and 11.3 billion dollars respectively...	Jul 2005
News From Bangladesh: Citing various studies, the WTO noted that the global turnover from offshore IT services reached 45 billion dollars in 2003, or less than 10 per cent of total world business service exports.	Jul 2005
ABC News: The research firm Gartner Inc. predicts that up to 15 percent of tech workers will drop out of the profession by 2010, not including those who retire or die.	Jun 2005
DiamondCluster: ...the number of buyers prematurely terminating an outsourcing relationship has doubled to 51 percent while the number of buyers satisfied with their offshoring providers has plummeted from 79 percent to 62 percent.	Jun 2005
Associated Press: ...entry-level programmers and help-desk workers in Vietnam earn an average, annual salary of about $3,000 per year. By contrast, India's IT graduates are paid about $5,400 -- not a lot, but almost twice as much as the Vietnamese. neoIT India controls 44 percent of the global offshore outsourcing market for software and back-office services, with revenues of US$17.2 billion (euro14.07 billion) in the year ended March 2005..."	Jun 2005
ComputerWeekly: Nearly three-quarters of international outsourcing companies in 10 countries expect to grow revenues within the next 12 months by an average of 11%.	Jun 2005
ComputerWorld: ...financial services firms in the U.S. spent about $590 million on offshore services from third-party outsourcers last year, while their European counterparts spent about $480 million overseas.	May 2005
Forrester Research: To get high-quality service levels from top-tier vendors, customers should expect to pay in the $24 to $30 per hour range for offshore labor...	May 2005
Saugatuck Technology: Twelve percent of outsourcing spending in 2005 will involve offshore resources, growing to 19 percent in 2009.	May 2005
Global Outsourcing: The ranking of 12 most valuable companies published in April 2005 issue of Global Outsourcing has IBM at the top, quite predictably, with a valuation of more than $140 billion. ADP takes the number 2 slot with market capitalisation of $26 billion, ahead of Accenture ($23 billion), a company with almost double of ADP's revenue. The next two positions are taken by Infosys and Wipro with a market capitalisations of $19.9 billion and $14.6 billion, respectively, a release said here."	May 2005
Confederation of Indian Industry (CII): Transiting from a major business process outsourcing (BPO) hub, India is set to emerge as a $17 billion knowledge outsourcing destination by 2010, states a new industry study.	May 2005
Deloitte Consulting: The survey of 25 large organizations with a combined $50 billion in outsourcing contracts found that 70% have had negative experiences with outsourcing projects and are now taking a more cautious approach. One in four companies has brought outsourced functions back in-house and nearly half have failed to see the cost savings they anticipated as a result of outsourcing.	May 2005
Sand Hill Group: Indian software exports exceeded $17bn last year, representing a $4bn jump over 2003.	Apr 2005
McKinsey Study: By 2009 the information technology and enterprise solutions (ITES) market in India alone is likely to reach $142 billion. This estimate contrasts with the current price tag of $532 billion to provide these services in the United States.	Apr 2005
Indo-Asian News Service: According to the National Association of Software and Service Companies (Nasscom), the total market size of knowledge process outsourcing business in India may rise to a staggering $15.5 billion, up from $1.2 billion now.	Mar 2005
Gartner: ...60 per cent of organizations that outsource parts of the customer-facing process will encounter customer defections and hidden costs that outweigh any potential savings they derive from outsourcing...	Mar 2005

Gartner: Gartner also predicted that through 2007, 80 per cent of organizations that outsource customer service and support contact centres with the primary goal of reducing cost will fail.	Mar 2005
Global Outsourcing Report 2005: Three-quarters of U.S. companies outsourced some or all of their information technology activities in 2004, and that percentage is likely to increase this year...	Mar 2005
Hewitt Study: Industry experts predict that by 2015, offshoring by the US companies would represent $135 billion in wages and 3.3 million professional jobs. And new countries like Czech Republic, Poland, Hungary and Mexico are likely to become new offshoring destinations this year.	Mar 2005
neoIT Study: ...estimates that in 2005 as many as 40 percent of global sourcing projects may fail to achieve desired results.	Mar 2005
CNET News.com: Over 40 percent of offshore initiatives will not yield anticipated savings, scale or risk diversification...' NeoIT said in its predictions for 2005. The key reason for these disappointments will not be due to supplier capability but buyer preparation and management.	Jan 2005
Wall Street and Technology: By 2005, Deloitte & Touche expects the top 100 global financial-services firms to offshore more than $200 billion of their operating costs and save more than $700 million. Shahrawat notes that the three largest Indian outsourcers will each surpass $1 billion in sales in 2004.	Jan 2005
IDC: Spending on the top 100 outsourcing deals worldwide increased from $48.3 billion in 2002 to $66.1 billion in 2003 and, for the first time, Europe surpassed the Americas, capturing more than half of the top 100 deals and accounting for more than half the value of these deals.	Dec 2004
TechWeb: Offshore outsourcing is expected to grow nearly 20 percent annually through 2008, with the average enterprise sending 60 percent of its application work to low-wage countries by 2009, a market research firm said Tuesday.	Dec 2004
META Group: Almost half of business and IT professionals believe the 2004 U.S. Presidential election will impact the number of U.S. companies using offshore outsourcing, according to a recent survey conducted by META Group. The survey found that almost 50 percent of respondents believe that offshore outsourcing will increase if George W. Bush is elected, and that it will decrease if John Kerry is elected.	Nov 2004
2004 Enterprise Systems Outsourcing Survey: Even though the term outsourcing" has become synonymous with the practice of sending jobs overseas, the bulk of outsourcing activities-70.2 percent-occur on the domestic front..."	Nov 2004
Mercury News: ...a University of California-Berkeley study that warns as many as 14 million Americans hold jobs at risk of being outsourced.	Oct 2004
IDC: ...the worldwide market for offshore IT services will grow from nearly $7 billion in revenues in 2003 to $17 billion by 2008, achieving a five-year compound annual growth rate (CAGR) of nearly 20%.	Oct 2004
META Group: Several offshore outsourcing vendors now exceed $1 billion in annual revenue, and the total market is greater than $10 billion.	Oct 2004
META Group: ...the average enterprise will ultimately outsource 60% of application work offshore (circa 2008/09).	Oct 2004
META Group: The offshore outsourcing market will continue to grow nearly 20% annually through 2008...	Oct 2004
AMR Research: AMR Research released a study today announcing that manufacturers plan to increase outsource spending 9.3 percent in 2005 in an effort to contain internal IT costs.	Oct 2004
INQ7.net referencing GAO Study: Despite these limitations, the report showed that in 2002 the US imported 37.5 billion US dollars worth of business, professional and technical (BPT) services, which is a 76.8 percent increase since 1997.	Oct 2004
Computer Business Review Online: Major IT services companies worldwide currently employ 14% of their combined workforce in India, as they tap into the country's low-cost IT and back-office skills base. Research from ComputerWire found that the top 50 IT services companies currently employ a total of 1.25 million employees worldwide, with 173,000 of this total based in India.	Oct 2004
Associated Press: The U.S. information technology sector lost 403,300 jobs between March 2001 and this past April...	Sep 2004
InformationWeek: American employers will hire 270,000 fewer IT workers this year than they did in 2003, according to a poll of 500 hiring managers by the Information Technology Association of America, providing fresh evidence that the IT-labor market continues to weaken.	Sep 2004

Newsweek: General Electric's '70-70-70' plan signals the possible extent of these shifts: It plans to outsource 70 percent of its head count, push 70 percent of that outsourcing offshore and locate 70 percent of its workers in India.	Sep 2004
Newsweek: The number of Indian professionals in the IT sector is expected to triple to more than 2 million over the next five years, and Morgan Stanley's Mumbai research center predicts that multinationals will match new jobs in Indian subsidiaries with head-count reductions elsewhere.	Aug 2004
Newsweek: In the first 32 months of a typical U.S. recovery, wages rose 10 percent; this time, wages have risen just 2 percent."	Aug 2004
Service Excellence Research Group, LLC: In the U.S. recession that ended in June 2001, half the job cuts were 'structural,' meaning permanently eliminated, compared to an average of 25 percent in previous recessions, according to the U.S. Federal Reserve. In other words, laid-off workers are much less likely to be rehired by their old companies and have to find new jobs or turn to self-employment. Data from the U.S. Bureau of Labor Statistics show that more than half of the jobs created since the end of the recession are part time, that tenured workers are still losing their jobs at record rates and those that find new ones are taking 57 percent pay cuts on average. Newsweek The topic of offshore outsourcing enlisted the strongest responses, said W. Ladd Bodem, Principal, ServiceXRG. 24% of customers indicated that they will stop doing business with a vendor if they outsource support offshore, regardless of the quality of support. It is not clear that they would actually stop doing business with a vendor, but it is clear that this is an emotional issue and one that must be factored into any outsourcing strategy."	Aug 2004
Harvard Business School: The brouhaha over the loss of service jobs, which currently account for over 80 percent of private-sector employment in the United States, is not merely an American phenomenon. Service jobs are at risk in all developed countries. In the U.K., where some claim that as many as 50,000 jobs moved offshore in 2003, the issue is just as prevalent and just as contentious. Countries like Germany and Sweden are feeling political tremors as well.	Aug 2004
Network World: About 21% of IT executives surveyed recently by management consulting firm DiamondCluster International said they had prematurely terminated offshore arrangements in the prior 12 months. The most common reasons cited: the provider had financial difficulties; the provider failed to deliver on commitments; or the buyer consolidated its outsourcing vendors.	Aug 2004
Network World: In India, they were pumping these guys out left and right. . . . Look at the deal here: We've got very highly paid SAP programmers that we could hire in the U.S. - and they're hard to find. Or we could go to India and find very talented SAP programmers immediately at 35% to 40% lower cost.	Aug 2004
Meta Group: The research showed that 80 percent of organizations have suffered problems ranging from time and cost overruns, to non-adherence to specifications and requirements, when outsourcing ADM projects.	Jul 2004
The Times of Inda: The number of software and IT service jobs in India will increase by 1.5 million to 2 million by 2008, according to a report. This represents a 40% compound annual growth rate.	Jul 2004
Meta Group: New research shows that 80 percent of businesses have spent more time and money on outsourced application development that was originally specified...	Jul 2004
Hudson Global Resources: Responding to survey on a prominent election-year issue, 66 percent of U.S. workers believe that offshore outsourcing of jobs is harmful for the economy.	Jul 2004
ELA Survey: 58% of American workers believe that companies outsourcing work that could be done by Americans to offshore contractors should be penalized by the US government...	Jun 2004
Forrester Research: 6% of those surveyed said they have lost a job because their work was sent overseas -- 30% know of someone, including a family member, friend or co-worker who had lost a job due to offshoring. -- 8% said they personally feel their job security is at risk because their employer might send their work overseas ELA Survey Forrester also increases its near-term estimate of lost jobs by 240,000 in its new report, projecting that a cumulative total of 830,000 positions will have moved offshore by 2005."	Jun 2004
Forrester Research: Forrester has increased its estimate of how many US services jobs will go offshore in the near term. Long term, we believe that our previous projection of 3.3 million by 2015 is still accurate.	Jun 2004

Wall Street & Technology: ...an employee could be paid as much as $50,000 to share a firm's data with a competitor.	Jun 2004
CRM Today: TowerGroup estimates that the top 15 global financial institutions will increase information technology spending on vendor-direct offshore outsourcing by 34% annually - representing an increase from $1.6 billion in 2004 to $3.89 billion in 2008.	May 2004
IEEE-USA: ...40% of the Fortune 500 expected to have [outsourced offshore] by the end of this year, according to the research firm Gartner Inc.... Fast Company American high-tech firms shed 560,000 jobs between 2001 and 2003, and expect to lose another 234,000 in 2004."	May 2004
Gartner: Offshore business process outsourcing services - which, unlike application development, typically require the transfer of personal data - grew 38% last year to just under $2 billion...	May 2004
The Economic Times: While the U.S. lost 234,000 IT jobs in 2003, for Indian techies 152,000 new jobs were created.	Apr 2004
McKinsey & Co.: About 14 million jobs, or 11% of the US total, have been identified as at risk of being sent abroad.	Apr 2004
Time Magazine: ...the Department of Labor estimates (the North American Free Trade Agreement or NAFTA) was responsible for the loss of more than 500,000 U.S. jobs between 1994 and 2002.	Mar 2004
Forrester Research: In the past 3 years, offshore programming jobs have nearly tripled, from 27,000 to an estimated 80,000.	Mar 2004
Reuters: More than 2.2 million jobs have been lost since Bush took office and the unusually tepid recovery in the labor market has fueled public concern over offshore outsourcing" to low-wage countries like China."	Mar 2004
eCommerce Times: Some 200,000 to 300,000 jobs could end up being shipped offshore this year...	Feb 2004
IBD: Nonmilitary government clients were the biggest outsourcing customers last year, with $18.5 billion in contracts. The defense sector finished a close second at $18.2 billion.	Feb 2004
TechWeb: While 93% of business technologists surveyed recently by Software Development magazine, a CMP publication, say the work that's going offshore is either important or critical to their companies' operations, 56% say what's coming back is worse than what could be achieved in-house and, in the worst cases, unusable.	Feb 2004
CNNMoney: At least 13 bills that would ban offshore outsourcing are now wending their way through various state legislatures.	Feb 2004
Datamonitor PLC: Global spending on major outsourcing projects - in which a customer hires an outside company to design, implement and run a computer network or other information technology endeavor - rose 44% from 2002 to $119 billion last year.	Feb 2004
Forrester Research: ...at least 3.3 million white-collar jobs and $136 billion in wages will shift from the United States to low-cost countries by 2015.	Feb 2004
TechWeb: ...Gartner says the (offshore outsourcing) market will grow to $160 billion in 2005, up from $101 billion in 2000...	Jan 2004
Dataquest: 26% of companies already using offshore services expect to double their spending in the next year.	Jan 2004
Forrester Research: ...60% of Fortune 1000 companies have yet to do any offshore IT outsourcing, and that the overseas movement within these companies is slow.	Jan 2004
ADTmag.com: The U.S. software industry lost 150,000 jobs last year...	Jan 2004
Earthweb: According to another Gartner survey, nearly 30 percent of companies saw no cost reductions or actually saw increased expenses as a result of outsourcing their IT work.	Jan 2004
Reuters: Analysts predict that as many as 2 million U.S. white-collar jobs such as programmers, software engineers and application designers will shift to low-cost centers by 2014.	Jan 2004
IDC: ...the offshore component in delivery of US IT services may rise as mush as 23% by 2007, up 5% from 2003.	Dec 2003
Computerworld: By the end of next year Gartner predicts that 1 out of every 20 IT jobs at user companies will have moved offshore.	Dec 2003
Computerworld: ...analysts at Meta Group Inc. predict that in the next several years, as much as 40% of production support may be managed offshore.	Dec 2003

Computerworld: One of the most popular nations for outsourcing is India, which is recording double-digit growth in revenues from IT services, which are expected to reach $57 billion in 2008, according to a joint study by McKinsey & Co. and Nasscom, an Indian software association. Based on a U.S. model of spending 5% to 7% of the IT budget on security, and with the IT budget consuming 15% of a service company's revenue, India should be ramping up to spend $450 to $600 million on information security and assurance by 2008.	Dec 2003
Computerworld: By next year, 80% of CIOs will have marching orders to take some IT offshore.	Nov 2003
CIO Magazine: Since 2001, according to the US Bureau of Vital Statistics, more than 500,000 people in IT professions in the United States have lost their jobs.	Oct 2003
SearchCIO.com: In fact, at the Gartner Outsourcing Summit 2003, analysts predicted that shipping work offshore will be discussed in more than 8 of every 10 U.S. executive boardrooms by next year, and more than 40% of U.S. firms will be outsourcing IT services through a global delivery model within that same time frame.	Oct 2003
: ... 20% of outsourcing deals do not produce cost savings...10% of those deals actually wind up increasing costs.	Sep 2003
Gartner Group: ... this year alone 50% of all outsourcing projects will fall short of delivering expected value and will be deemed unsuccessful.	Sep 2003
Investors.com: More than 1.3 million additional Western jobs will vanish by 2014 due to the accelerated movement of work to India and other offshore locations," says the study released Nov. 15. Hackett doesn't talk of this as good or bad, but as something that will be a reality ? and a challenge ? for more Western businesses. Hackett says the pace of job erosion has nearly doubled this decade."	Aug 2003
Infoworld.com: When you send programming offshore, you're moving it 12 time zones over, to developers with a very different native culture who usually speak English with less than full proficiency. Agile would require them to communicate frequently and informally with business users who don't speak the programmers' native language with any proficiency, through a teleconferencing circuit and maybe a Web conferencing session.	Aug 2003
The Outsource Blog: There is research that proves that many companies that outsource either domestically or internationally don't perform as well as before the outsourcing. In a study, the average user satisfaction deficit was 13 percent. Other criteria, like value for money and company perception by customers, showed similar drops. One has to ask oneself if it's really worth it.	May 2003

Table D-3: Index of published statistics regarding offshore outsourcing.

Table D-4 is taken from RTTS website and represents and assemblage of publications and research articles from 248 computing business magazines that discuss outsourcing since 2003.

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Table D-4: Assemblage of publications from 248 computing business magazines