

## **Chapter 1 Introduction**

This thesis addresses questions concerning the impact of Internet-based e-commerce (EC) upon supplier and customer relations. These questions are investigated from an industry value chain perspective, by means of interpretive management research combined with agent-based modelling.

Starting from the baseline hypothesis that Agent-Based Social Simulation (ABSS) can provide insight on the impact of EC upon value chain relations, and upon the opportunities that exist for intermediation, my specific objectives are, firstly, to advance the state of the art in multi-agent modelling by incorporating qualitative aspects into a formal model, and by inviting the input of ‘stakeholder’ experts working in the industry, and secondly, to inform those stakeholders on the opportunities and pitfalls of initiating an e-commerce system within their existing value chain configuration. These objectives will be tested by carrying out a case study investigation involving interpretation of fieldwork data and analysis of the model to explore e-commerce scenarios.

In doing so I will argue that (1) an agent-based representation is appropriate to model the supply chain interactions and engage stakeholders in the processes of formulation and evaluation of these models, (2) the behaviour this type of model can demonstrate plausible outcomes and identifiable patterns associated with the system under investigation, (3) whilst formal models cannot capture the syntactic depth of findings that emerge through interpretation of qualitative fieldwork, it is nevertheless possible to qualify simulation data in a satisfactory way, and (4) modelling is valuable when used in conjunction with qualitative analysis as a complementary method to explore the research questions in a rigorous and formally consistent way.

The roadmap for the thesis is as follows: in the literature review of chapter two, the new technological developments in electronic commerce technology are placed in the light of the literature on value chains and the economics of markets. This discussion involves historical perspectives of the changing nature of markets and organisations as well as more contemporary work on transaction costs economics and value chains, and the impact of socio-technological developments. The chapter then moves on to a

discussion of Electronic Data Interchange (EDI), a well established form of e-commerce, which provides many of the same business advantages, but also similar problems of adoption and integration. Finally, the remainder of the chapter focuses upon the role of the intermediary and the development of a potential new marketing and distribution arrangement, namely direct sales via the Internet channel.

In chapter three, comparing ABSS with other approaches involving formal modelling, it is argued that this promising new field of modelling offers benefits for research focusing upon difficult problems involving complex, distributed, interactive systems, such as the Internet. The chapter provides a grounding in the objectives and opportunities of agent-based modelling, and reviews some recent work of a high standard in this field.

Chapter four surveys the field of qualitative research methods, with a focus on case study research carried out in the area of Information Systems. The research methodology is outlined in section 4.1.4. Drawing upon several different paradigms, it combines individual methods to integrate the qualitative with the quantitative. It is argued that flexibility in choice of research methods (i.e. multi-methodology) allows a richer understanding to develop of complex issues involving technological change.

This chapter also provides a preliminary discussion of the case study. As part of a large multinational based in the UK, the industrial partners manufacture a range of products to equip factories with Industrial Automation equipment. The market is exclusively business-to-business, and there is a large number of independent distributing companies (distributors) throughout the UK who hold inventory and provide a local service to the many smaller customers. The company also has thousands of customers who are supplied directly from a central European store.

At the time of the study, the company was undergoing business process reengineering to integrate existing EDI and telephone/FAX-based communication with Internet-based e-commerce in a gateway system to interface with their internal systems and databases. The centrepiece of this transformation was the Internet-based electronic mall, specifically designed to encourage e-commerce amongst direct customers not currently using EDI. In addition, the company wanted to bring its distributors onboard

with their own electronic systems, hence improving information flow and customer service throughout the supply chain.

The research objectives and case study design were jointly defined by the author and the stakeholders over a series of meetings. The research questions centred on the impact of Internet-based e-commerce upon intermediaries' role and market share, upon the internal processes, efficiency improvements and resource savings that could be realised, and the identification of inhibitors and incentives for customer adoption of the electronic mall. Semi-structured interviews took place with nine employees, including members of the e-commerce team, order management and internal sales departments.

These qualitative data were analysed, and the emergent findings of the fieldwork investigation are presented in chapter five. This chapter reveals the respondents' views on the future direction of the company and opportunities for moving towards a fully-integrated electronically mediated supply chain. Interview responses were analysed regarding customer and distributor perceptions of e-commerce: their concerns and objections as well as their understanding of the benefits. It explores what the manufacturer expects of its distributors in terms of compliance with e-commerce systems, and analyses their influence through different strategies for encouraging adoption.

The aim of chapter six is to link the qualitative findings discussed in chapter five with the agent-based model of the case study. It discusses how the fieldwork informed the model specification, and how stakeholder involvement influenced its development. Section 6.1 describes the interactions between the researcher and the stakeholders, and how the relationship developed. Stakeholder evaluation involved taking the findings of the research back into the company and soliciting their expertise. Their contribution was in terms of clarifying the basis for model assumptions, providing feedback upon the simulation results, and suggesting improvements to the research design.

Chapter seven, section two presents a description of the model, which, it is argued, is an abstraction of the market system described in the fieldwork of chapter five that allows exploration of the research issues discussed earlier. Throughout the

description, assumptions of the model are noted, and the justification for using them stated. Section 7.3 presents the results of the simulation experiments with the model. It is divided into a discussion of four distinct model scenarios, each of which focuses on a particular aspect of the model to address specific research questions. A sensitivity analysis was also carried out to test the robustness of the results to changes in program implementation: in the less well-validated model assumptions, and in several parametric values used.

Chapter eight discusses the contribution of the research to knowledge about value chain issues, to qualitative research methodology, and to agent-based modelling technique. The success of the project is evaluated both in terms of academic value to other researchers and in terms of its value to the stakeholders. This chapter reflects on the importance of the stakeholder contribution, its successes and failings, and the usability of the approach. The lessons learnt from developing the agent-based system in collaboration with industry are summarised. Finally, a balanced critique of the work undertaken in this thesis is made, and some suggestions for further research are presented.