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A RULE BASED MODEL FOR THE OBJECTIVE DETERMINATION OF THE  
E-BUSINESS REQUIREMENTS OF A MANUFACTURING ORGANISATION

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Doctor of Philosophy

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E-Business Requirements of an Organisation

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Doctor of Philosophy  
2008

### Thesis Summary

E-business as a concept emerged around the turn of the millennium. The rapid growth of the Internet had stimulated interest in how business could best take advantage of the new possibilities. There was a tendency to re-label some software products as "e-business" software products. There was clearly the need to find a way of supporting sensible investment while discouraging initiatives that were unlikely to be beneficial.

The starting point of this research was the belief that manufacturing and similar industries need help with the concept of e-business, especially in assessing the relevance of possible e-business initiatives. The research hypothesis was that it should be possible to produce a systematic model that defines, at a useful level of detail, the probable e-business requirements of an organisation based on objective criteria with an accuracy of 85%-90%.

This thesis describes the development and validation of such a model. A preliminary model was developed from a variety of sources, including a survey of current and planned e-business activity and representative examples of e-business material produced by e-business solution providers. The model was subject to a process of testing and refinement based on recursive case studies, with controls over the improving accuracy and stability of the model. Useful conclusions were also possible as to the relevance of e-business functions to the case study participants themselves.

Techniques were evolved to synthesise the e-business requirements of an organisation and present them at a management summary level of detail. The results of applying these techniques to all the case studies used in this research were discussed.

The conclusion of the research was that the case study methodology employed was successful. A model was achieved suitable for practical application in a manufacturing organisation requiring help with a requirements definition process.

### Key Words

E-commerce  
Enterprise Requirements Planning  
Supply Chain Management  
Electronic Data Interchange

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## 1 Introduction and Background

1.1 In the experience of this researcher who actively works in the software industry, the term "e-business" became common around the turn of the millennium, as a concept that seemed primarily marketing led. The dot.com boom was reaching a peak just before a crash; the boom in new computer software sales generated by the (so -called) year 2000 problem was over. There was a search for new ideas to help sell software products. One Major software provider (The Oracle Corporation, [www.oracle.com](http://www.oracle.com)) invented the catchphrase "The internet changed everything", and renamed its proprietary ERP business system software offering as its "e-business suite". Examination of its more recent web site would suggest that the former catchphrase is no longer evident, but the "e-business suite" remains.

1.2 At the time of starting the research project of which this thesis is a product, there had been a recent "dot com" boom (and bust). There was an evident enthusiasm for many Internet based functions, and indeed there was plenty of material in the academic domain that would seem to convince the observer that e-business represents an unstoppable wave of progress. For example, according to a report quoted by Fraser et al (2000), but evidently produced earlier, most leading UK organisations had developed an e-commerce strategy. Indeed, the top 100 UK companies believed that 20 per cent of their revenue would have come from e-commerce transactions by 2000! Furthermore, according to Tetteh et al (2001), the growth of electronic business has surprised even the most optimistic of forecasters. Indeed, according to Damanpour (2001), the key problem was that many businesses were playing catch-up with E-business, and jumping into it without carefully considering strategic implications to the move. As one of the earliest manifestations (for example Rajkumar, 2001), electronic purchasing was thought to be going to change the way that organisations purchase goods. According to Ranganathan (2003), the potential of B2B E-commerce was something that had to be recognised, and that adopting a wait-and-watch approach was undesirable.

It seemed that there were clearly opportunities for manufacturing industry to take potentially useful initiatives. However, the recent "dot com" experience also seemed to illustrate the dangers of common sense and judgement becoming a casualty of the over-enthusiasm accompanying a period of breathtaking technological advance. It seemed that manufacturing industry needed some help in preventing time and money being wasted on systems that had not been conceived or justified on a rational basis.

1.3 Even at the time, however, there were hints that the situation might not be clear-cut. For example, Edwards et al (2001) quoted a surprising finding relating to the limited impact that

the Internet had on the way that most of the companies were operating. Despite widespread publicity regarding the adoption of the Internet for business to consumer selling (there was) little evidence that the companies were proactively considering the implementation of applications that use the internet to transfer messages between companies within the same supply chain.

Somewhat later, in a study on what the best-performing companies do in respect of best manufacturing practice (Laugen et al, 2005), e-business was found to be the least adopted action programme among the fourteen studied. It was considered possible that this may be due to the fact that the concept is rather new, especially in the engineering industry. However the authors considered it unlikely that e-business will have a great impact on the performance of manufacturing operations.

- 1.4 The starting point of this research was the belief that manufacturing and similar industries need help with the concept of e-business. It was felt that there is a need for a way whereby the relevance of possible e-business initiatives can be assessed. On the one hand there is the desirability of preventing unnecessary and money wasting initiatives at the behest of software vendors whose motives are simply to sell their solutions. On the other hand there is the desirability of encouraging those investments that are genuinely relevant and potentially beneficial.

The initial research hypothesis was that it should be possible to produce a systematic model that defines usefully the probable e-business requirements of an organisation based on objective criteria. The meaning of "useful" implies that the accuracy of the e-business requirements specification should be sufficient to represent a constructive input to a planning process. The meaning of "objective" is that the model should use facts relating to the organisation as opposed to prejudgements about what the company requires.

No such approach can be expected to cater for all the (perhaps idiosyncratic) needs of an organisation and it is reasonable to expect that the results of a model will be subject to critical review based on local circumstances. However a model that could generate requirements with an accuracy of 85%-90% was felt to be capable of being a sufficiently useful and constructive tool.

The research issues were therefore twofold:

- Is it possible to produce a generic model, based on characteristics and concerns, which can generate a functional specification to a useful level of detail, at a useful level of accuracy?
- How can the accuracy and usefulness of the model be judged?

1.5 The research started with an academic literature review that attempted to arrive at an understanding of the e-business subject and its place in the life of the manufacturing and distribution company. An attempt was made first to understand how the e-business concept relates to that of e-commerce. E-business was then studied in the context of the related domains of Electronic Data interchange (EDI), Enterprise Requirements Planning (ERP) systems, Customer Relationship Management (CRM) and Supply Chain Management (SCM).

As a result of the literature review, the research issues were confirmed and a research methodology developed to address them. To make these reviews of continuing relevance, discussion of further referenced literature was added as the research progressed. Further literature added subsequent to the design of the research methodology, together with the research itself, has served to reinforce the judgements made at the time.

1.6 In order to take a perspective derived from actual e-business in practice, and also to provide input into an initial version of an e-business model, a survey was conducted into detailed e-business activity in organisations deemed relevant to this research. An e-business questionnaire was designed to capture four basic types of information:

- The e-business activity currently being undertaken or envisaged;
- The levels of satisfaction with what is being done (or not done);
- Concerns that may be inhibiting e-business;
- Benefits that have been achieved with e-business.

The survey is described in detail in chapter 4. The results supported the view that, in practical terms, e-business represents incremental improvements rather than a revolution in the conducting of business. There was also support for the initial proposition that there is a need for more unbiased advice and support to organisations contemplating or embarking on e-business initiatives. Useful input was provided into the e-business functional model. Based on the results of this survey, a paper was published in the "Manufacturing Engineer" magazine (Dilworth and Kochhar, 2004).

1.7 Input to the e-business functional model was obtained from examples of e-business material produced by representative organisations that are involved in influencing, guiding

or selling products or services into organisations embarked upon e-business initiatives.

Such material included:

- The e-business functional specifications provided by two major ERP vendors (SAP and the Oracle Corporation), probably more focused on selling to the larger organisation;
- An example of an e-business product for the small to medium organisation;
- An example of an e-business exchange vendor, viz. Covisint;
- A well-known standards organisation active in the e-business (The Organisation for Date Exchange and Tele Transmission in Europe).

A commentary on this material is included in chapter 5. Additional subject knowledge to be exploited resided with the researcher, who has worked in the e-business field and related fields for some 20 years. This experience was used primarily to direct attention to the most likely sources of good information and in suggesting rationales to link these e-business functions to possible characteristics.

- 1.8 From the various sources, it was possible to construct a comprehensive identification of the detailed functionalities covered by the "e-business" label. These functions were clustered into a number of functional domains and structured into 3 levels, according to whether they represented the one-way accessing of information, the routine transmission of business transaction information, or a two way collaboration process.

These e-business functions were linked to preliminary sets of reasons that might make them relevant, thus allowing a preliminary list of characteristics to be produced. Management concerns that were deemed to be capable of influencing the relevance of e-business functions were also identified and linked to these reasons. The resulting functional definition, reasons, characteristics and concerns were combined together into a model in effect containing the rules that provide the linkages. The development of this model was the subject of a paper published in the Journal of the Institute of Operations Management (Dilworth and Kochhar, 2006).

- 1.9 The major activity of this research was the development, followed by the recursive testing and refinement, of this preliminary model so that a working version suitable for practical application in a manufacturing organisation could be produced. The testing and refinement of the model was therefore the critical phase. It was necessary to demonstrate that the process resulted in a model that could be demonstrated as approaching an acceptable level of accuracy. The process chosen was one of recursive case studies and consisted of three phases:

- The first phase and the first case study was regarded as a "system test" in order to execute the process and to get as many technical errors and obvious mistakes out of the model as possible;
- Seven more case studies were allocated to phase two (the "refining phase"), the objective of which was to improve the a model so that it could then be considered capable of achieving an 85-90% accuracy in the identification of relevant e-business functions;
- Phase three comprised five more case studies (the "re-testing phase"), the objective of which was to verify that the model was indeed now achieving an accuracy of 85-90%.

1.10 These three testing phases are described in chapter 6. In all three of these phases the process was fundamentally the same. Each individual case study was conducted along the following structured lines:

- The case study contact was interviewed and the input questionnaire was completed interactively;
- The model was processed and a report produced containing the predictions of the model;
- The report was then discussed with the interviewee, and an agreement reached as to whether the functions being recommended were correct and complete;
- All areas where the model gave answers that were deemed incorrect or questionable were studied and if the model was changed if it was felt to be wrong;
- All changes to the model were logged and categorised for analysis.

The statistics of the model development process were collected and used to monitor the improving accuracy and stability of the model. A type of "delta" analysis was developed to monitor and analyse the accuracy of the model and also to control the evolution of each case study results as a consequence on subsequent model evolutions made as a result of later case studies. It was therefore possible to control the on-going stability of the model results for any given case study. Useful conclusions were also possible as to the relevance of e-business functions to the case study participants themselves.

1.11 As a by-product of conducting the case studies, the requirement evolved for a means of summarising and presenting the results at a management summary level of detail. An "e-business profile" concept was developed to cover this requirement. In order to illustrate the power of this concept, the e-business profiles were recalculated and commented upon (chapter 7) for all the case studies at the latest model version produced by the research.



1.12 It was recognised during the research that the concept of management concerns was capable of being developed to produce worthwhile results. Of particular interest was the notion of using the model both with and without taking concerns into account. Using the model without taking concerns into account would theoretically provide a more objective analysis. By contrast, the (normally considered desirable) practice of taking concerns into account tends to include more subjective factors. By analysing the difference between the two, the potential was recognised for achieving extra insights, for example:

- The real needs of the organisation as opposed to what can be reasonably expected to give benefits assuming current attitudes;
- The areas of e-business most adversely affected by current attitudes and concerns;
- The potential difficulty of the implementation of e-business functions.

In order to illustrate this potential, the e-business profiles were calculated both with and without concerns and are presented comparatively with comments in chapter 7.

1.13 The objective in this research was to create a model good enough to provide useful input to an e-business requirements definition process. A model has been created and tested that provides an accuracy of 85%-90%. It is concluded therefore that the case study methodology described in this thesis was demonstrated as an acceptable method of achieving the research objectives. The overall model development and testing process was the subject of a paper published in the Journal of Manufacturing Technology Management (Dilworth and Kochhar, 2007). The model thus generated is available for further use and development.

## 2 Literature Review

### 2.1 Introduction

This chapter reviews a number of academic references relating to the topic of "e-business". In considering these references it was the intention to address the following issues:

- What exactly is meant by e-business, in what respect (if at all) is it distinguished from e-commerce, and in what is it real as opposed to technological hyperbole;
- How e-business and the Internet relates to the concepts of Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM), concepts with which e-business is frequently coupled with;
- How e-business and the Internet relates to the modern thinking of Supply Chain Management (SCM).

Discussion of the literature is organised under a set of headings that discuss the current state of the art in ERP, supply chain management, and the consequent impact of the Internet on these. It was also the objective to use this material as part of the process of developing a structure for the development of the e-business model.

### 2.2 What is E-business / E-commerce?

#### 2.2.1 e-business in the context of e-commerce

(a) A starting point must be to try to establish a working definition of e-business and e-commerce. The first question to ask is whether there is a difference. Duffy and Gale (2002), apparently written at the height of the dot-com enthusiasm, recognise that it is not easy to find a generally accepted definition of e-commerce, but seem to suggest that the definition of e-business is not as problematic! They recognise (similar to Fraser et al, 2000) that e-commerce covers a wide span of activities:

- Business to business (B2B) via Electronic Data Interchange (EDI), (see below section 2.3), either bespoke or using standards;
- B2B via the Internet through modems and personal computers; and
- Business to consumer (B2C) via the Internet.

Three definitions of e-commerce are suggested:

- Any form of business or administrative transaction or information exchange that is executed using any information and communications technology (a definition from an organisation majoring in EDI);
- A trade that actually takes place over the Internet, usually through a buyer visiting a seller's Web site and making a transaction there (perhaps a journalistic interpretation somewhat influenced by the dot.com boom);

- The sharing of business information, maintaining business relationships and conducting business transactions by means of telecommunications networks (clearly somewhat wider in scope).

By comparison the apparently less problematic e-business is described as enabling employees, business partners, suppliers and customers to work together, share information and transact electronically. Specifically it is where a company has integrated all of its business processes and functions electronically so that information can be shared amongst all users, partners and systems, with Internet functionality linked in to its back office procurement, administration, stock holding and delivering systems.

Ironically therefore it seems that more concrete and substantial the concept (e-commerce), the greater is the difficulty of definition, because there are alternative definitions possible. E-business by comparison is supposedly sufficiently vague and insubstantial to be capable of easy definition!

- (b) Krell and Gale (2005), while admitting that there is significant semantic muddying of the terminology, reserve the label e-business for a broader conception of the potential impact of the Internet on business than that represented by the term electronic commerce. Jelassi and Enders (2005), somewhat tautologically, define e-business as the use of electronic means to conduct business both internally and externally. Their definition emphasises internal e-business activities involving the linking of employees though an internet to improve information sharing, facilitate knowledge dissemination and support management reporting. In their view, e-commerce is a subset of e-business dealing with the facilitation of transactions and selling of products and services on-line using the Internet or any other telecommunications facility. Similarly, Auramo et al (2005) suggests that "e-commerce" and "e-business" are two common terms for business models using IT – the former relating typically to web-based sales, and the latter to a more holistic use of IT. Taken together these three sources would seem to support a view of e-commerce representing inter-business (or with consumers) contrasting with e-business that represents the use of the Internet for more general business activity.
- (c) By contrast, Rodgers et al (2002), assert that e-business and e-commerce are two separate concepts, for three reasons that actually seem somewhat arbitrary.

Firstly, e-commerce refers primarily to the buying and selling activities over the Internet, but requires human interaction when the information is processed by the client and stored in databases. E-business, by contrast envisages that the processes are fully automated.

Secondly, e-commerce is basically focused on the customer side. All other stakeholders of the organization, including employees and suppliers, are generally not the main concern for e-commerce. E-business goes beyond customers/clients to include such entities as suppliers, employees, and regulatory authorities.

Finally, e-commerce is typically limited to client/server software with a high degree of system functionality. An e-business infrastructure is much more technologically advanced than e-commerce.

Rodgers et al. admit, however, that e-business and e-commerce solutions are similar in that they both incorporate newly developed Web technology into organizational and business processes. Essentially their argument boiled down to nothing more than e-business encompasses e-commerce, and e-commerce is a first step towards e-business.

- (d) More helpfully, according to Cagliano et al (2003), the emerging factors concerning the use of the Internet have been labelled e-commerce, e-procurement and e-operations.

"E-commerce" refers to sales and customer service and support, thus representing the adoption of e-business in downstream relationships.

"E-procurement" refers to the use of the Internet in purchasing activities, including procurement of both strategic and standard parts. In this case, the Internet is adopted to manage upstream relationships with suppliers.

"E-operations" refers to the use of the Internet in the operational activities across the company value chain, including order processing and tracking, production planning and scheduling, inventory management and transportation planning. This factor represents the adoption of the Internet in all those processes, which, although dealing with physical and information flows along the supply chain, are mainly focused on internal operations.

Two basic types of mechanism are identified:

- Information sharing, which refers to the exchange of information on production plans, delivery frequencies and inventory levels (the average use of such mechanisms being "quite high");
- System coupling - the adoption of tools and techniques, such as VMI, KANBAN and co-location, aimed at coupling the interface between customer and supplier.

In this view therefore, we have a definition of "e-commerce" drawn quite narrowly. In effect, the concept of "e-business" requires the addition of "e-procurement" and "e-operations" to that of "e-commerce"

- (e) Similarly, according to Lesjak and Vehovar (2005), the term e-business, in its broadest sense, is usually understood as the application of information technologies (IT) into a business process. Despite various terminological problems, the notion of e-business extends the more narrow understanding expressed with the term "e-commerce". The latter typically relates to the process of buying, selling, or exchanging products, services, and information via computer networks as it typically excludes some not-strictly-commercial applications, such as communication, administration, conducting electronic transactions within an organization.
- (f) By complete contrast, Osmonbeko, Bello and Gilliland (2002) would seem to draw a definition of e-commerce so wide so as to encompass e-business. For them, e-commerce involves the use of network communications technology to engage in a wide range of activities up and down the value-added chain and both inside and outside the organisation. Fink (2006) is similar in envisaging a broad concept of e-commerce.
- (g) Damanpour (2001), using "e-business/e-commerce" together as one concept, defines it as any "net" business activity that transforms internal and external relationships to create value and exploit market opportunities driven by new rules of the connected economy. He acknowledges that e-business comes in many forms and can be implemented to a very small or large degree. There is also an acknowledgement that the "Internet" and the "Web" are essential components of an e-business/commerce strategy. Therefore, companies must participate in external business relationships by using computer interactions (i.e. transactions, support, marketing, communication and collaboration) by either business-to-business or business-to-consumer, if it is to be considered an E-business.
- (h) Using the concept of e-business alone, Rodgers et al (2002) provide a similar definition with the characteristics of e-business defines as follows:

- The connection of the extended organisation (employees, customers/clients, suppliers and other partners);
  - The use of common electronic data standards with computer automation technology to electronically interconnect the business processes throughout the extended organisation;
  - Automated system interaction eliminating unnecessary human intervention;
  - The use of the Internet, intranets, and extranets and web systems to provide these links.
- (i) Pant and Ravichandran (2001) similarly define E-business information systems as computer applications that leverage intra- and inter-firm process and systems integration. In particular E-business information systems are computer applications that use the Internet technology, its universal connectivity and the capabilities of the Web browser to integrate business processes within and beyond an enterprise
- (j) It becomes apparent that the e-commerce/e-business distinction is largely one of arbitrary definition. According to Bhatt et al (2001), electronic commerce (e-commerce) refers to conducting business electronically (which as a definition can of course be all encompassing). They then go on to include in the concept the buying and selling of information, products, and services via computer networks. However, they then goes on to assert that the above concept of e-commerce is very narrow, as the Internet offers huge potential in building communities of interests, forging alliances, and transforming public attitude towards technology. One could presumably therefore follow Krell and Gale (2005), Jelassi and Enders (2005), Auramo et al (2005), and allocate the term e-business to this less "narrow" concept. However all that has been achieved is a non-debate caused by arbitrary definitions of what is meant by "conducting business electronically".
- (k) In conclusion, it can perhaps be safely asserted that the terminology is somewhat insecure (to put it tactfully). Rather than getting involved in semantics and arbitrary definitions, the approach of regarding the two terms e-business and e-commerce as interchangeable, seems a reasonable working hypothesis to simplify further examination of the subject. Others (for example Turban et al, 2004), in defining e-business and e-commerce interchangeably, would seem to support this view. Croom (2005) helpfully defines e-business simply as the use of systems and open communication channels for information exchange, commercial transactions and knowledge sharing between organisations. This definition seems to fit either "e-commerce" or "e-business".

To summarise, it could perhaps be suggested that perhaps e-commerce definitions tended on the whole to clarity and detail – to focus on tangible functionality, whereas e-business definition was more likely to stray into the insubstantial and futuristic. For example Duffy and Dale (2002) quotes Score Research in defining e-business as 'what you will become' ([www.scoresearch.com](http://www.scoresearch.com)). The inescapable conclusion nevertheless is that the case for the e-business concept being substantially different from the e-commerce concept is not made. For continuing exploration of the concept, the working hypothesis will be that the terms e-business and e-commerce are to be regarded as synonyms.

### 2.2.2 The scope of e-business

- (a) Having established that it is better to regard "e-business" and "e-commerce" as interchangeable concepts, it is now necessary to explore further how wide the scope of the e-business/e-commerce concept should be drawn. At the most basic level, Delfmann et al. (2002) insist that that the initiation and agreement stage of economic activity are essential components. This excludes the mere online search for product information followed by a visit in a traditional shop as e-commerce. By the same token, the mere advertising on the Internet without the possibility for closing the deal online cannot be treated as e-commerce.
- (b) At the most all-embracing level, for Van Hooft and Stegwee (2001) e-business is a secure, flexible and integrated approach to business activity that combines the systems and processes that run core business operations with the simplicity and reach made possible by Internet technology. Given this definition, not surprisingly, the argument is quoted that the "e" – will soon be dropped and that e-business will be business as it comes to be generally understood. Similarly, Porter (2001) argued that the key question is not whether to deploy e-business to take advantage of the Internet technology, but how to deploy it.
- (c) Croom (2005) attempted to structure e-business by conceptualising a five-stage model representing cumulative progress towards something called integrated supply chain management. He studied the claimed progress along this path of some large organisations.
- Stage one involved e-mails and web sites (84% had got to this stage);
  - Stage two represented the use of "Customer Relationship Management" (CRM) systems (54% had apparently got to this stage);
  - Stage three seemed to involve the use of ERP (enterprise resource planning) systems (37% had evolved to this stage);
  - Stage four emphasised of e-procurement systems to reduce purchasing costs (45% had done this);

- Stage five "integrated e-supply chain management" typically involved the use of platforms such as e-fulfilment, global positioning and order tracking (12% had supposedly done something in this area).

It was useful to see an attempt to structure the e-business issue as a structured path towards integrated supply chain management, but ultimately it seemed to serve only to demonstrate two problems. The first problem would seem the complete arbitrariness of the e-business concept (for example what makes ERP stage 3 and CRM stage 2?). The second problem lies in the difficulty of understanding precisely what detailed achievement lies underneath the claims of progress.

(d) Fink (2006), in envisaging a broad concept of e-commerce, sees it as comprising activities that are both internal and external to the business. These range from systems that focus on the external customer environment (for example B2C e-commerce) to internal systems, for example enterprise resource planning (ERP). The applications that make up e-commerce would seem to encompass:

- Visitor relationship management (VRM): the use of a web site to attract customers to the organisation;
- B2C e-commerce: the use of a web site to conduct electronic transactions between the organisation and consumers;
- Business-to-business (B2B) e-commerce: the use of a web site to conduct electronic transactions between the organisation and other organisations;
- Customer relationship management (CRM): the management of the organisation's customers through a customer database and reporting software;
- Electronic procurement (EP): the use of internet technology to conduct electronic purchasing;
- Enterprise resource planning (ERP): the management of the organisation's resources through integrated enterprise-wide software.

ERP is discussed as a concept later (see 2.3), but this analysis provides an interesting example of the "e-business/e-commerce representing the world" way of thinking.

(e) Kim and Ramkaran (2004) consider that e-business is a fundamentally different way of doing business (the characteristic including the concept of the customer driving things and mass customisation). However this surely only relates to a particular type of business and product (e-business must surely potentially be allowed to apply to organisations selling non customised products).



- (f) On a more sceptical note, Van Hooft and Stegwee (2001) suggest that the exact meaning of all displayed "e-" applications is less relevant as new applications arise every day and definitions vary widely. This perhaps serves to warn against an attempt to fix too rigid a definition of e-business and an overall conceptual level, and encourages the focus on what are useful individual functions.
- (g) Soliman and Youssef (2001) suggest that Internet-based e-business is about next generation manufacturers and their consumers adopting a new process or methodology in doing business. This involved connecting suppliers and customers with the various components on the supply chain. They sum up their argument "Basically, the Internet-based e-business process involves taking information as raw material and producing value added information-based products or services". This perhaps sums up the e-business problem; is such a concept too vague for any useful purpose?

### 2.2.3 Evolution or Revolution

- (a) The "Electronic Business Assessment Tool" produced by the UK Council for Electronic Business is a short questionnaire designed to "focus on your organisation's e-business capability". There are 15 "performance touchstones" provided, classified into 5 groups:
- Business Fundamentals (for example is there an e-business vision);
  - Business Processes (for example are there documented processes supported by procedures);
  - People and organisation (for example are there the right knowledge, skills and attitudes);
  - Information Management (for example are there standards for electronic information);
  - IT infrastructure and applications (for example the quality of the networking infrastructure).

One is asked to rate oneself as "high", "medium" or "low" against each of these touchstones, based on one's assessment of which of three descriptions best characterises one's own situation. For example, these are the three possible ways that one can characterise the first of the performance touchstones: "e-business vision":

- "Low" is "Discussed but not fully defined by CEO/management team";
- "Medium" is "Clearly articulated but not yet fully owned by middle management";
- "High" is "An e-business strategy fully integrated within the overall business strategy".

An initial reaction is that all of the performance touchstones seem very sensible. It is fair to say that progress to improve performance in all or any of these aspects is likely to prove a relevant part of an e-business project (in fact the same words were used 10 years ago in respect of ERP projects and 20 years ago in respect of MRP II projects). In fact the same questionnaire could probably be used *mutatis mutandis* to assess the capability of any business to do anything relating to any technological initiative, or in fact any initiative at all. From a particularly e-business point of view, the content seemed very thin. For example, a significant omission would seem to be that there is no attempt to assess the position and relative power in a company's global supply chain vis-à-vis its partners, customers and suppliers. Once more, as in Soliman and Youssef (2001), we have a concept defined at a high level, such that it is difficult either to disagree with it or to use it. It is perhaps relevant to consider whether the e-business concept could suffer from the same problem.

- (b) Coltman et al (2001) suggests that the e-business case can be argued in one of two ways. It can be summarised as the incremental improvement versus revolution argument.

One side of the argument is that the fundamental rules that have governed business for centuries – supply versus demand, market competition, segmentation pricing, contracting, and the nature of governance in the firm – will remain as relevant today as they were when Adam Smith described the workings of a pin factory. In other words, there is no such thing as e-business, there is just business and some of it is electronic.

Alternatively one can adopt the revolution argument where the Internet changes everything. In this the Internet medium will have a major impact on corporate strategy, organisation, and business models. The Internet will drive a global market-place transformation and paradigm shift in how companies get things done, how they compete and how they serve their customers. In other words, there is no business bar e-business.

- (c) Whichever case one adopts will probably depend on what one's audience wants to hear and/or what one is trying to sell. However, if one is to be objective, it is difficult to see how the revolution (for example Pant and Ravichandran, 2001) case is made. Firstly, if e-business means that companies can use the Internet to do (in a cheaper and more accessible way) what they have done previously using older techniques, this is surely an incremental improvement rather than a revolution. Secondly, there seems to be little critically assessed evidence for the assertion that e-businesses are really attempting to use the Internet to integrate "seamlessly" enterprise systems, databases, and workflows across organisational boundaries. Thirdly, it is easy to discover (e.g. Croom, 2005) that

organisations are now using the Internet in a significant proportion of their business critical applications. However, this can mean anything including e-mail, which although extremely useful, is surely also another incremental improvement. Finally, if it is also true that the Internet and the Web technologies allow individual users to interact with organisational information systems in novel ways and at very low cost, it may also be that in most cases these represent incremental improvements in efficiency and convenience (such as on-line shopping). However much one appreciates the convenience of on-line shopping, it is difficult to see it as anything more than an incremental technological improvement.

- (d) Croom (2001) mentions many other studies that "have been published by consultancy and research organisations, which support the view that alternative forms of governance are likely to be adopted as a consequence of the adoption of E-Business systems and processes". This may be true, but one could argue that there is some self-interest here in consultants generating business.

He also reflects "It is important to note that this research has been exploratory in nature, and thus the conclusions drawn relate to limited empirical evidence but reflect the expectations of early adopters in terms of the future impact of their e-procurement systems." In other words there is little evidence of achievement but there are expectations, and these will be what they have been sold!

- (e) The general impression of *plus ça change* is perhaps best illustrated by Krell and Gale (2005), who listed 10 e-business myths:

- E-business migration is solely a technology issue;
- It is possible to out-source the entire process;
- E-business enabled processes can be isolated in the organization;
- Current business processes can remain unchanged;
- The firm's strategies can remain unchanged in the effort;
- E-business technology can be integrated into the current business without strategic change;
- E-business migration does not create organizational change;
- E-business migration adoption is a single-pass, sequential process to an implementation goal;
- E-business processes can be implemented under the direction of a single individual or department;
- Implementation of an e-business initiative is done only once.

The most striking insight from this was that one could substitute for the words "e-business" the name of any technological or business improvement technique of the last fifty years, and not need to change another word for the same 10 rules to make sense.

#### 2.2.4 Benefits (or otherwise) of e-business/e-commerce

- (a) According to Fraser et al (2000), at the core of the attractiveness of e-commerce is the ability to gain four possible sources of competitive advantage:
- A reduction in intermediation costs associated with wholesale and retail activities;
  - The ability to lower costs associated with purchasing by curbing the time and effort involved in supply and logistics operations;
  - Improved information gathering and processing that permit improved management of the supply chain;
  - The prospect of expanding market share and/or developing new markets by lowering the cost of gathering and processing information on the wants of existing and potential customers.
- (d) According to Damanpour (2001), the value proposition of E-business includes the creation of new market opportunities through electronic channels. These electronically channelled market opportunities enable companies to lower transaction costs, reduce delivery times, improve customer services, and add convenience. He suggests that increasingly, electronic sales, marketing, and distribution channels will grow at the expense of traditional channels for business. The speed at which a company should move in adopting e-business is a strategic business decision. Damanpour reminds us that as in any business strategic decision, a company must consider and compare its business decision with that of competitors and also consider new threats to a company's future health.
- (b) The fundamental question to be asked is whether the posited benefit expectations of e-business are realistic. Fraser et al (2000) pose the following questions that need to be resolved if there is to be successful transition to the "brave new world" of e-commerce:
- Are the costs of e-commerce solutions offset by the benefits?
  - Will user resistance require extra systems and costs that destroy the benefits?
  - Will the learning costs destroy the benefits?
  - In the context of ones business partners Is it more beneficial to be a late adopter?
  - What part of the business operations will not work effectively in a virtual world?
  - Will adoption of e-commerce solutions lead to sustainable competitive advantage?
  - Is adoption of e-commerce solutions necessary to prevent exit from the market?

They conclude that e-commerce solutions are unlikely to lead to sustainable competitive advantage but once they are widely adopted (once they become workable and useful) they will become a condition of doing business.

(c) It is possible indeed to argue against the value of e-business. For example, De et al (2001) suggest some ways in which e-commerce on the Internet could actually be counter productive to the operation of true markets:

- Collection of information about customers allowing targeted products and marketing campaigns;
- Increased outsourcing can reinforce the seller's monopoly by encouraging specialisation;
- Suppliers can exploit IT networks to create captive buyer networks;
- Suppliers can exploit linkages to provide partial information to certain customers, thereby extracting larger profits;
- Organisations benefit by having customers locked-in to their products, for which they can charge a premium;
- Open information about competitors' prices is available to the sellers, allowing in effect price fixing.

(e) Coltman et al (2001) try to penetrate to the reality behind the e-business so-called revolution. The Internet itself may indeed represent a revolution in communication. Yet to them the real, and still unresolved issue is whether it represents a revolution in the *conduct* of business.

For them, one of the valuable lessons from prior encounters with technological change is that there is often a difference between *espoused theories* (what is said about the technology) and *theories-in-use* (how the technology is actually used). Although predictions about the impact of e-business on supply chains have also been revised downward post-bubble, they still remain significant.

They suggest that e-business has so far failed to transform business in a significant way. Certainly there have been savings in the time and cost of routine tasks (tracking inventory and delivery schedules), but few of the visionary predictions concerning the e-business revolution have materialised. The most salient insight emerging is that the principles that have governed business success for centuries remain largely the same. Despite the hyperbole, the ability to predict the future is still firmly grounded in the past. Disintermediation is another unproven myth; there will simply be new and different

opportunities for middlemen to add value. It is possible that there are other myths to be exploded in e-business.

- (f) Dignum (2002), recognises there is no unique, successful business model for companies that perform electronic business. The model depends (just as in traditional business) on issues such as the products (or services) of the company and the market structure. For instance, electronic sales are possible in many industries. Whether the ordering should be done through an on-line catalogue or based on repeating schedule messages depends on the specific situation.
- (g) In the analysis conducted by Croom (2005), one of the paradoxes reported was to find that while a large number of organisations were involved with the adoption of the e-procurement aspect of what was touted as e-business, less than half of those believed that procurement had a strategic function. The cost benefits of e-procurement were widely accepted, but there seemed to be limited evidence that there is a clear understanding of the nature of the mechanisms required to achieve such cost improvement. Despite the importance given to the financial benefits of e-procurement, it was not generally believed that the financial benefits of e-procurement would meet the widely "hyped" benefits promoted in the press. Consequently, targets and financial justification for e-procurement implementation were based on more conservative expectations.
- (h) According to Lesjak and Vehovar (2005), the majority of companies with e-business projects report a strong positive economic effect of e-business on their companies and their operations. The overall satisfaction with e-business is also relatively high. However there is no distinction made between levels of e-business functionality. Also a large majority (86 per cent in their survey) of the companies with sizeable e-business projects do not use any formal methods of evaluation, and they also did not yet think about their implementation. Almost half of them also agreed that the effects of e-business are so obvious, that no evaluation is needed. On the other hand, however, the majority of companies also believe that the lack of time for proper economic evaluation is the greatest among the problems they face when implementing e-business. This somewhat demonstrates the ambiguous, inconsistent and relatively contradicting perception of e-business evaluation. One might indeed question whether the players in e-business implementation intentionally avoid formal evaluation. Such evidence that there is would suggest that it could be a mistake not to evaluate. For example Standing and Lin (2007) conclude not only that the use of evaluation methodologies affects the level of benefits obtained from B2B e-commerce, but

also that organisations that use evaluation methodologies are more satisfied with their B2B e-commerce.

- (i) Tan et al (2004), Clegg and Tan (2007), and Tan and Bennett (2007), describe in similar terms the application of a "Quality Function Deployment" (QFD) methodology to help organisations assess the potential e-business solutions that are most beneficial in respect both of feasibility and criticality. Three different applications are described in (respectively) a low tech labour intensive Chinese printing company, a micro-size (under 10 employees) IT services company, and a Singapore manufacturer of cardboard boxes. All three of these organisations are classified as small to medium enterprises, and the papers focus on the use of the technique to enable such companies to engage with the e-business concept.

A "Balanced Score Card" (BCA) technique is used to help an organisation understand the strategic objectives of the organisation (the "whats"). A "Value Chain Analysis", based on the work of Porter (1985), applied to the e-business domain as an "E-value chain analysis" (Porter, 2001), is used to define in overall terms the business processes that can help achieve the objectives (the "hows"). The Quality Function Deployment (QFD) technique provides a structured method of prioritising the application of solutions as a means of achieving objectives, by a process of surveying senior managers on the perceived inter-relationship between the two.

The technique described seems of general application to all sizes of company, and indeed may be more applicable to the larger organisation with the greater intellectual resource to engage with it. The question that arises is the degree of detail of the "detailed" operational processes contained in the VCA analysis, and hence the usefulness of the recommendations provided. Nevertheless, there seems no reason conceptually why the technique cannot be equally applied to different sources of "whats" and "hows".

### **2.2.5 Case Studies**

- (a) Chan et al (2000), describes an e-commerce history at BHP steel. The objectives that were set were to extend the reach of the e-commerce implementation into small and medium trading partners as an alternative to Electronic Data Interchange (EDI) type solutions, and to extend the range of e-commerce transactions provided. The history was in three phases starting in 1988.

An early implementation, which was characterised as "VAN-based EDI", (which seems to have been some sort of Personal Computer based proprietary pilot), did achieve some benefits, but was merged in 1993 with "Phase Two".

Phase two was a so-called "electronic trading gateway", which seems to have been a fully-fledged EDI and bar coding project. This proved difficult to implement widely, having achieved only three partners after 4 years, and there seemed to develop a perception that EDI was in decline generally throughout Australia and overseas").

Phase three, so called "internet e-commerce", was then the replacement approach, expected to provide an alternative to the existing high-cost, VAN-based EDI for small and medium-sized trading partners.

For BHP, setting up a comprehensive Web site to provide information about the steel industry, products, services and so on, was the first step in the company's plan for an Internet-based e-commerce implementation. In terms of tangible results, the (phase 3) expected achievement of an "internet e-commerce" (in effect a cheaper EDI) seems only to illustrate the poverty of the e-commerce concept.

- (b) Graham and Hardaker (2000) discussed the activities of General Electric (GE), a major organisation that is making money by creating an online business community that allows the company to transact about \$1 billion worth of business with more than 1,400 suppliers scattered around the globe. In effect this is an early example of an "exchange". Other examples were also quoted:
- The "big three" auto makers in the USA, are launching the automotive network exchange (ANX) to further understand the impending effects of electronic business communities;
  - JC Penny shares packing, shipping, inventory and product movement with suppliers;
  - Philips Petroleum ([www.phillipsbb.com](http://www.phillipsbb.com)) shares product movement trends and forecasts with pipeline partners.

This case study seems an early example of the exchange type initiative. The exchange concept seems fundamental to the e-business concept and is dealt with in depth later (see below 2.6.3).

- (c) The CBI "Reality Bites" Report was an attempt to salvage "e-business" from the recession caused by the bursting of the Internet bubble. The thesis is that progress continues to be



made based on a pragmatic approach to costs and benefits. The report cites a number of case studies, for example:

- Provision of self-service tools for people (Customers, Suppliers, internal) to do things for themselves;
- Electronic payslips and similar documents;
- Centralising e-mails, databases and systems;
- Internet based requisitioning and purchasing;
- Web-based performance and productivity analysis system;
- Web sites (for example Store locators, Advertising);
- Auctions;
- Web based on line order processing;
- Direct integration of the sales order with the purchase order to suppliers;
- On-line trading services for marine industry, chemicals, energy sector, currency;
- Internal personnel admin;
- Electronic knowledge and best practice sharing.

However, the initial impression is that the functionality included was a little thin. The question that seemed not to be answered is whether many of the e-business functions (particularly self-service facilities) are really beneficial. Is it really necessarily the best idea to have experienced professionals (for example salesmen) doing their own administration (for example typing and producing letters) instead of doing what they (presumably) are being paid for (for example selling)?

- (d) Al-Mashari (2002) provides a comparative study of organizational experiences with electronic commerce. A number of relevant case studies were discussed; BHP Steel, Ford, Barnes and Nobel (online bookseller), West Marine (recreational and commercial boating supplies), Dell. Transtec, being a medium-sized manufacturing company, seemed the most interesting and was characterised as an example of successful electronic commerce. The achievements seemed to amount to the integration of Intranet and Internet applications, an electronic product catalogue and an order tracking and tracing function.
- (e) Subramaniam and Shaw (2002), in a case study involving a major heavy-equipment manufacturer located in the mid western United States attempted to identify the criteria that might enable Web-enabled business-to-business (B2B) to give significant benefits over more traditional EDI type approaches. They confirmed (as they expected) that the major benefits of deploying web-based procurement were realised in complex unstructured procurement decisions rather than those involving repetitive purchasing. Yen and Ng

(2003), in a case study in the Hong Kong textile industry, suggested benefits that can be expected from an electronic commerce based supply chain. These included a reduction in product development time from 6 weeks to 2; a reduction in buyer replenishment inventory from 17 weeks to 7, and a cut in total cycle time for orders from 40 weeks to 20. The supply channels were transformed from a hierarchical structure to a star network resulting in a shortened supply chain and better procurement consolidation.

- (f) Hollingum (2000) discusses some case studies relating to the use of the Internet in manufacturing. The scope for business use of the Internet seemed to involve the following themes:
- Manufacturing profit depends increasingly on high value-added output achieved through developing new knowledge;
  - The need to create a strong climate for investment in both R&D and capital;
  - The need for manufacturers to adopt a culture of continuous improvement, innovation and best practice;
  - The need to ensure that all levels of the workforce have the right skills and training.

The experience of the Cummins Company was discussed. In terms of tangible achievement, this seemed to amount to implementing one CAD system worldwide, as a result of which the management team putting it all together apparently learned a lot more about "collaborative management". The other achievements seemed to amount to studies, action plans and objectives and decisions. The implication was that progress was inhibited by the variety of home grown systems.

- (g) Barnes et al (2004), describe three cases that serve as useful illustrations of how manufacturers, stalwarts of the old economy, can use e-commerce to seek competitive advantage in the new economy. Some examples of the internal uses of e-commerce were given but they seemed to represent the sort of systems that the manufacturers should have with or without e-commerce (for example Management information and cost accounting systems). Perhaps the e-business enthusiasm was acting as a stimulation of systems development!

Although there was no attempt objectively to evaluate the performances achieved by companies as a result of their use of e-commerce in support of their strategies, all three cases seemed convinced that benefits were accruing, based on improvement in some of their existing performance measures. They felt that they had reduced costs through the productivity gains available from conducting business electronically. It was argued that they

could do much more in this respect, especially as none has made much progress in the adoption of e-procurement. (However no thoughts were offered in respect of the characteristics that might justify e-procurement).

Barnes et al concluded with a call for more empirical research to be undertaken both to track the progress of the use of e-commerce in the manufacturing sector and also seek a better understanding of how the new technologies might be used more effectively.

- (h) Feng Li (2007) highlights probably the most well known case studies of the Internet era, representing three contrasting situations:
- IBM is as an example of a virtual organisation that went wrong. As a classic example of the fallacy of outsourcing what are perceived to be non-core competencies, they lost control of the personal computer business to Microsoft. Perhaps they should have realised that they should have developed these into core competences in order to control the market.
  - E-bay as a company that would not exist if it were not for the Internet.
  - Dell as a company that existed before the Internet and would continue to be a success without it, but the Internet has made it work much better.

#### 2.2.6 Summary

A relatively coherent picture of what "e-business" amounts to has emerged. The twin themes are:

- The integration of systems inside and with those of customers and suppliers;
- Using the Internet.

Whether this represents an incremental improvement or a revolutionary event (Coltman et al, 2001) can be debated but it is difficult to see how the revolution case is made. When one moves from broad themes to actual practical functionality, the apparent coherence disappears and one is in the world of arbitrary models, claims and conjecture. One is forced to conclude that "labels", either the "e-business" label or the "e-commerce" label, are not actually all that helpful. Therefore it seems that it is better to adopt the incremental improvement approach. It follows therefore that it would be better to concentrate on specific functionality and practicality at the detail level. It may therefore be argued that this supports the initial hypothesis that there is a value in providing detailed guidance to organisations in respect of the functions that are relevant to them in the e-business domain.

One other thing seems clear - that it is a waste of time concerning oneself with the difference between e-business and e-commerce. There can surely be no legitimate reason for distinguishing between the two terms (any more than distinguishing between the terms "business" and "commerce"). The common-sense standpoint, in regarding e-business and e-commerce as equivalent and interchangeable, should be adopted.

From the above discussion, it seems that the integration of systems inside and with those of customers and suppliers is a fundamental component of the "e-business" picture. Indeed in an investigation of what should be the major research and development areas regarding the logistics of electronic business (Auramo et al, 2002), the priority areas were the management and optimising of the supply network, and the integrated ERP (Enterprise Resource Planning) systems in the supply networks.

This outline exploration of the e-business concept has exposed associations with four other concepts, either as part of the concept or as closely associated. These are:

- Electronic Data Interchange (EDI);
- Enterprise Resource Planning (ERP);
- Customer Relationship Management (CRM);
- Supply Chain management (SCM), which leads on to the Exchange concept.

In order to complete the examination of the e-business concept it is appropriate to study in more detail these other concepts.

## **2.3 EDI in the context of e-business**

### **2.3.1 Introduction**

Since e-business is clearly related to the interchange of electronic information between businesses, it is first necessary to consider its relationship with the more established domain of "Electronic Data Interchange" (EDI). Indeed according to Fraser et al (2000), there is confusion between e-commerce and EDI because both are completely concerned with electronic data interchange. EDI has been used (Archer et al, 2000) since the early 1970s to link one or more firms to their customers or suppliers through private value added networks. The point made by Archer et al is that in the business-to-business (B2B) e-commerce environment, inter-organisational information systems (IOS) have been used since those early 1970s to link one or more firms to their customers or suppliers, and that EDI is simply an early form of IOS. It is therefore necessary to establish where the concept of EDI fits into that of e-business.

### 2.3.2 Nature and Scope of EDI

- (a) According to Delfmann et al (2002), electronic commerce includes any form of economic activity conducted via electronic connections. Although principle this can be by electronic data interchange (EDI) or Internet technology, in practice it is Internet technology (with its low costs and simplicity) that is currently the most promising backbone for conducting economic transactions. There appears to be an expectation that it will become the only medium for electronic transactions within the next decade.
- (b) Murillo (2001) similarly sees electronic commerce (e-commerce) as technically a sophisticated form of EDI. However he states that it relies on a much broader concept than EDI, based on a truly worldwide network of digital communications (i.e. the Internet) and activities in many different branches of commerce and among many different economic agents. He makes the observation that by the mid-1980s, the benefits of EDI had been universally recognized and increasingly businesses of lesser size were adopting the network. This is a view that perhaps exaggerates the success of EDI.
- (c) The essence of the EDI concept is that of electronic data interchange using standardised message formats. Amongst examples of standardised message formats are those provided by the ODETTE (Organisation for Data Exchange and Tele Transmission in Europe) organisation for the automotive industry in Europe. According to Kim (2000), traditional EDI standards developed by ANSI and EDIFACT enable different organizations to share data in a structured way, and hence become the basis for enterprise models of business-to-business software. However, common understanding of meanings of shared data is enforced by restrictive data formats, and as a result, EDI standards are not flexible to support sharing of non-standard or extemporaneous data. In the (for example XML based) alternate forms of EDI, integration is enabled by explicitly representing the meanings of entities. Translation from one entity in one data model to a similar entity in another model is executed by applying the definitions of these entities to draw relationships between them.
- (d) In a survey into current supply chain practices conducted electronically (Croom, 2005), it was found "not surprising" that e-mail, web sites, funds transfer and EDI dominated the list. The reason suggested was that E-mail and web sites are dominant and ubiquitous systems. The advantages of EDI include integration and presentation of data in a common format. EDI on the other hand is relatively costly except for high volume communications between common trading hierarchies. Thus EDI is often found in common use for the exchange of data between frequently trading partners, such as retailers and their major

suppliers, manufacturers and their major suppliers. Often, EDI was deployed for the management of direct supply chains, i.e. for components and materials in manufacturing, or saleable products in retailing. The cost per unit is then relatively low, the benefits of high speed transmission and the sunk cost of investment are all factors which are seen as likely to sustain EDI, or at least integrate it into an internet-EDI structure for the management of specific high frequency exchange supply chains.

- (e) In order to eliminate the so-called confusion between e-commerce and EDI, Fraser et al (2000) define EDI as the particular sub-set of electronic commerce that uses standardised, agreed formats for electronic "messages" to create extremely cost-efficient handling of transactions. An example of such a transaction is given as product re-ordering between distributors and manufacturers who operate a "build to order" philosophy.
- (f) Archer et al (2000), in seeing EDI as simply an early form of inter-organisational information systems (IOS), suggests that the range of application of such systems has now grown from simply handling transaction data to supporting all forms of information exchange, including procurement transactions, supply chain management, sourcing information, new product development, shared electronic mail. Angeles et al (1999) demonstrated that the more depth of EDI implementation, the more success was likely; and suggested that Internet EDI would democratise EDI to the extent that such depth would become available to small and medium size companies.
- (g) Dignum (2002) distinguishes between catalogue based ordering and EDI (message) based ordering. For him it is basically a question of:
- Whether the products are standardized products or specialised build on order?
  - Whether there are long-term relationships (contracts) between companies or are most transactions one-at-a-time?

He accepts the need for adequate standard message formats and discusses the problem of standards trying to be all things to all men. For instance a company might like to use the same format for its messages in dealing with all its suppliers. Usually this leads to taking a union of all the fields that are required for each supplier and thus creating a large message that is half empty. This is the situation in EDI standards like EDIFACT. However, with the rise of XML one can now more readily define a flexible format. The format itself is included in the message and can be used by the supplier to determine the content.

### 2.3.3 Case Studies

- (a) Auramo et al (2005), in describing a study to provide empirical evidence of benefits from IT in supply chain management, came to the conclusion that EDI is still "alive and well". As was expected, EDI/EDIFACT had in general been used for over five years, but with some companies having adopted the solution only recently.
- (b) Chan et al (2000), in describing a case study at BHP steel, position EDI and "internet e-commerce" according to the following principles:
- For strategic transactions (characterised by high volume, high risk and high return), the use of traditional EDI is considered most appropriate;
  - For tactical transactions (characterised by medium volume, medium risks and medium return), the use of EDI and e-fax are considered suitable;
  - For consumer transactions (low value, low risks and low return), "various e-commerce technologies" i.e. the internet" may be used.
- (c) In a survey described by Cagliano et al (2003), companies belonging to the automotive industry were the ones with the lowest adoption of the Internet. This apparently was a surprising finding, since there is a view that this industry is technologically highly developed, relying strongly on supply chain processes. The conclusion of the survey was that the high diffusion of EDI has hampered the penetration of web-based technologies. A more acute perception might have been that the high diffusion of EDI has made less necessary the penetration of web-based technologies. More positively, the conclusion could equally have been that web-based technologies have more to offer those organisations that did not have the resources to adopt EDI.
- (d) In a study of the Intel Corporation reported by Sammon and Hanley (2007), Intel has planned to replace much of its EDI connections with Rosetta Net interfaces. As described, "Rosetta net" addresses the issue of the automating of the integration of data interchanges between business partners, something that had apparently been lost with simplistic web-site type interfaces. In fact Intel were reported to have been one of the few organisations that have shown enough confidence in Rosetta Net (presumably related to the fact that Intel was a founding member of the Rosetta Net Consortium). The study concluded that progress had been slower than expected.

### 2.3.4 Summary

To summarise it is clear that the concept of EDI was invented to address the same basic requirements that e-business now purports to cover. In that respect it can truly be regarded

as an early form of e-business. E-business can be regarded as extending the concept in two basic ways:

- Firstly by extending the breadth of functions covered, transactions supported, and types of interaction made possible;
- Secondly, by the use of Internet-based communication technology to enable such interactions to be economically available to all sizes of organisations

Despite the impression (typically, Archer et al, 2000; Delfmann et al, 2002; Murillo, 2001) that EDI is old fashioned and about to be rendered obsolete, real life case studies tend to support the view (for example, Auramo et al, 2005) that EDI will survive for some time yet.

EDI practitioners might caution against the potential loss of the standardisation enforced by EDI once data interchange concepts combine with the anarchy of the Internet. A cynic might also draw a parallel between the overblown expectations initially associated with the EDI concept and those currently evident for e-business.

## **2.4 ERP Systems in the context of e-business**

### **2.4.1 Introduction**

- (a) The concept of Enterprise Requirements Planning (ERP) has already been established as closely related that of e-business, whether as a stage on a route (Croom, 2005) or as a key component (Fink, 2006;). It is necessary to examine and understand this relationship.

Soliman and Youssef (2001) see two information technology components tools for achieving sustainable competitive advantage. These are:

- Internet-based e-business; and
- Enterprise integration using Enterprise Requirements Planning (ERP) systems.

The elegant distinction made here is between inter-organisation integration, which is the domain of e-business, and intra-organisation, which is the domain of ERP systems. This is different view from some others quoted earlier (for example Pant and Ravichandran, 2001), which would imply that e-business encompasses the whole.

By complete contrast, Nah, Lau and Kuang (2001) see two important new frontiers for ERP:

- Electronic business (e-business) reaching beyond their own corporate walls to better connect with suppliers, distributors, and customers;
- Supply-chain management, reducing cycle times and inventory by linking supply-chain applications with other business systems.



This view therefore would have ERP being the overarching concept encompassing the whole, with e-business (and Supply Chain Management) being components. Either way it is necessary to include a close examination of the ERP concept alongside that of e-business.

- (b) Before going on to review the ERP concept, a few observations on terminology (based on the experience of the author) are probably in order. All concepts ending with the abbreviation "RP" are derivative of the base concept of Material Requirements Planning (MRP). This was originally conceived as a formal system to plan priorities (what has to be done and when) in order to respond to the needs of the marketplace (Wight, 1984). From thenceforward the idea would seem to have been extended in many ways for three main reasons:
- To extend the functionality, for example to the management of capacity, hence Capacity Requirements Planning (CRP) and the redefinition of the acronym to that of Manufacturing Resource Planning;
  - To widen the application domain (for example to the wider distribution chain, hence Distribution Requirements Planning (DRP);
  - To update the terminology so that there is a perception of progress (for example Manufacturing Resource Planning II, hence MRP II).
- (c) Biehl (2005) finds that a key component of e-business, namely the successful use of exchange functionality, becomes dependent on the existence of internal systems capabilities, more so as the complexity of the firm's operations increase. For example it is unrealistic to maintain product structures on an exchange, if they are not being properly maintained by the internal (ERP) system. To put it another way, to be effective in inter-organisation integration, one must be effective in intra-organisation integration. Investing in an ERP system therefore comes with a double benefit if the firm uses or intends to use exchanges:
- The direct increase in internal capability; and
  - The increase in the effectiveness with which external supply chain functionality can be used.

The converse is not true. Cagliano et al (2006) confirm that the adoption of ERP systems *per se* is not associated with higher levels of integration of information flows with suppliers, nor does it influence the level of integration of physical flows.

- (d) Bendoly and Schoenherr (2005) suggest that success in ERP implementation is interlinked with success in e-business. The hypothesis is that the positive effects of both the product and the process of an ERP system implementation could have a positive effect on the level of B2B e-procurement effectiveness. If ERP systems provide reductions in material requirements uncertainty and thus more advanced planning capabilities, they may also be associated with an increased potential to benefit from the timely use of B2B marketplaces for internet-based procurement. Conversely, firms with ERP systems in place should be capable of greater reductions in materials procurement costs through the use of B2B marketplaces.
- (e) The problem here is that there is confusion about the meaning of the ERP concept. This is exemplified by the observation that Bendoly and Schoenherr distinguish ERP system from situations where reliance on MRP and homegrown extensions provided dominant architectures. In effect therefore they have adopted a definition of ERP which relates to "has the organisation implemented an ERP package or not?" rather than based on functionality. Therefore their argument amounts to little more than an assertion that a focus on a standard package implementation is likely to be constructive in terms of facilitating e-business. This may be true, but it is a different point and does not help us understand the nature of ERP systems.
- (f) Nevertheless, it would seem that the concepts associated with e-business and ERP should be regarded as inextricably interlinked, if not indeed simply different views of the same picture. It is relevant therefore to examine the ERP concepts and review issues affecting ERP systems as a pointer to issues potentially relevant to e-business also

#### 2.4.2 Nature and Scope of ERP

- (a) For Mabert et al (2000) and Rondeau and Litteral (2001), ERP is based on the concept of implementing the set of best practices, procedures, and tools that the different parts of an organisation can employ to achieve something that they call total organisational excellence through integration. Mabert et al go on to observe that market leaders in the provision of ERP software (they mention SAP, BAAN and Peoplesoft; but interestingly enough it would have to be a different list in 2008) provide such a set.
- (b) By contrast to such clearly marketing inspired thinking, Manetti (2001) quotes the following definition for ERP, and attributes it to APICS, the American Production and Inventory Control Society:

- An accounting-oriented information system for identifying and planning the enterprise-wide resources needed to take, make, ship, and account for customer orders. An ERP system differs from the typical MRP II system in technical requirements such as graphical user interface, relational database, use of fourth generation language, and computer assisted software engineering tools in development, client server architecture, and open system portability.
- More generally, a method for the effective planning and control of all resources needed to take, make, ship and account for customer orders in a manufacturing, distribution, or service company

The first part of this definition is interesting if only to show the confusion that is abroad. Can it really be the case that technological requirements such as graphical user interfaces and fourth generation languages were characterising differences between ERP and MRPII? Is ERP defined at least in part by the technology adopted?

- (c) Reyes et al (2002) describe ERP as an advance on Manufacturing Resource Planning (MRP II) systems. MRP II systems were characterised as a useful tool to address the mid to long range planning at independent locations. However these were too static and became less adequate to meet the customer's expectation of a quick response. So enterprise professionals needed more real time information. So the next evolution was to enterprise resource planning systems (ERP), which purports to focus on business and production management processes. In other words ERP systems evolved from MRP II systems by linking the firm's multiple divisions into one enterprise database. Similarly for Payne (2002), the single database is the simple core of the concept.
- (d) For Rondeau and Litteral (2001), ERP systems mark a significant turning point in the development of manufacturing control systems because they enable firms to improve supply chain processes through customer-driven information management. It is claimed that the promise of ERP systems (over their MRPII predecessors) lies in the provision of a suite of integrated products running under a common information technology architecture that can be tightly coupled or entirely decoupled. It can also apparently be integrated with any other application or legacy system. The idea is one of seamless, integrated information flow from suppliers, through manufacturing and distribution. This view of ERP seems very idealised and it is no wonder that they report also dissatisfied customers!
- (e) There are views (Nah et al, 2001 and Willis and Willis-Brown, 2002 are typical) that describe ERP as a packaged business software system that enables a company to

manage the efficient and effective use of resources (such as materials, human resources and finance) by providing a total, integrated solution for the organization's information-processing needs. It supports a process-oriented view of the business as well as business processes standardized across the enterprise. Among the most important attributes of ERP are its abilities to:

- Automate and integrate an organization's business processes;
- Share common data and practices across the entire enterprise; and
- Produce and access information in a real-time environment;
- Thus holding the promise of improving processes and decreasing costs.

They equate ERP with the aggressive, efficient use of information technology on the basis that this is, now more than ever, essential for an effective business strategy.

- (f) The question arises therefore whether ERP is part of the story or the whole story. Is ERP the whole wall or only some of the bricks in the wall? Reyes et al (2002) assert that additionally to MRP II, ERP adds the ability to interface with all processes within the firm, with respect to the overall multiple manufacturing system requirements. Communication between the suppliers, enterprise, and its customer base is key for getting demand and supply information into balance. In this view the ERP system should encompass everything. They then go on to suggest that many ERP systems are integrated with Supply Chain Management (SCM) software, providing an integrated solution. Some software vendors have indeed relabelled their Material Requirements Planning (MRP) module as an SCM module (for example Oracle). The implication here is therefore that the concept of an ERP system in itself does not encompass everything. Their solution seems to be based on achieving collaboration by adding a so-called "Advanced Planning System" (APS) to the mess of disparate planning systems that are the "ERP systems".

Such a strategy of achieving collaboration by adding a so-called APS system to a so-called "ERP" system is not necessarily a wrong strategy. Indeed it might be the only practical alternative in a world where not everyone in the enterprise can be made to use the same ERP system. But it seems unwise to pretend that it is anything other than a pragmatic expedient (and the business of those organisations selling APS software products that work with existing ERP systems).

- (g) Manetti (2001), in similar vein, introduces another type of product, namely Supply Chain Execution (SCE) applications. An example would be warehouse management data capture systems supporting stock type functions. The presumption is that this was another type of

non-ERP application. He observes that a key to the flexibility of ERP is the ability to open the system up to third party modules. Although the monolithic structure of ERP claimed to solve the problem of integrating data and functionality, he observes that the history of ERP has clearly demonstrated that ERP cannot do everything for reasons including:

- Business is developing too rapidly for ERP systems to keep pace;
- The existence of in-place and valued company systems.

- (h) This confusion between "ERP" and "Packaged Based Software" solutions seems common, and to make matters worse there is another frequently discussed comparison, namely that between ERP and the alternative of "best of breed" software. Essentially this represents a debate as to whether one should buy one single (marketed as "integrated") software solution from one supplier, or choose select different (often called "best of breed") software solutions for different requirements and make them work together. Payne (2002) adopts a definition of ERP that equates to the one integrated solution, and then quite reasonably observes that this will provide better levels of integration than with the best of breed approach. However he supposes that a best of breed approach might be better as a means of saving the cost and pain associated with ERP implementation. He then spoils things by suggesting that it does mean accepting that a competitor with a fully implemented, fully effective ERP system (begging the question as to whether this ideal is meaningful or achievable) may have a decided competitive edge. Having then created this "straw man", he then suggests that such systems have been seen as being so cumbersome and unwieldy that they could be a brake on innovation and a barrier to lean and flexible thinking.

Overall the view portrayed here is the common one based on the twin concepts of comprehensiveness and integration. This is fair as far as it goes, but where the stance becomes more questionable is when the assumption is made that ERP is a monolith commodity of defined functionality. For Payne, ERP is a pre-defined process. He suggests that although all organisations are different, "much" of any system is constant. However one might suggest that this attitude could be at the heart of the lack of success of ERP systems (if the business critical issues are those that are outside the "much").

- (i) There also seems to be appearing a new view of ERP, referred to as "ERP II", (Møller, 2005) which would have the ERP umbrella concept taking over what is currently considered to be "e-business". He describes a conceptual framework for ERP II, which seems to amount to an umbrella concept covering almost every abbreviation current in the manufacturing and control system domain:
- Integrated database (DB);

- Application framework (AF);
- Enterprise resource planning (ERP);
- Business process management (BPM);
- Supply chain management (SCM);
- Customer relationship management (CRM);
- Supplier relationship management (SRM);
- Product lifecycle management (PLM);
- Employee lifecycle management (ELM);
- Corporate performance management (CPM);
- Business-to-consumer (B2C);
- Business-to-business (B2B);
- Business-to-employee (B2E);
- Enterprise application integration (EAI).

The model is offered as a first step towards a tool to analyse the completeness of the ERP II vision in an enterprise or to analyse the products from an ERP vendor. This approach contrasts with the others (for example Pant and Ravichandran, 2001; Croom, 2005), which would imply that ERP systems are a component of the all-encompassing e-business whole.

- (j) According to Wieder et al (2006), the definitions of ERP systems provided by the literature vary slightly, but they all have one common theme: enterprise-wide integration of data/information and business processes. Their research discovered no significant performance differences were found between ERP adopters and non-adopters, either at the business process level, or at the overall firm level. This was felt to contradict the claims of ERP vendors. However the game was somewhat given away by the disclosure that "all ERP products from vendors other than the "big-3" (SAP AG, Oracle, and Peoplesoft) were verified to ensure that they really met the definition of ERPS used in our research" (page 21). In other words if a company had installed SAP AG, Oracle, or Peoplesoft, it was *ipso facto* presumed to have implemented "ERP", whereas if it had implemented anything else it risked being downgraded to a non-ERP user! They seemed therefore to have proved little more that the implementers of SAP AG, Oracle, and Peoplesoft were no more likely to gain benefits than the implementers of anything else. As such it does provide an elegant demonstration of how the ERP concept can be in some situations little more than a marketing construct invented for the benefit of the major software providers.

### 2.4.3 Summary

(a) Despite the obvious centrality of the ERP concept to that of e-business, a relatively incoherent picture of ERP seems to emerge from the above discussion. Questions arise such as:

- Is ERP a database and transaction processing foundation on which one builds added value applications?
- Does ERP represent the totality of all the computer applications for an organisation, or is it merely one component of "e-business", which is in itself the totality?
- Are concepts such as Customer Relationship Management and Supply Chain management part of ERP or are they concepts that one adds to an ERP based foundation system?

One might be forgiven for suggesting again that much depends on what one is trying to sell (and to whom).

(b) Most analyses of ERP concepts seem to a greater or lesser extent typical of the "next generation buzz word will solve the problem" school of thought. ERP apparently has the job of focusing on the things that MRP II was supposed to be doing (but never succeeded in doing properly)! Presumably MRP II had the job of focusing on the things that MRP (Material Requirements Planning) was supposed to be doing (but never succeeded in doing properly)!

It is perhaps understandable that with the attributes claimed for ERP systems, disappointment is the norm (for example Willis and Willis-Brown, 2002), especially if one views ERP in monolithic terms (an organisation adopts "it"), rather than as a concept capable of multiple layers of implementation. It is also perhaps little wonder that, with these expectations, practitioners have experienced the difficulties and high failure rate in implementing ERP systems that Willis and Willis-Brown cite.

When one (somewhat inevitably) moves to the concept of ERP II, it is not surprising that Møller (2005) admits that it is a new vision that has only recently been embraced by ERP vendors, and it will take a while before one is able to actually evaluate the impact of ERP II on industry.

(c) It seems reasonable to conclude that the unmet aspirations are linked to the fact that the largely unchallenged expectations from ERP are in reality over-stated and intrinsically

unachievable. A link can be drawn between this and similar expectations in the "next generation" of ERP systems - those relating to the management of the entire supply chain. It might be thought that there is a danger of repeating the same mistakes on the wider stage.

It is also clear that there is a worrying parallel between the overstated expectations around ERP systems in the past, and the similar expectations around the e-business area now. This tends to reinforce the conclusion that concentration on meaningful functionality at a detailed level is the better way to approach planning of the systems of the enterprise. Over concentration on fashionable labels, of which "ERP" is surely one (and e-business is perhaps another) is a recipe for frustration and un-met expectations.

## **2.5 CRM in the context of e-business**

### **2.5.1 Introduction**

Since Customer Relationship Management (CRM) seems to be yet another concept associated by some in the same context as e-business, it is relevant briefly to review its nature and scope and its relationship to the e-business concept.

According to Kotorov (2003), CRM appeared as a new concept at the peak of the Internet boom. In 1998, analysts forecasting that the demand for CRM technology would grow with double-digit annual rate because the Internet was causing a quiet revolution in the way customers demanded to interact with corporations.

### **2.5.2 What is CRM?**

- (a) According to Bose (2002) and Ahn et al (2003), Customer Relationship Management (CRM) involves acquisition, analysis and use of knowledge about customers in order to sell more goods and services and to do it more effectively. Apparently the term "customer" may have a broad definition that includes vendors, channel partners or virtually any group or individual that requires information from the organisation!

Bose suggests that CRM has many similarities with Enterprise Resource Planning (ERP) where ERP can be considered back office integration and CRM as front office integration. A notable difference between ERP and CRP is that ERP can be implemented without CRM. However CRM usually requires access to the back office data that often happens through ERP-type integration. One might be forgiven for finding this somewhat muddled. On the one hand, CRM represents all front-office type applications, presumably customer facing. On the other hand CRM involves everyone who needs information including vendors!



This would seem to explain why Light (2003) talks about "The concept and confusion of CRM" that has become one of "the" buzzwords for many organisations.

- (b) For Ahn (2003), the primary reasons for the emergence of CRM are the changes in the marketing environment and advances in Web technology. With the growth of web users, the web is producing large volumes of data and analysing this data in order to produce information is considered to be a serious issue. CRM therefore is not a new concept – it has always been a part of doing business. However, Ahn suggests that CRM has recently become the focus of attention, because:
- The relationship with customers is newly recognized as a key point to solidify competitive power of a company;
  - As companies procure large volumes of data related to customers, they can perform customer management more easily and efficiently using data warehousing, data mining and other information technologies; and
  - The Web has opened up a new medium for business and marketing, and it is now possible to express customer actions online into data. In other words, the scope of data to analyse behaviours of customers is extended, and the environments for one-to-one marketing have been enhanced.
- (c) Payne (2002) discusses CRM systems as a concept different from ERP. "The adoption of ERP peaked just as the customer relationship management (CRM) movement was taking off and the two were seen as being in opposing camps: ERP installers were "producer-led" just as the world was being urged to adopt CRM customer-led strategies. CRM adopters found that remodelling the business around such a large software suite was very difficult, if not impossible".

Such a discussion illustrates a difficulty of both the ERP and CRM concept. Why is CRM not just a different module(s) of the ERP system? One really cannot have it both ways. If an essential factor in the ERP definition is its comprehensiveness then by definition all functions are encompassed. In any case the notion that ERP systems are producer led seems very dubious. One might be forgiven for suggesting that they were software producer led, in the same way that most technological solutions are. The reality probably is that CRM became "considered different" because the software producers and consultancies took the view that the ERP market was saturated, static in the years following the millennium bug instigated software investment peak, and with a bad reputation. CRM vendors wanted to develop business in a new field not tarnished with past associations.

### 2.5.3 Detailed Functionality of CRM

(a) Zeng et al (2003) adopts a definition that involves CRM as encompassing all the tools, technologies and procedures to manage, improve, or facilitate sales, support and related interactions with customers, prospects and business partners throughout the enterprise. Like with Bose (2002), this rather broad definition would involve in every process of a business transaction. However there is a useful second level definition of the functionalities that typically lie within the concept. These are said to be:

- Relationship management: including instant service response based on customer input, one-to-one solutions to customers' requirements, direct online communications with customer anytime and anywhere, and customer service centres that help customers solve their questions;
- Sales force automation: including automation of sales promotion analysis, automatically tracking a client account history for repeated sales or future sales; and coordinating sales, marketing call centres, and retail outlets;
- Use of technology: to make up to the second customer data available, and applying data-warehousing technology to aggregate transaction information to provide key performance indicators;
- Opportunity management: forecasting based on sales history and managing unpredictable growth and demand.

(b) Zeng et al (2003) went on to compare CRM with something called B2B e-commerce, a concept that they basically equate with hubs or exchanges (see below 2.7). Certain similarities were noted, namely:

- Application availability anytime and anywhere: since both B2B and CRM are online Internet operations, they are available to customers online anytime and anywhere;
- Hub services are necessary for the success of both B2B and CRM systems: horizontally and vertically expanded services can help B2B retain the customer and increase customer loyalty (which is the main purpose of CRM);
- Both B2B and CRM need to have comprehensive customer research regarding what customers need and who the target customers are. Both therefore need strong technology supports such as data warehousing and database management.

(c) According to Xu and Walton (2005), the CRM systems that have been implemented by many companies are dominated by operational applications – contact centres, sales and marketing solutions with limited customer knowledge gained from the current CRM application. The analytical power of CRM has not been adequately perceived by many

organisations. The provision of analytical CRM solutions is limited to some large organisations.

#### **2.5.4 Summary**

The role of the Internet in the emergence of CRM has clear similarities with its role in the emergence of e-business. However whereas the Internet seems central to the concept of e-business (or at least to making the concept of e-business accessible to other than the largest organisations), it seems more marginal to the CRM concept (a concept which in its fullest sense seems more relevant to large organisations).

The most striking similarity, however, between the e-business concept and the CRM concept lies in the fact that it seems a marketing driven concept designed to sell software. CRM, in particular seems a somewhat arbitrary collection of functions under an attractive marketing label. For example it seems incongruous to bring together, within one "concept", call centre management systems (a concept clearly of relevance only to those organisations that run call centres) with the concept of maintaining information about ones customers (a concept in principle relevant to all organisations). Certainly views typified by Croom (2005), where CRM is one of the steps towards e-business, seem excessive.

It is possible to adopt definitions of CRM (for example Bose, 2002 and Ahn et al, 2003) that would allow it theoretically to encompass everything relating to one's customers, and be relevant to all customer situations. However, once one moves to consideration of more detailed functionality, it is clear that the real significant functionalities are rather specialised and are of most relevance to those organisations that operate primarily in the "Business-to-Consumer" domain (or at least to those organisations that have a large and volatile customer base). In developing the e-business functional model therefore (a model primarily oriented to the Business-to-Business domain), it was decided that "CRM" functions were of marginal relevance.

## **2.6 Supply chain management in the context of e-business**

### **2.6.1 General**

It has previously been established that the management and optimising of the supply network is a fundamental component of the e-business concept. It is therefore necessary to investigate the management of the supply chain as part of this study of e-business. And this dependency would seem to go both ways. The Institute for Systems Research Project ENSE-621 quote a Forrester Group survey in saying that while most planned on moving towards a packaged solution by 2001, 69% of users feel that their current supply chain

systems won't make the grade in this multi-enterprise world. The most significant reasons cited for this failure are their applications lack of electronic commerce capabilities and integration with internal systems. In other words effective management of the supply chain depends to a significant extent on e-business techniques.

### **2.6.2 The Nature of Supply Chain Management**

- (a) According to Rodgers et al (2002), "Supply Chain Management" (SCM) commonly means the integration of logistics. Intranets are commonly used for transactional and interactive processes and information sharing purposes. Extranets allow links to suppliers and customers. This allows for logistics improvements such as systems interconnection, production streamlining, and automatic material ordering.

The dominant view (for example Lin et al, 2002) is that SCM is a technique for linking a manufacturer's operations with those of all of its strategic suppliers and its key intermediaries and customers. The approach seeks to integrate the relationships and operations of immediate first-tier suppliers with those several tiers back in the supply chain. The objective is to assist every one to meet requirements including quality, delivery and the timely exchange of information. Additionally and most importantly, organisations that embrace supply chain management also solicit collaboration from key suppliers in both the logistics and product development process. The two strategic issues in SCM (for example Shore, 2001) are therefore integration and co-ordination:

- Integration is the design of the supply chain so that the network of suppliers can operate as a virtual organisation;
- Co-ordination is the process that manages the flow of materials, information, and funds between the partners and may link the decision-making across all nodes of the supply chain network.

- (b) It has been recognised (for example Kirchmer, 2004) that in order to design and implement inter-enterprise e-business processes efficiently and effectively, it is constructive to use available industry standards in the form of reference models. An example of this is the supply chain operations reference model (SCOR), which aims to assist the design of such e-business processes. The SCOR model is a development initiated by the "Supply-Chain Council (SCC), apparently a non-profit making organisation comprising 700 companies aiming to developing and sharing best practices in supply chain management. For the SCOR model four Stages of e-Business are postulated ranging from web presence to complete automatic triggering of processes in one's suppliers.

- (c) The processes described within the SCOR umbrella seemed to represent a reasonable definition of scope for what is popularly called "Supply Chain Management". However the essence of the problem with this sort of model is that the level of detail dealt with remains superficial. A six level architecture is envisaged, although the model only deals with the top three. However understandable and necessary this is (to avoid a model of monumental complexity!), it can be argued that the subject is not being dealt with at a sufficient level of detail to be useful for the average organisation with issues to resolve (for example EDI transactions should be utilised – but which ones?). Ironically it was easy to criticise the detail when detail was actually available. For example Advanced Shipping Notices was suggested as being associated with relationships of tight synchronisation, but this is rarely appropriate simply because the interchange of such information is conceptually unnecessary and in any case unlikely to be sufficiently timely.
- (d) Reyes et al (2002) define a concept called Global Supply Chain Management (GSCM), which seems to amount to the same thing. Here, SCM becomes a big issue as a result of two definite trends in the modern manufacturing world: subcontracting and wide geographic distribution. Conversely it is the existence of effective supply chain management techniques that can be said to make subcontracting and wide geographic distribution feasible. The idea is the synchronisation of demand and supply across all the nodes of a supply chain by reducing uncertainty in demand or supply and trying to maintain a permanent and optimal balance between them. According to Van der Vorst et al (2002) uncertainty reduction requires:
- Objective performance indicators to manage the supply chain in the right direction;
  - Sufficiently timely information on the environment and current supply chain state;
  - The ability to estimate the impact of alternative actions;
  - Sufficient potential control actions to manage the system to achieve the objectives.

### 2.6.3 Supply Chain Planning

- (a) Kehoe and Boughton (2002) define the concept of Supply Chain Planning (SRP). There seem to be two concepts included in this:
- BSC (Base Stock Control), which seems to amount to taking a strategic view of inventory working on the basis of the actual end user customer demand rather than against demand generated by the next point in the supply chain;
  - LRP (Line Requirements Planning), which seems to amount to the Material Requirements Planning (MRP) concept, applied all the organisations in the supply chain.

In these concepts, however, there seem to be some important questions begged. When considering planning across organisations, the issues are surely whether there is likely to be the availability of sufficiently accurate information across organisations within the supply chain, and the behaviour of people in the supplier / customer relationship. It is questionable whether just giving MRP another name is helpful. It also seems to beg the all-important question of whether providing full information to everyone induces everyone to act for the greater good (an issue dealt with more fully in section 2.9).

- (b) The systems cited by way of example were Oracle, a fairly standard ERP system (see 5.2.4) in partnership with an "Advanced Planning System" (I2Rhythm), and the Covisint automotive exchange (see below 2.7). It was unclear whether this combination had actually provided anything really useful or made a genuine impact. A longer perspective is probably required to determine whether the idea actually delivers anything.

There was a further suggestion that an LRP approach would provide the most appropriate alignment of an e-business strategy within the automotive industry. However the detail behind this suggestion would indicate nothing more than the application of MRP concepts to the overall supply chain. At least at this level it is therefore reasonable to describe these ideas as proven, but beyond this it is too early to predict the size of the long-term significance of LRP as a concept.

- (c) The impression of "nothing really new" is reinforced by an analysis by Gunasekaran et al (2001) of the performance measurements relevant to a supply chain environment. More than 40 performance metrics were suggested at three levels: strategic tactical and operational. They included "hard" measurements (for example Rate of return on investment Net profit versus productivity ratio), and also less well-defined concepts (for example Buyer-supplier partnership level).

The list of performance measurements was unexceptionable and seemed to be of fairly obvious application to organisations that buy, make or sell things. This would tend to suggest that supply chain management contains little really revolutionary, but represents a trend whereby organisations are encouraged (if such encouragement were needed!) to place more emphasis on the need to concern itself with issues outside its own four walls, relating to its wider position in a supply chain.

## 2.6.4 Supply Chain Planning and the Internet

(a) McCormack and Kasper (2002) quote Forrester Research as predicting in December 2000 that enterprises would connect their supply chains to the Internet, forming network supply chains. They define a three-phase approach starting from integrating the planning activities, orders and logistics, progressing through cooperative advanced planning, scheduling and synchronization, to a full network supply chain (implying co-habitation, shared employees, shared information and shared secrets). For a perhaps more realistic viewpoint, Skjoett-Larsen (2000), in discussing the future influence of the Internet on logistics systems, suggests three areas where the Internet will assist inter-company communication in the overall value chain:

- Customer order fulfilment;
- Communication of planning information;
- Increasing use of electronic purchasing (both direct and indirect).

Similarly, Kehoe and Boughton (2002) comment that by using Internet-based information transfer, supply webs will replace the traditional linear movement of information within supply chains, thereby facilitating a more interactive approach to supply chain partnering.

(b) Cox (1999), while recognising the concept that e-business is transforming modern thinking on supply chain management by eroding disintermediation and speeding up information flows, takes overall a more sceptical line. He observes that most of this is merely a re-branding of existing commonsense operational approaches that have always been pursued. He observes also that what is perhaps new is the tendency to believe that there is now a "one best way" to manage supply relationships, associated with lean thinking. One could perhaps be forgiven for thinking that in reality this is a common property of all new ideas at this stage of their development.

Specifically he associates modern thinking on Supply Chain Management with the "lean approach", the basics of which were gleaned from the way in which Toyota has historically managed itself and its relationships with customers and suppliers. He suggests that exponents of the lean approach fail to understand the circumstances that allowed Toyota to achieve what it achieved. In fact Toyota (probably out of necessity rather than foresight) was forced to recognise that it could not replicate the Western vertically integrated approach to supply chain management. It, therefore, appears to have made a strategic decision to concentrate only on those resources that were of critical importance to its participation in the supply chain. Lacking the resources to be able to undertake total control of the supply chain, necessity was turned into a virtue, and the concept of Supply Chain

Management becomes a key issue. Cox reminds us that the development of integrated supply chain management is therefore a highly problematic process to implement in Western Culture. The reason for this is because in the West, the culture is for suppliers to be opportunistic rather than deferential, and do not have the same incentive to tie themselves to one customer unless they are forced to do so.

- (c) Ritchie and Brindley (2000 and 2002) introduce the Amorphous Supply Chain. The premise is that the linear supply chain relationship model, which dominates most sectors, will be replaced by an "amorphous" supply chain relationship model facilitated by the Internet. The point about the amorphous supply chain is that it relates not only to new channels and customers but also the ability to build, change and reformulate flexible partnerships at speed.

They discuss a trend to increased product complexity, and quote a source estimating that between 1970 and 1995 that product complexity as a result of component parts or manufacturing method, had doubled. There is clearly a trend that the internet causes an increase in supply chain complexity, because it enables an effective business communications channel, providing access to suppliers and markets that the business was previously unable to reach. Furthermore, the Internet will facilitate the potential for effective collaboration (i.e. providing a package of products and services from more than one supplier to meet total consumer needs).

The problem with this concept is that, although the Internet improves access to markets and suppliers, product complexity is arguably pushing in the opposite direction by making expertise more important and tending to concentrate expertise in fewer hands. One could argue that there is a distinction to be made between the commodity and the engineered product: a complex engineered product will surely continue to require high expertise. One could also argue that the concept of disintermediation confuses expertise with the ability mechanically to perform an activity. It is difficult to believe that, because everyone can advertise on the web, advertising agencies will be abolished. It is surely more likely that there will arise many other middlemen with specific expertise in specific domains.

#### **2.6.5 Case Studies**

- (a) McCormack and Kasper (2002) describe research on what companies are actually doing with the concept of the extended supply chain, based on a series of overall SCM measures, and indications of technology use.



In general, the research discovered that Internet usage appears to be in an early phase of adoption. Basic e-mail interaction seems common between both suppliers and customers, while taking orders online was surprisingly low. Considering the e-commerce focus during the last few years, it was expected that taking orders online from customers or placing orders online from suppliers would be almost commonplace. However, over 50 percent of responders never take or place orders online. The gathering of information about customers and suppliers was also lower than expected. The statistical study also suggested that Internet usage has more of an impact on SCM performance when used in interacting with customers (e-mails, gathering information and data), but not in accepting orders from customers. Conversely, placing orders with suppliers over the Internet has a positive impact on performance but interacting and gathering information does not. These results suggest more of a benefit from Internet usage looking towards the customer than looking towards the supplier.

These were interesting (but not all together surprising) conclusions. The suggestion was that it might be explained by the fact that in B2B interactions, the set of suppliers and customers is very stable and well known, reducing the need for information gathering. Overall the impression was of slower e-business adoption than might have been expected. This was an interesting piece of work, which tended to throw the cold water of reality on the hyperbole surrounding the SCM concept. The results gave the lie to any suggestion that the "amorphous supply chain" idea had actually made much progress in practice.

- (b) Cagliano et al (2003) attempted to assess the adoption of the internet within the supply chain by asking companies the following question: "To what extent do you use internet to integrate the activities of the following processes along the supply chain?" There were two main conclusions:
- First, Internet adoption generally follows incremental strategies that go from a limited to a wider use of e-business tools along the supply chain, starting from external processes and subsequently integrating internal ones;
  - Second, extensive use of the Internet along the supply chain is coupled mainly with close collaboration relationships, while limited adoption is often simply related to information sharing effectiveness.

Companies operating upstream in the supply chain generally show the lowest use of the internet, while those operating downstream are more likely to adopt it, in particular for the procurement process, in some cases even for all processes together.

- (c) In a specific case study quoted by the Institute for systems research Project ENSE-621, CISCO claimed the two benefits from "networking" its supply chain. Firstly, seventy five percent of all Cisco orders now occur online, up from only 4 percent in August 1996. User satisfaction has improved dramatically with the growth of online ordering and other web applications during this same period. Secondly, Cisco slashed supply chain inventory almost in half within three months by arming suppliers and manufacturers with real-time demand signals.
- (d) Ghosh and Fedorowicz (2008) attempt to analyse the role that trust plays in supply chain partnerships in a case study involving collaborative planning, forecasting and replenishment, and present an approach for addressing the issue constructively.
- (e) Smart (2008), from an analysis of four case studies, found little evidence that adoption of e-business applications was contributing to supply chain integration. The implication was that the applications were being approached in a sort of functional isolation without considering the supply chain implications of implementing the e-business solutions. The conclusion was that the demand and supply side applications discussed in the case studies would not lead to integrated supply chain solutions, unless they are brought under an IT umbrella which can support and justify the supply chain big picture.

#### **2.6.6 Summary**

- (a) Ultimately supply chain management seems to consist of two basic themes. Firstly, there is the theme of extending the reach of ones systems beyond the management of internals to the management of one's suppliers and customers (both immediate and ultimately throughout the supply/demand chain). In this it can be regarded as ERP/MRP written on the multi-organisation stage. Secondly, there is the notion of co-ordination, collaboration and control across organisations so that everyone will behave for the greater good.
- (b) Supply Chain Management in the Internet-impacted e-business world therefore follow the theme of the creation of the ability to network. The modern supply chain management view is that of the virtual supply chain. Relationships now are more amorphous, subject to change. In addition there is a trend to disintermediation. People can go direct to their sources and not work through middlemen. The diffusion of timely information throughout the supply chain is the single most important key to getting the supply chain to work in an optimised way. By giving everybody information, the classical distortions and amplifications, caused by the ordering practices at each level in the chain, are avoided.

- (c) In summary, many aspects of the concept of e-business depend for their credibility on their close alignment with modern supply chain management concepts. One is forced regretfully to conclude that many of these concepts are unproven. The Internet may create (or enhance) the ability to network, but this may be of little value if the fundamentals of doing business have not changed. The notion of co-ordination, collaboration, control and timely information availability enhancing the ability for everyone to work for the greater good is a touching concept. However, one would need more convincing that real organisations in practice are prepared to work this way. This issue will be dealt with later (Section 2.9).

## **2.7 Exchanges**

### **2.7.1 Introduction**

- (a) According to Archer et al (2000), Supply Chain Management strategies involve business relationships that can be competitive, collaborative, or some mix of the two.

Competitive sourcing is appropriate if sourcing tends to be ad hoc, there is little real market differentiation among products and service and the customer is interested in testing supplier capabilities. This implies less relationship building and more attention to cost efficiencies. Collaborative sourcing is appropriate if supplier and customer have complementary capabilities and there are strong and enduring relationships.

- (b) In support of both collaborative and competitive strategies, on-line B2B marketplaces, or "Exchanges" have evolved as a new way facilitating a more interactive approach to supply chain partnering. According to Lee and Clark (1997), electronic markets became popular as an alternative to the traditional forms of commerce as a means of reducing transaction costs as the costs of electronic communications decline and as the ability to convey complex information through networks increases. It is believed (for example Kehoe and Boughton (2001) that, increasingly, by using Internet-based information transfer, supply webs will replace the traditional linear movement of information within supply chains. According to Lin et al (2002), Business-to-business online commerce will be equated with exchanges.

### **2.7.2 The Nature of Exchanges**

- (a) According to Mullane et al (2001), exchanges are a type of B2B organisation that serves as an intermediary between the buyer and the seller. This company sets up and operates a Web site that can be thought of as a virtual version of the ancient bazaar with many sellers and many buyers gathered in one place. Obviously this practice is not new, but now it can

be easily carried out on a global basis using Internet technology. These types of Web sites are known by several different names such as buying networks, exchanges, or hubs.

Some of these Web sites are organized into what are referred to as vertical hubs. A vertical hub serves a particular industry with a particular commodity or line of products. Other hubs serve wide-ranging industries with wide-ranging products. These are called horizontal hubs. As a part of these Web sites, items offered by the many participating suppliers are listed at pre-negotiated prices. An example of a horizontal hub is an exchange providing a wide variety of products to small businesses. Some of the products (for example office supplies) are offered at pre-negotiated prices while others, such as consulting services, are offered on a request for quotation basis.

(b) Duffy and Dale conclude that the greatest growth in e-commerce will be in the area of B2B, with a proliferation of trade exchange activity in almost every sector. So this implies that exchanges are certainly the thing of the future. According to Reynolds (2000), the objectives of exchanges are:

- Greater efficiencies and cost savings in buying on the Web;
- Collaborative buying opportunities for non resalable goods;
- More efficient planning and forecasting in supply chain;
- Increased range and choice of sourced goods, particularly in own label goods.

Reynolds differentiates between single firm driven and collaboration exchanges. Single firm, or one-to-many exchanges, represent an attempt by one (probably powerful) company to automate and simplify its supply chain using processes made possible by the Internet. The collaboration exchange and true "marketplace" situation is when established retail businesses collaborate either with a third party exchange provider, or with other intermediary businesses (perhaps even competitors) to develop consortium business-to-business collaborative buying ventures.

(c) Kehoe and Boughton (2002) consider the Automotive Network Exchange, subsequently renamed as "Covisint" (from the author's knowledge derived from communication, visibility, integration), as a practical manifestation of the application of the LRP concept (see above 2.6.3). The Automotive Network Exchange represented an initiative involving collaboration between US automotive giants General Motors, Ford and Chrysler. This initiative was intended to bring together complex supply networks and facilitate the management of parts inventories from an integrated inventory perspective. This is seen as very much in line with

the LRP approach. The functionality provided by Covisint is explored in more detail in Section 5.2.6.

- (d) Dignum (2002) divides electronic markets elegantly into four types:
- Web sites, connecting one supplier with one customer;
  - Sales portal, connecting many suppliers with one customer;
  - Procurement portal, connecting many customers with one supplier;
  - Exchange, a virtual market place connecting many suppliers with many customers.

Dignum sees Covisint as a good example of the virtual market place for the car industry. This is seen as a closed market where a number of companies bundle their procurement and thus establish leverage against the suppliers. In these markets competitors should cooperate in their procurement, because for a large part they use the same components for the products they produce. Their competition only arises in the way they add value to the components during the assembly of the products.

- (e) According to Kandampully (2003), Covisint offers an excellent example to illustrate how businesses can transform themselves to a new way of conducting business on the Internet. It is said that the electronic marketplace not only illustrates the potential for this new business model, but also, in the process, continues to invent numerous efficient ways to conduct businesses while simultaneously offering benefit to all parties involved. Businesses that choose to operate in the virtual marketplace are claimed to enjoy lower overheads, are able to reduce processing time and can offer customers various self-service and delivery options that traditional companies are unable to offer. This results in:
- Shortened transaction times;
  - Increased productivity;
  - Lower costs.

Such a view on the potential for marketplaces may prove to have been over-influenced by marketing considerations and as yet there is little evidence to predict the size of the long-term impact of exchanges for the average company.

- (f) The evidence would suggest, if anything, that this impact could be limited. For example, Sherer (2005) suggests that online marketplace use has been hampered by lack of trust. Originally billed as a tool for streamlining the automotive supply chain, the image of Covisint has changed and is being shunned by some suppliers, because they are the tool for reverse auctions and market testing against the incumbent supplier. Some suppliers have refused to participate in Covisint while others say they are just more careful when

they suspect a bidding event is merely a market test because they know it is a product currently being made by another supplier. Even earlier, commentators (e.g. Day et al (2003, p.131) were remarking on the remarkably short boom to bust cycle in business-to-business exchanges caused by a "glut of competitors" and a "collective delusion".

- (g) Murtaza et al (2004) suggests that many e-marketplaces have failed to deliver on their promise, having not been able to attract the numbers of buyers and sellers that their business model required. They suggest that, although taking supply chains online can reap significant benefits, there are many concerns associated with e-marketplaces.

First of all there is the issue of security and confidentiality. Participants must trust the site's privacy and confidentiality capabilities. Also companies are concerned about sharing sensitive data such as engineering information, demand forecasts and production schedules.

Because of the relative newness of the concept and its relative immaturity, there is still a need for industry-wide standards (for example common supplier qualification criteria, consistent item coding schemes and XML-based integration guidelines).

The lack of integration of a company's systems with e-marketplaces is a significant issue. This lack of integration derives from the original use of such marketplaces in marginal operations, like spot buying and indirect procurement, which were mostly manual processed anyway. Because of the uncertainty of the future of many e-marketplaces, organisations may not want to invest in integration.

Finally there is the issue of anti-trust legislation because successful e-marketplaces can run the risk of limiting competition unfairly.

- (h) Auramo et al (2005), in describing a study into the benefits of IT in supply chain management in "progressive companies", make the interesting observation that electronic B2B marketplaces were non-existent in the sample. Their conclusion was that companies have progressed in the use of e-business technologies in the execution of transactions, but comprehensive electronic models are still yet to emerge. The key enabling factors for the increased use of IT have been the proliferation of the Internet and the emergence of third-party service providers in information transmission. The results of the study indicate that operational use of IT has developed in the last five years with increased possibilities to

network with supply chain partners. However, in most cases the solutions used are quite individualistic, as they are developed from a single company's point of view.

### **2.7.3 Summary**

It is clear that the "Exchange" concept does address the provision of functions that are relevant to the world anticipated by the promoters of e-business. Specifically Exchanges support the notions of advanced supply chain management typified by the theories of optimisation, collaboration and timely information availability, which will be critically discussed below (2.9.2).

As an indication of the evolution of the concept it was worth monitoring the evolution of Covisint (see above 2.7.2). In the early years of the life of Covisint, a series of functional services were provided that provided an input into the development of the e-business model). However, monitoring of the evolution of the Covisint web site (2008) (<http://www.covisint.com>) suggests that the emphasis seems to have changed more to the provision of technology services and a platform for the hosting of company portals. For example Covisint now hosts the Ford supplier portal. On this portal there are many applications that could be considered collaboration systems (with Ford), but there seems little concept of the exchange as intermediary between buyer and seller (Mullane et al, 2001). Ironically one of the tasks recently (direct experience of the author, 2007) taken on by Covisint is that of a "Value Added Network" communicating traditional EDI messages between the General Motors Corporation and its suppliers!

The question is whether the exchange world is the real world inhabited by business, and it is this question that is not yet answered. It is reasonable to conclude that exchanges have their place for the performance of some useful functions in some specific situations (a conclusion that perhaps mirrors the relevance of the entire e-business concept).

## **2.8 E-business in relation to Small and Medium Enterprises (SME's)**

### **2.8.1 Causing a trend towards smaller organisations?**

- (a) According to Tetteh et al (2001), the growth of electronic business has caused the realisation that the rapid adoption of e-business by SME's is crucial to continued economic success throughout the world, since they comprise a very large part of the global economy. The impact of e-business on the smaller organisation therefore seems to merit special attention.

The thesis is that SME's can achieve global competitiveness without necessarily increasing their actual size, but rather by building on their virtual or soft assets in order to expand. These virtual assets include information skills, digital resources, and competencies for managing inter-firm relations and collaborative engagements with other firms. The core competencies required for successful global operations relate to skill development and exploitation of distinctive virtual assets within a dynamic yet consistent view of the global market held by these businesses.

- (b) Croom (2001) quotes an interesting correlation. Existing evidence at the industry level indicates that that increases in investment in information technology are associated with a decline in average firm size and rise in the number of firms. Also he quotes some interesting research that shows that industries investing more of their capital stock in information technology also contract out more of the value of the goods and services they produced to external suppliers (i.e. a higher buy/make ratio in production).

Here one is led to ask which is the chicken and which is the egg? Is there really a cause/effect relationship here, or are the developments parallel and unrelated. In either event it seems that there is a genuine trend towards e-enabled commerce involving more complex relationships with more and smaller organisations.

### **2.8.2 Potential impact of e-business on SME's**

- (a) There is an argument that the potential impact of the more flexible "Amorphous Supply Chain" developments on the smaller business (the SME's) is likely to be even more significant than the impact on larger organisations. Ritchie and Brindley (2000 and 2002) comment that that the smaller organisation will increasingly be favoured by such developments given the lower fixed overheads and the ability to be more flexible and rapid in response to changes in both supplier and consumer needs (given that every organisation can have economic access to the Internet). For example the SME may utilise the Web to promote and sell its products directly to potential customers at home and overseas. This could effectively exclude intermediaries such as sales and promotion agencies currently supporting the sales of the SME to the marketplace. This same development may also enable the SME to offer its products and services to markets not previously entered or considered commercially viable in terms of the initial entry costs of establishing representation and agencies. Hence, rather than maintaining exclusive relationships with a single intermediary the SME may seek to negotiate with a number of intermediaries simultaneously, effectively enhancing competition and reducing dependency on specific partners.



- (b) Painting a contrary picture, Keindl B (2000) suggests that the virtual marketplace gives a competitive advantage to the larger organisation that can master the technology better, and this may be a problem for SME's. To be a player in this competitive arena, a large investment in personnel and infrastructure is required. Even for those businesses that spot opportunities, firms that have already gained first mover advantages may have foreclosed access to resources and customers.

Based on a study, McCue (1999) developed a checklist of retail e-commerce functions of particular relevance to SME's. These ranged from the trivial (e-mail, simple web sites), through selling products and services over the Internet, to the improvement of customer service (by providing same-day service, getting feedback from customers, offering paperless documentation, improving response time to customer queries, and using e-mail as a customer communication tool).

- (c) Jeffcoate (2002) describes how small businesses involved in e-commerce may benchmark their performance against a number of critical success factors. It encourages an SME to analyse its own strengths and weaknesses on a continuing basis and to compare them with those of its competitors. This would seem traditional consultancy advice typically applied in respect of IT strategy development in general.

### **2.8.3 Case Studies**

- (a) In a survey conducted by Cagliano et al (2003), e-purchasers had the highest concentration of small firms and the lowest presence of medium and large ones. This was an interesting and unexpected result, which means that the Internet is both feasible and actually adopted by SME's.
- (b) Ritchie and Brindley (2000 and 2002) quoted an example of disintermediation where a medium sized furniture business forged a direct relationship with the hardwood suppliers seeking to bypass the host of intermediaries that normally attend the supply of timber in their environment. Although one does not really know without detailed study how significant the changes in practice really were, it was concluded that business size no longer dictates whether a company can use the Internet for competitor analysis or global promotional campaigns.
- (c) Research by Wagner et al (2003), however, failed to support the notion that adoption of e-business strategies will have a dramatic and positive effect on both the customer and

supplier in terms of transforming the business strategy. E-mail and web pages were standard in all participants, but implementation rarely went further than that, with the exception of high technology SME's. Positive attitudes (growth benefits to the business) were demonstrated in small companies that were subsidiaries of large companies. Internet adoption has so far not demonstrated any benefits in terms of reduced transaction costs or improved supply chain efficiency. Face to face contacts between customers and suppliers are still seen as the most appropriate way to conduct supply strategy and therefore this is a barrier to adoption. Business relationships are important – the amount of information sharing and openness being reflected in the level of trust between trading partners.

- (d) Fillis et al (2004) attempted to understand why some smaller firms implement and develop e-business activities and strategies while others do not. They concluded that a propensity to develop e-business activities would vary by sector (for example high-technology industries will exhibit higher e-business participation rates). In addition to the start-up costs, Internet transaction and information-based activities will be viewed as impediments to risk-averse firms. Although the proposition was that e-business enabled firms would experience improved levels of customer service through flexible approaches to doing business, those firms with an existing need for high levels of customer contact will be poor adopters of e-business practices. The suspicion here is that in some way e-business will inhibit the personal touch in dealings with customers.

During the course of the study by McCue (1999), the SME's sold next to nothing on the Internet, despite the best attempts by e-commerce experts, in-depth training, constant analysis of constraints, and changing of web site content and other marketing techniques. The conclusion of participating firms was that they plan to keep using the Internet for marketing and customer support, although they did not sell as much as they had expected.

- (e) Quayle (2002) comments that there is a great deal of "hype" about e-commerce and SME survivability and that those SME's that have tried to implement e-commerce solutions are dissatisfied with both the concept and the service providers. The reasons could be failure to achieve return on investment, but probably additionally include inertia, fear of previous failures, a general lack of faith in e-business and future shock (the pace of change). It seems from this that SME's are not motivated very much in the direction of e-commerce unless they are forced to be so by external pressures.
- (f) Pavic et al (2007) investigated the e-business progress in a number of case studies in the SME marketplace. Neither of the companies could be considered to be using e-business, to

any significant extent, if the definitions of e-business generally supported by the literature are to be adopted.

In one the company is successfully using e-mails, as an efficient internal and external communication tool, a web site, which positions them in the worldwide market, and "e-commerce", where they are able to order and pay online. The organisation seems to have done little in the area of supply chain integration, apparently because of the IT limitations of their business partners.

In another the company, having struggled with the implementation of a new ERP system (amongst other things) have done little but get back to where they started (after a long struggle). The company is successfully using e-mails and a web site for internal and external communication, and plans to engage more in e-commerce transactions.

In the case of seven other SME's owner-managers it emerged that SME's do not like to be pushed by anyone, especially the Government and DTI. In terms of their technological and organisational readiness, the companies would like to take a step at a time and move into e-business gradually and when they feel they are ready.

#### **2.8.4 Summary**

The impact of e-business on the smaller organisation is still open to uncertainty. On the one hand it might be thought that e-business concepts represent "big" information technology, relevant primarily for the bigger organisation. Paradoxically, it is argued that e-business not only encourages a trend towards smaller organisations, but also needs to be made to work in smaller organisations in order to be a viable concept.

The only thing that seems safe to say at the present time is that the theory of e-business relevance to the smaller organisation seems sound. The results in practice, however, do not yet seem to measure up to the theory. One must continue to monitor further the current achievements of e-business in the smaller company.

### **2.9 Discussion and Conclusions**

#### **2.9.1 Critique of optimisation, collaboration and timely information availability**

- (a) The theory of optimisation, collaboration and timely information availability seems central (for example Horvath, 2001) to supply chain management thinking, and by extension, to e-business thinking. Quite simply, strategic supply chain management demands collaboration among all participants in the value chain. For example it is unrealistic to expect to optimise one's own operations until one understands the demands of one's customers' customers as

well as the constraints of one's suppliers' suppliers. The claimed benefits for such collaboration include:

- Lowered inventory costs by more efficient distribution;
- Cost savings through increased productivity and streamlined business processes;
- Accelerated product development;
- Improved customer responsiveness and flexibility for changing market conditions;
- Improved customer service and satisfaction, and retention.

The problem is that the whole concept stands or falls by collaboration. If it can be achieved, it may be worth doing; if it cannot for whatever reason (politics, human behaviour, relative power structures, sufficient information availability) then the whole thing can be a potentially expensive failure to achieve anything worthwhile.

- (b) Kehoe and Boughton (2002) suggest that the current and future technological capabilities of the Internet mean that it is possible for demand data as well as supply capacity data to be visible to all companies within a manufacturing supply chain. It is perceived that manufacturing supply chains will change from an order-driven lot-sizing approach to one more akin to a capacity-availability-booking approach supported by appropriate search engines. They assert that the key to enhanced supply-chain operations is not solely efficient information transfer but timely information availability. In fact the use of information systems to ensure visibility (transparency) of item demand, location and status to all parts of the logistics network was identified over a decade ago. Furthermore, using Internet-based information transfer, supply webs will replace the traditional linear movement of information within supply chains, thereby facilitating a more interactive approach to supply chain partnering.

They make the very telling point that most research to date indicates that real business benefits only occur when the entire supply chain is optimised rather than individual enterprises. A cynic might suggest that this represents a counsel of perfection that can be used to make excuses if a supply chain management project fails to live up to expectations. The issue is whether practically in real life, in an imperfect world, with average people, these ideas actually cause a significant benefit to be achieved. Local optimisation of individual enterprises is a fact of life: it is how real people behave.

- (c) In similar vein, for Shore (2001) the ultimate goal is one of supply chains involving strategic supplier alliances with information flowing both ways. Systems then will integrate everything internally and share data with the planning and control systems of supplier organisations.

For example, one could have a system that identifies changes to customer requirements on the shelves of a retail store. This could automatically trigger changes to the production schedules, component and raw material requirements and the planning of distribution. In fact (Angeles, 2005) the major retail pioneers in the use of key supply-chain management technologies, have been investing heavily in technologies such as Radio Frequency Identification in its effort to improve the efficiency and visibility of the supply chain. The question remains whether real business people would allow a system to work this way, or whether the injection of human judgement at the various steps in the process would be considered necessary.

- (d) Van Hoek (2001) presents the argument for exchanges in improving supply chains, claiming that the supply chain dimension of e-business is largely neglected and managed poorly. He quotes Lee et al. (1997) in pointing to the relevance of information exchange in avoiding one of the best-known problems in the supply chain, that of Forrester's "bullwhip" effect. The theory says that irregularities and unpredictability in order quantities increase with the number of layers in the chain. Because a supplier faces uncertainty about the order quantities of a direct customer, he will anticipate demand with inventory or speculative production. Because the supplier of the supplier faces the same uncertainty in his relation with the supplier of the customer, the supplier's supplier will face considerable volatility and further anticipate orders, leading to even greater speculation at this point in the supply chain. Specifically, orders to suppliers tend to have larger variance than sales to the end user and the distortion propagates upstream in an amplified form. To summarise, even small changes in demand downstream may result in large fluctuations upstream.
- (e) Similarly, Skjoett-Larsen (2000) provides a definition of supply chain management in the co-operative context. One of the advantages of close, integrated co-operation between the actors in the supply chain is an increased transparency in the supply chain to the effect that distorted information from one end of a supply chain to the other can be eliminated. Again this reduces the "bullwhip" effect. Through close co-operation in terms of organising, planning and monitoring, it is possible to remove superfluous stocks, reduce lead-time, reduce uncertainty, and achieve better capacity utilisation. SCM cooperation will normally include the following characteristics:
- Joint planning and mutual exchange of information;
  - Co-operation based on end users' requirements;
  - Cross co-ordination on several levels in the participating companies;
  - Long-term co-operation and trust between the actors;
  - Fair sharing of risks and benefits; and

- Common visions and company cultures.
- (f) Manetti (2001) also comments that with increased co-ordination, suppliers could avoid being whipped around constantly because of inaccurate manufacturing schedule projections of the customers. This is rather stating the obvious (rather like saying that if everyone was honest, the world would be a better place). In the real world, it is arguable whether increased co-ordination is possible given the typical attitude of all-powerful customers.
- (g) The implication of the above discussion is that the problems of uncertainty and lack of coordination in the supply chain can be solved by the better dissemination of information through the supply chain. The question begged by this (and so many others) is that the provision of information leads to changing of behaviour. Scherer (2005) encapsulates the position. He accepts that Information technology will soon no longer be an impediment to the flow of networked information through hubs that link supply and demand information. However he recognises that moving from managing supply to advocating customer value requires a new level of trust and the development of new metrics. Most companies deploying supply chain technology are only getting a small fraction of the benefits that are promised, and the problem is one of trust. It is not that people do not trust the systems or the technology; people do not trust each other.
- (h) Modern thinking in Supply Chain Management discussed earlier (for example Lin et al, 2002, Kehoe and Boughton, 2002) is based on the concept of global optimisation as superior to local optimisation. However this begs the question about whether this is realistic taking into account politics, human behaviour and the realities of business. To summarise, there is the notion that every one wants integration through the supply chain because all problems can be solved if everyone throughout the supply chain has access to accurate timely information. There is an expectation that users will use the collaboration tool to upload forecasts and actual plans, and then both buyer and seller could (!!!!) go into a collaborative mode to come to a common understanding and consensus on what the seller is going to supply to a buyer. Finally there is the implication that ERP amounts to focussing on local optimisation, and SCM systems bolted on the top assists global optimisation.
- (i) To summarise, Cox (1999) makes some very useful observations relating to the fundamental flaws in modern supply chain thinking which seem particularly to apply to notions of collaboration. Any approach to supply chain must be based on an understanding of what business is actually about in theory. Essentially business is about appropriating

value for oneself; it is not about passing value. He observes that the concept of power is rarely discussed in supply chain writing, except to deny it as important, or to argue that power should not be used because lean approaches should be based on equity, trust and openness.

Companies are only successful if they possess power over something or someone. In understanding how to manage supply chains strategically and operationally it is essential that practitioners properly understand the power structures that exist in their supply chains. If they do not, then both practitioners and academics may well be guilty of recommending strategies and operational practices that are inappropriate for the supply chains in which they operate.

### **2.9.2 Conclusions**

- (a) A relatively coherent picture of "e-business" amounts has emerged, in so far as the concept affects manufacturing industry. The theme is the integration, using the Internet, of systems both inside and with those of customers and suppliers (the latter being the domain of what is termed Supply Chain Management). The question is how valid is the concept.
- (b) The literature review confirms the initial impression that there is enough material in the academic domain to convince the observer that e-business represents an unstoppable wave of progress. There is plenty of evidence also that much of this impact is overrated. In fact (following Reynolds, 2000) one can easily detect the common mistakes of all predictive activity:
- Depending on trend extrapolation without understanding the factors that influence change;
  - Believing that a forecast describes the reality of a future situation;
  - Failure to expect the unexpected;
  - Ignoring factors for which little data exists;
  - Becoming too persuaded by technology as a determinant of social change; and
  - Assuming that every forecast is upwards.
- (c) The overwhelming impression gained from the available material is one of people following fashion rather than necessarily thoroughly thinking things through. There seems simply too much uncritical acceptance of marketing material. So much seemed to be hyperbole, good intentions, what people are thinking of doing, or what people are studying doing. It reminds of the type of material that is often produced by an enthusiastic team at the start of a project. Allied to this, once one moves away from the consumer oriented aspects of e-

business (for example "Internet shopping") towards supply chain management, the impression given was of much talk, many plans, but not much concrete achievement.

- (d) In most case studies, the organisations involved seemed to have achieved results that were fairly ordinary and straightforward. These were typically accompanied with plans for bigger ideas in the future. Again there seemed to be too much uncritical adoption of marketing pitches, and much seemed superficial and assertive. Much seemed to focus on what was enabled and what was possible. But there was little evidence of usefulness in actual practical experience. For example swapping information may be enabled but there was little evidence that swapping information has actually delivered a significant improvement in supply chain management.
- (e) The experience of General Electric seems typical of the "e-business" initiatives that have become fashionable in large corporations with enough resources able to make such a move. That some things are being done is indisputable, but what is missing is the perspective that there is long-term significance in these initiatives, that such initiatives are proven to be more than yet another passing fad. What is purported to be achievement seems too close to the marketing initiatives of consultants and software vendors. For example the quotation "Even small and medium-sized enterprises increasingly now rely on international networks of suppliers, distributors, and customers, frequently via the Internet, to improve their global competitiveness through reducing fixed and operating costs and overall competitive position" (Graham and Hardaker, 2000, page 289) represents assertion only. Such enterprises do have access to such tools, but there is not much evidence for their long-term significance.
- (e) The emergence of virtual corporations seemed a substantial consequence of the impact of the Internet on supply chain management. The bottom line is apparently that the "E" in e-business makes it easier to share/integrate information. The Internet may increase the volume of communications through greater interactivity between the firm and the customer, but does volume equal richness? The analyses of case studies would suggest that the answer is "not much". There is certainly the need for more detailed and critical analysis of more real life case studies.
- (f) As Fraser et al (2000) points out, the Internet is often associated with the metaphor of the "information superhighway", and this is a misnomer. The metaphor suggests that there is travel involved, that to gain the relevant piece of information, a journey has to be made and distance commuted. This is not the case; in fact the major benefit of the "highway" is that



relevant information can be sourced from the desktop or armchair. It is an unconstrained network with no miles to travel. The term "highway" also suggests that everyone is driving and following the same route. This new network that is the information superhighway is more like a "super byway", as it constitutes very many country lanes where everyone can carry out whatever information-led activity they like.

The key is to think about the information superhighway as a trading centre or market, although in a virtual environment. In the future, it will pervade a number of areas of most lives, where it will be normal to sell, trade, invest, talk, inform and meet new people. Perhaps the most appropriate image of the "information highway" is a marketplace for information trading.

- (g) Is e-business then just another passing fad, borne out of the need for technological solution suppliers to get people to buy something (anything!), or does it represent significantly beneficial functionality? The literature could be used to support either view and in reality either view is probably correct (in parts). What is clearly confirmed from this review is that there is a value in providing ways in which organisations can be supported in investigating their own specific requirements at a detail level, rather than being put in the position of having to buy the concept blind!

It is therefore clear that there is a need for a systematic process that can propose at a useful level of detail the probable e-business requirements of an organisation based on objective criteria. The next chapter reviews the research methodology adopted in order to try to develop this process.

### 3 Research Methodology

#### 3.1 Research Background

##### 3.1.1 The Research Hypothesis

The literature review in Chapter 2 concluded that there is a need to assist organisations to penetrate beneath the level of overview material in order to make concrete decisions on those e-business opportunities that could be worthy of investment. As indicated earlier, the hypothesis of his research is that it is possible provide this assistance by developing a systematic process that defines (at a useful level of detail) the probable e-business requirements of an organisation based on relevant facts about the company.

Figure 3.1 illustrates the concept envisaged. The process starts with the collection of the relevant facts by an interview process with an appropriate company person. These are then matched against the reference model that defines the complete set of functions available, and contains the rules that decide those situations where a particular function should be relevant (or otherwise).

From this matching process, a list of recommended functions for the enterprise is produced, and presented alongside a trace of how and why particular selections were made.

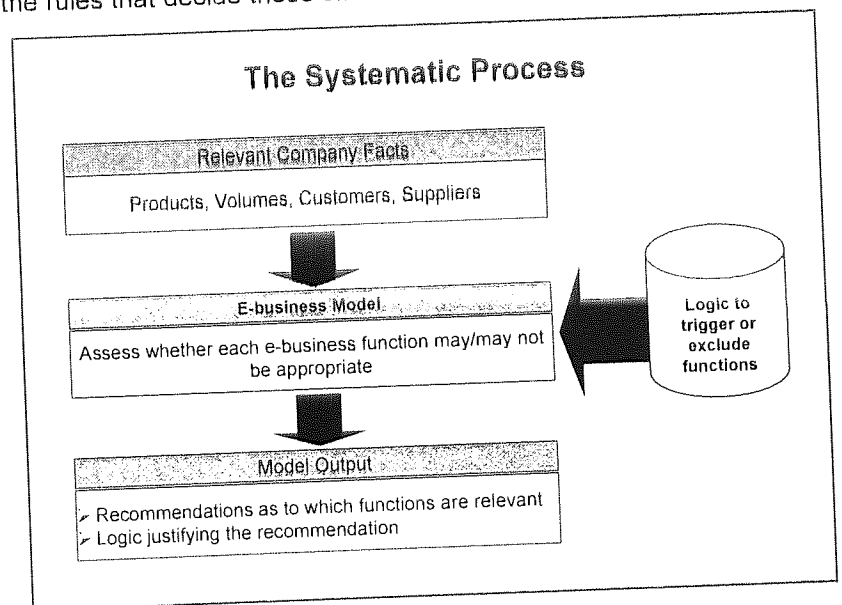


Figure 3.1 - The Concept of a systematic process

The research issues therefore are twofold:

- How to produce a generic model, which can generate a functional specification to a useful level of detail, at a useful level of accuracy?
- How to judge the accuracy and usefulness of the model?

In order to develop a methodology to answer these research issues, it is appropriate to review some general research methodology issues.

### 3.1.2 General

Business research is a systematic Inquiry whose objective is to provide information to solve managerial problems (Cooper and Schindler, 2003). This research conducted under the auspices of this project is designed to solve a managerial problem, namely how to provide objective assistance to decision makers who need to focus on what their organisation needs from e-business rather than what prospective vendors are anxious to sell to them. This research is clearly therefore "business research" within the above definition and it is necessary to consider what type of research this represents and what are the means best adapted to carry it out.

### 3.1.3 Type of Research

(a) Cooper and Schindler describe four different types of research:

- Reporting - the gathering of data and providing statistics;
- Descriptive - an attempt to describe a subject typically by creating a profile of a group of people, problems or events;
- Explanatory - an attempt to explain (based on a theory or hypothesis) why an event has occurred and how the variables interact as they do;
- Predictive - an attempt to predict (also based on a theory or hypothesis) when and in what situations an event will occur.

Then also describe the twin logical dimensions of logic; empiricism (observable, concrete data versus interpretative ideas) and existentialism (inductive empirical approach versus theoretical deductive reasoning), and identify two potential styles of thinking in this context:

- The literary method (moderate empiricism and moderate existentialism), characterised by case studies; the interpretation of things in terms of the perspectives of the players rather than in terms of abstract and general categories;
- The scientific method (moderate empiricism and moderate existentialism), characterised by:
  - Direct observation of phenomena,
  - Clearly defined variables methods and procedures,
  - Empirically testable hypotheses,
  - The ability to rule out rival hypotheses,
  - Statistical rather than linguistic justification of conclusions,
  - A self-correcting process.

(b) According to Walle (2001) empiricism involves objectively gathering evidence without prejudice, and basing conclusions upon actual facts. Much modern business research is

empirical because it systemically applies the analytic techniques that derive from the "hard sciences" to social phenomena.

However it is still necessary to establish the appropriate balance between statistical techniques that seem to be a part of what is characterised as the scientific method, and more interpretative techniques, which seem to imply a more literary research method.

#### **3.1.4 Qualitative versus quantitative research**

- (a) Cooper and Schindler characterise quality as the essential character or nature of something and quantity as the amount. Quality is the what; quantity is the how much. In respect of the use of this concept in research, qualitative refers to discovering the meaning, the definition or analogy or model or metaphor characterising something, while quantitative assumes the meaning and refers to the measuring of the thing. The example that they give is that qualitative research would define the nature of fishing, while quantitative research is concerned with issues such as counting the spines on the fin of a fish!
- (b) According to Patton and Appelbaum (2003), the qualitative researcher concentrates on the instance, trying to pull it apart and put it back together again more meaningfully while the quantitative researcher seeks a collection of instances, expecting that, from the aggregate, issue relevant meanings will emerge.
- (c) According to Jarratt (1996), Quantitative research is deductive, forcing researchers to work within a theory, whereas Qualitative research is what is used to get fresh perspectives on things and investigate subjects of which little is known.

He quotes Stainback and Stainback (1988) in summarising the differences between quantitative and qualitative research, described in figure 3.2.

<b>Dimensions</b>	<b>Quantitative paradigm</b>	<b>Qualitative paradigm</b>
<b>Purpose</b>	Prediction and control	Understanding
<b>Reliability</b>	Stable – reality is made up of facts that do not change	Dynamic – reality changes with changes in people's perceptions
<b>Viewpoint</b>	Outsider – reality is what quantifiable data indicate it to be	Insider – reality is what people perceive it to be
<b>Values</b>	Value free – values can be controlled	Value bound – values will impact on understanding the phenomena
<b>Focus</b>	Particularistic – defined by variables studied	Holistic
<b>Orientation</b>	Verification	Discovery
<b>Data</b>	Objective	Subjective
<b>Instrumentation</b>	Non-human	Human
<b>Conditions</b>	Controlled	Naturalistic
<b>Results</b>	Reliable	Valid – the focus is on design and procedures to gain real rich and deep data

Figure 3.2 - Illustrating the differences between quantitative and qualitative research

- (d) McKinnon (1988) differentiates between field studies and experimental survey studies, a distinction that seems to relate to the distinction between quantitative and qualitative research:
- Experimental survey studies are concerned with causal relationships and/or correlations between variables;
  - Field studies are more concerned with describing the complex pattern of interactions comprising a phenomenon and are directed towards better understanding of the phenomenon or to the discovery of new phenomena.
- (e) Vinten (1994) gives some interesting perspectives on the justification for and place of qualitative research. He provides a list of 36 possible reasons why qualitative research can be justified, including the following 16 that seem relevant to this research project:
- To find out in own words reasons for an event;
  - To allow the respondents' perspective to emerge;
  - To allow the extent of a person's knowledge to emerge;
  - When the issue was complex in definition and scope;
  - To look at organizational structure and feedback mechanisms;
  - To explore range and variety of experience;
  - To help in the construction of theory from respondents' own view-points;
  - To allow respondents to introspect on reasons for doing something;
  - To give an insight into experiences;
  - To give people time to think and develop their responses;
  - To gain cognitions, attributions and emotions relating to specific situations;

- To develop criteria for understanding something using respondent categories;
- To explore in-depth attitudes to issues raised in a quantitative study;
- To identify respondents' perceived needs and whether needs catered for;
- As a method of exploring the appeal, strengths and weaknesses of a new concept;
- To understand a process from the point of view of participants.

(f) According to Penzhorn (2002), qualitative research accepts subjectivity as a given, relying on the interpreted nature of reality. Qualitative research follows the premise that human beings are not objects, and therefore strives for subjective understanding rather than manipulation of human behaviour.

Penzhorn suggests that qualitative research methods are most suitable for the study of information needs. This is because they are concerned with discovering the facts of the everyday lives of people, and thereby providing an understanding of the meaning of information in the lives of the people. The examples given included the following of interest to this research:

- The critical-incident method, tied to the decision-making process in a specific situation and defining the criteria used in source selection and system performance;
- The study of information needs as they arise in work settings or as the result of work tasks;
- The study of patterns, in the use of information, based on the value that users apply in the evaluation of information as a dynamic function of intended use;
- The action research approach - users themselves present problems to be solved and are involved in the discovery of potential solutions to these problems.

(g) Jarratt combines the concepts of qualitative and quantitative research, by using the term "generative research" to describe three phases:

- First generating the concepts (for example by literature reviews);
- Then fleshing out the concepts;
- And finally more formalised quantitative research as necessary.

### 3.1.5 The Case Study Approach

(a) The objectives of this research project clearly indicate a qualitative approach, the most relevant method being that of the case study. Specifically, Penzhorn's suggestions that qualitative research methods are most suitable for the study of information needs is surely relevant to e-business considerations, a most closely associated topic. Indeed most of the Vinten's (1994) list justifying qualitative research seems appropriate to the research needs

of this project. It also seems clear that the use of Field or Case Studies is an appropriate method for gathering the data needed in this research, and it is appropriate to examine further the nature and scope of such studies.

- (b) The use of case studies, and their problems and methodologies, are directly related to the issue of quantitative versus qualitative measures. According to Yin (1994), the case study is the preferred strategy in exploratory research, because:
- "How" questions are posed to identify operational links, which have to be traced over time;
  - The investigator has little control over events (unlike in an experiment); and
  - The focus is on a contemporary phenomenon within some real-life context.
- (c) According to Walle (2001) one of the most significant techniques of analysing business strategies is the case study method. According to this technique, the reader views actual events from within the social, cultural, competitive, and/or economic context in which they occurred. The basic premise is that by studying the achievements and failures of the past, it is possible to distil principles of effective response capable of being generalised.
- (d) According to Voss et al (2002), case research has consistently been one of the most powerful research methods in operations management. However, there are several challenges in conducting such research: it is time consuming, it needs skilled interviewers. Also care is needed in drawing conclusions that can be generalised from a limited set of cases, thereby ensuring rigorous research.
- (e) According to Patton and Appelbaum (2003), case studies offer the opportunity for a holistic view of a process, and indeed qualitative methods tend to predominate in case studies. They go on to discuss the criticisms that often come from the quantitative "Let's get it down to something that can be counted!" school. The first major criticism is that a case study is non-representative as a point of observation for a phenomenon. Specifically, case studies are accused of being subjective, lacking rigor and yielding findings that cannot be generalized across settings. The second criticism is the lack of rigor in the collection, construction, and analysis of the empirical materials that give rise to the study (largely related to the problem of bias, introduced by the subjectivity of the researcher and that of the field informants).
- (f) According to Jennings (1997), Case studies may be used to provide illustrations of situations that are thought to be of wide interest. Examples of these include the exposure of

best practice, or the provision of exercises in problem solving. Problem-solving cases provide material for the application of specific techniques and general problem-solving skills.

- (g) Stirling et al (2002), in selecting an action research methodology in preference to a case study approach imply that with case studies it is more difficult to engage deeply with any one situation.
- (h) In terms of generalisation, many state that one cannot generalise from a single case, and therefore that case studies are only useful for creating hypotheses but not for testing them. Patton et al (2003) argue that the possibilities of generalising from very few cases, or even one single case, may be reasonably good providing that:
- One accepts that the role of a "qualitative" researcher is to expand and generalise theories and not to enumerate frequencies (statistical generalisation); and
  - One has a good descriptive or analytic language by means of which one can truly grasp the interaction between various parts of a system and the important parts of a system.
- The key is to build a proper case with analytic sophistication rather than creating something that can be easily replicated time and time again.
- (i) In terms of the lack of rigor criticism due to the lack of standard methodological procedures, it is argued that the lack of pre-determined steps makes case studies harder and more demanding; and that this should be regarded as a strength. Case studies utilise a plethora of data collection methods including observation, interviews, histories and quantitative measures. Finally a "Case Study Roadmap": is proposed consisting of the following five steps:
- Determine the Object of Study;
  - Select a pertinent case that will allow the subject to be investigated fully;
  - Build initial theory through a literature review;
  - Collect and organise the data gathering;
  - Analyse the data and reach conclusions.
- (j) According to Gummesson (2003), in case study research one or several cases are used to arrive at specific or general conclusions about certain phenomena, recognising the multitude of variables, complex interrelations and ambiguities of business life. A case study could be primarily inductive where the cases provide data for conceptualisation and theory generation, or primarily deductive where cases are used to confront existing theory with reality and tests validity. The sample is theoretical and purposeful: find the cases that give a



maximum of information and stop when the new information of additional cases approaches zero.

- (k) Amaratunga and Baldry (2001) similarly expose the criticism of the case study method in that it suffers from a lack of rigour and an excess of bias. The dangers of *ad hoc* theorising and of neglecting to test data are great. The use of "subjective" judgements during the data collection stages can render constructs invalid.

They discuss triangulation as the combination of qualitative and quantitative methods in the study of the same phenomenon. The need for triangulation arises from the ethical need to confirm the validity of the process or processes. In case studies, triangulation can be achieved using multiple sources of data. The fundamental notion of the triangulation technique is that qualitative and quantitative methods should be viewed as complementary rather than as rival camps.

- (l) Van der Vorst et al (2002), solve the potential problem areas in their case study by adhering to three principles of data collection:
- Use of multiple sources of data collection (i.e. triangulation);
  - Creation of a case study database (with narratives, notes and computerised files) so that all information can be retrieved later;
  - Maintenance of a chain of evidence, such that an external observer could follow the derivation of any evidence from initial research questions to ultimate case study conclusions.

- (m) Näslund (2002) describes three different forms of case study. Firstly, in "Normal" case studies, the clear objective is the conduct of research, in other words to discover something or to test a hypothesis while including relevant real-world information into the research. In the second form, "Application Descriptions", practitioners typically report success stories of their experience implementing a particular application for a given assignment. Thus, the author's objective is not to conduct a research study and consequently, this cannot be described as case study research. Finally, in "Action Research" the process of change becomes the main subject of research. The researcher is a participant in the change process, but simultaneously she/he wants to evaluate for example a certain intervention technique. Action research aims to contribute both to the practical concerns of organizations in a problematic situation.

- (n) McKinnon (1988) deals with issues of validity and reliability in field research. Validity is concerned with the question of whether the researcher is studying what he/she purports to be studying. Reliability is concerned with the question of whether the researcher is obtaining data that can be relied upon, independent of the accidental circumstances under which it is gathered. He examines the nature of, and threats to, validity and reliability in field studies and documents some strategies and tactics that may be employed to counter those threats: He identifies four threats to validity:
- Effects caused by the observer's presence;
  - Observer bias causing selective perception and interpretation;
  - Limitations in the access to sufficient data, or time and access constraints;
  - Subject Limitations, including deception, unconscious bias, forgetfulness.
- Among strategies to overcome these threats, he recommends more time spent immersed in the research setting and multiple methods and observations.

### **3.1.6 Examples of Relevant Case Study approaches**

- (a) Amaratunga and Baldry (2001) outline an example of a case study based research strategy for a facilities management performance case study, a study that consisted of the following research phases:
- Literature review, producing the research objectives: a priori constructions and relationships;
  - Pilot study confirming the feasibility of the research objectives and producing the case study strategy;
  - Case studies, involving in-depth study and causal explanations of performance measurement in FM organisations;
  - A phase one analysis, producing the initial qualitative findings and the performance measurement tools which form the postal survey questionnaire;
  - A questionnaire survey providing quantitative support for qualitative data;
  - A phase two analysis, the in-depth analysis of qualitative and quantitative research and theory building and verification.
- (b) Lubbe and Remenyi (1999), illustrate a case study based methodology in the related area of investigating the performance of IT investments in organisations, with the following aims:
- To evaluate the approach by organisations to IT investment and IT benefit identification;
  - To develop a preliminary thesis of good practice in the field;
  - To test this thesis by reference to other enterprises and practitioners; and
  - Thereby develop the thesis into managerial guidelines.

In this illustration, the methodology of the research project consisted of two phases:

- The production of case studies - numbering a total of 20 from 11 industry sectors, allowing IT investment to be examined in a holistic manner within a real life situation;
- A focus group, to test the theories deduced from the case study work, obtaining access to a number of experts and widening the range of views (also providing additional triangulation).

(c) Auramo et al (2002) described a study that represented essentially the collection, analysis and verification of the expression of opinions of experts. It attempted to prioritise what should be the major research and development areas in e-business logistics based on a methodology that essentially consisted on interviews with a number of the said experts. The study consisted of five stages:

- The creation of the preliminary e-Logistics vision based on a literature study;
- Interview sessions, with 65 people, from some 50 organisations (representing industry, logistics service companies, consultants and IT companies, universities and research centres) with the objective of determining their opinions on the key research and development topics in the field of e-business logistics;
- Analysis of interview results;
- Further evaluation and refinement of the results by workshop panels drawn from these experts;
- Final formulation of the research and development agenda to guide future research work in the field of e-business logistics.

(d) Stirling et al (2002) describe a methodology for the structured development of manufacturing information systems based on a collaborative action research project. Essentially the project involved producing a structured approach to the problem of meeting systems requirements within manufacturing organisations (for example should core systems be replaced, modified or augmented). Once the methodology had been developed, it needed to be validated and this was achieved through a series of structured interviews with systems development professionals. These people were selected from manufacturing industry and ERP package vendors. The issues addressed included:

- The utility of a system development methodology for manufacturing, planning and control systems;
- The applicability of the proposed methodology;
- The utility of the supporting questions.

The conclusions from the study were that the methodology described represents a focused and pragmatic tool that will be useful to practitioners, particularly those with limited systems development experience.

- (e) Although the above case study approaches describe work in a similar domain to that of this research, it seems difficult to find examples of research that the generation of system requirements at a sufficient level of detail to be useful for real organisations. One example of a technique that has been proved good enough is the work of Howard et al (1998).

This research demonstrated that it was possible to predict the detailed functional requirements of a manufacturing system for an industrial enterprise, based as far as possible on objective factual characteristics (such as volume parameters and the nature of the product). It was demonstrated that by processing such characteristics through a reference model, one could produce a functional specification at a level sufficiently useful to become the basis of an invitation to tender for potential software suppliers. Moreover in one case it was demonstrated that the specification produced was more complete than that produced by a project team using the more traditional method of requirements specification (such as asking all interested parties what were their needs).

### 3.1.7 Action Research

- (a) Since Näslund (2002) gives us the choice between "Normal" Case Studies and "Action Research", the issue arises of whether this research should be categorised as an action research process (This issue also arose in a paper produced as a by-product of this research). It is therefore appropriate to consider the issue of "Action Research" in more detail.
- (b) It is a fact that there are case study reports into Action Research limitations in situations that seem to have some superficial similarities to this research. For example Stirling et al (2002), in research into the ERP systems development process of the collaborating company in question, recognise the limitations of the Action Research approach:
- Retention of the objectivity of researchers;
  - Problems in generalising any conclusions.

However, they consider that these limitations are more than outweighed by:

- The opportunity for researchers to gain a deep understanding of the environment with which they are concerned; and

- (Because it was hoped to develop a practical tool that could be used by practitioners in industry), the opportunity to gain a detailed understanding of ERP systems and their associated problems.
- (c) There are some interpretations of Action Research that are drawn very widely. For example, for Mumford (2001), Action Research (AR) is a vague concept but it has been defined as research that involves practical problem solving which has theoretical relevance. It usually involves not only gaining an understanding of the problem and generating ideas for improvement but also the practical application of these ideas in the real world situation.
- (d) Kotnour (2001) described the use of an Action Research based methodology to ensure that a theoretically sound, valid framework is developed that reflects the organisation's specific situation. He concluded that Action Research is a viable research strategy to produce useful knowledge for both the organization and the researcher. However he warned that the researcher must have an established understanding of the research process, knowledge of the domain and the ability to exercise some level of control of the research process. From this the researchers can have confidence in their abilities to make the Action Research approach successful.
- (e) Coughlan and Coughlan (2002) admit that the concept of Action Research is a generic term that covers many forms of action-oriented research, and indicates diversity in theory and practice. It thus provides a wide choice as to what might be appropriate for their research question. The characteristics of such research are that it is:
- Research in action;
  - Participative;
  - Concurrent with action;
  - An iterative approach to problem solving.
- (f) On the other hand, other literature seems to reserve the term Action Research for situations when researchers are far more embedded in the processes and events that they are studying. In this view, Action Research (for example Gummesson, 2003; Näslund, 2002) is reserved for situations when researchers assume the role of change agents of the processes and events they are simultaneously studying.

Altricher et al (2002) suggest that an approach is Action Research only when it is collaborative and achieved through the critically examined action of individual group members.

For Westbrook (1995), Action Research can be seen as a variant of case research, but whereas a case researcher is an independent observer, an action researcher is a participant in the implementation of a system, but simultaneously wants to evaluate a certain intervention technique. The Action Researcher is not an independent observer, but becomes a participant, and the process of change becomes the subject of research. The intervention technique is adapted as it is used, and the understanding of its scope and limitations develop with each application.

O'Leary et al (2004) summarises the Action Research concept as being essentially concerned with a group of people who work together to improve their work processes.

- (g) Chiasson and Dexter (2001) describe an example of such a concept in a case study that was an Information System Prototype project involving an outpatient clinic and the redesign of its information systems. The principles of action research are reported as including:
- A focus on the knowledge of action and outcomes from action;
  - Studying a phenomenon in its natural setting to uncover its complexity and richness;
  - Interpreting and/or sometimes critiquing individual and organizational patterns of practice;
  - Valuing researcher, developer, and user experience in creating knowledge;
  - Employing the "process view" of research, which requires sustained and detailed data collection over a long period of time.
- (h) Daniel and Wilson (2004) describes a collaborative workshop approach to generating a model for e-commerce prioritisation, where the action researcher brings theoretical knowledge as well as a breadth of experience; the clients bring practical knowledge and experience; and the two then collaborate in order to co-produce solutions.

Gilmore and Smith (1996) describe a set up reduction study that amounted to a team focused on solving a particular problem by brainstorming the issue, coming up with ideas, proposing and implementing solutions and evaluating the results.

### **3.1.8 Conclusions and Implications**

- (a) As already indicated, the objectives of this research clearly indicate a qualitative approach, the most relevant method being that of the case study. In case study research that involves creating models that help describe and predict behaviour, the testing and refinement of the model is the crucial stage (Stirling et al). It therefore is reasonable to agree with Jennings,

that it behoves any researcher to attempt an initial reference model at the earliest possible stage in the research process.

- (b) Following Van der Vorst et al (2002), an attempt should be made to ensure a reduction of bias by:
- Adopting the principles of triangulation (Amaratunga et al) in so far as it describes the use of multiple sources of evidence and/or multiple sources of data in a given study;
  - Ensuring that all changes to the model were recorded together with the reasons for the change – it was possible therefore to analyse the stability of the model during the case study process;
  - Maintaining a chain of evidence by storing the status of the model versions before and after the case studies thus allowing the evolution of the model to be demonstrated.
- (c) From the examples of relevant Case Study approaches, there were a number of pointers of relevance here including the use of structured interviews and the use of questionnaires. In fact the inputs to the model itself should take the form of a structured questionnaire that thereby makes possible a structured interview

In qualitative research aimed at understanding a process the importance of avoiding putting words into the mouths of participants was emphasised (for example Morrison, 1999). Selection from pre-defined responses or categories is less desirable. The use of open questions was indicated together with *post hoc* analysis and categorisation by grouping together similarities in the freeform responses of the participant responses.

The importance of the fact that research should always be supported by genuine subject knowledge on the part of the researcher is emphasised (for example Kotnour, 2001; Stirling et al, 2002),

- (d) On the subject of Action Research, it appears that there are some definitions of action research that are drawn so widely that any research would qualify if, as in this current research, it involves practical problem solving that has theoretical relevance (for example Chiasson and Dexter, 2001; Mumford, 2001). It seems, however, that the weight of literature (for example Altricher et al, 2002; Gilmore et al, 1996; Gummesson, 2003; Näslund, 2002; O'Leary et al, 2004; Westbrook, 1995) reserves the term "action research" for situations when researchers assume the role of change agents of the processes and events they are simultaneously studying. This does not apply to this research.

It is concluded therefore that the boundary between a case study approach and an Action Research approach is therefore somewhat arbitrary and perhaps irrelevant for the purpose of this research.

- (e) After weighing the above considerations it seemed appropriate to adopt, for the e-business model in this research, a structure with similarities to the work of Howard et al (1998). Some development of the method was additionally necessary to reflect the fact that the functional requirements of the e-business domain are less well defined and have not as yet been long established.

### 3.2 Description of This Research

#### 3.2.1 The e-business model

- (a) The objective reference model structure adopted for this research starts with the definition of the e-business functions. Reasons why such functions may be appropriate or inappropriate are postulated. Company characteristics and management concerns that cause such reasons to be activated or not are identified. These are put together into an objective reference model with a structure illustrated in Figure 3.3.

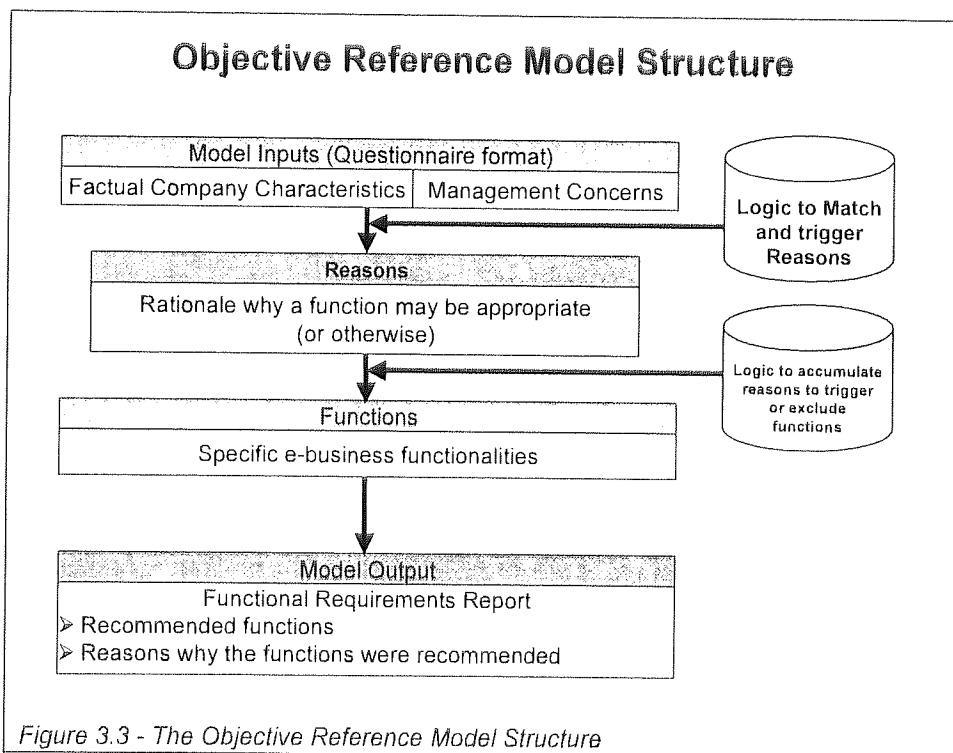


Figure 3.3 - The Objective Reference Model Structure

- (b) The value of the model lies in its ability to predict from the inputs, what is likely to be significant and what is not. It should be emphasised at the outset that there is no pretence that a perfect functional specification of requirements can ever be produced automatically



from a model. It is to be expected that the results would be subject to critical review based on local circumstances. This is intended therefore to be an (hopefully constructive) input to a process rather than a complete tool.

In principle, company characteristics are intended to be as objective and factual as possible (such as number of items despatched per year). For example there is no point in asking the interviewee whether he/she feels that a particular function is necessary for the business, and then producing a report saying that this function is a necessity for the business. This is obvious and of no use (not even to consultants!). The aim is to produce a model that can predict that the function is worth thinking about even if the customer has not thought of it.

- (c) By contrast, the concept of management concerns may at first sight seem anomalous in a model purporting to be objective. The importance of the concerns is that they address the issue of how internal attitudes or customer/supplier behaviour can make or break the relevance of certain functionalities irrespective of the objective relevance or otherwise of these said functions. This seemed to be of particular importance in an area of interest which the above literature review demonstrated to be still of questionable value and technologically immature. Concerns could conceptually be thought of as being either a reason for doing something (for example excessive current clerical activity ought to be a motivation for automating a clerical task), or a reason for lack of confidence in the success of an initiative (for example suppliers are not sufficiently technologically competent).

Specifically the e-business domain deals with functionalities that not only are under the control of external organisations (for example customers and suppliers) but functionalities that are only of any meaning when such organisations are working collaboratively. It would seem therefore that management concerns should take a larger role in such situations than would be the case in the case of systems in more controlled environments.

### **3.2.2 Development of the Research Structure to achieve this model**

- (a) The research method adopted consists broadly of the following three stages:
- A review of the material available in order to obtain the widest possible appreciation of the topic (including academic literature, current expertise, current activity and products available in the marketplace);
  - The development of a model based on these inputs;
  - The testing and stepwise refining of the model using a selection of case studies leading to the production of an acceptable model;

(b) Support for this type of reference-based approach is common, for example Bititci (1995), and Jennings (1997), in areas related to the domain of e-business. Jennings in particular recommends the construction of a systems model as soon as there is sufficient information (possibly during the prior research, certainly after the first visit) with the model being further developed iteratively throughout the case research process. Howard et al (1998) also provides support for this approach, although in this case the work was in the manufacturing domain, where functional requirements are well defined and long established.

In respect of this specific research, the e-business domain is less established as a concept and its detail functionalities similarly less worked through. The implication of this is that it is necessary to have a good variety of inputs (Amaratunga et al, 2001; Van der Vorst et al, 2002) to the process of deciding the relevant e-business functionalities that must provide the basis for and the outputs from the model.

The schematic diagram in Figure 3.4 outlines the research method adopted. Illustrated are the four inputs to the model, the areas of the model where these inputs had the major impact, and the subsequent testing and refining of the model.

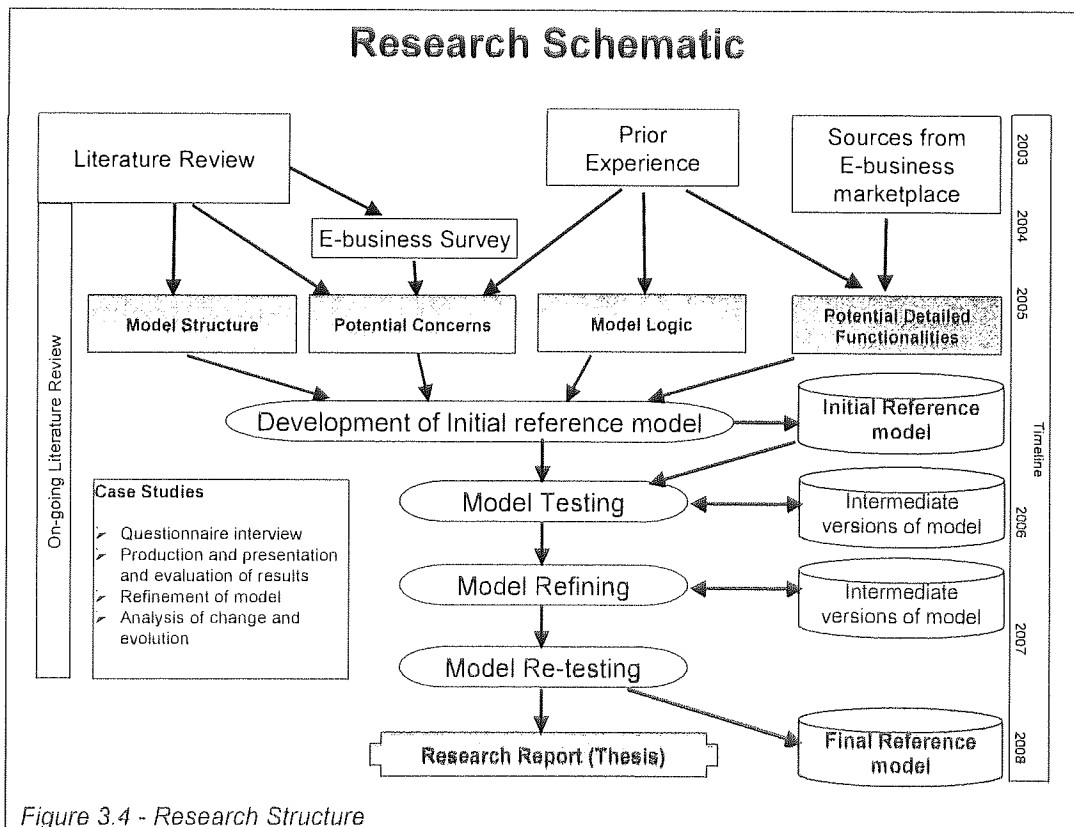


Figure 3.4 - Research Structure

Detailed descriptions of each step in this process follow.

### 3.2.3 Inputs to the Model

#### (a) *Literature Review*

Firstly it was necessary to set the research in an academic context, this representing the only resource that should be independent of the interests of the solution providers. The starting point was to attempt to arrive a considered current state of the art in e-business, based mostly on refereed academic literature. It was also relevant to review material from organisations representing the business community that attempt to encourage those interested in moving forward with e-business (for example The CBI, the UK council for Electronic Business). In addition to confirming the nature and scope of e-business, the literature review also provided input for the structure of the initial version of the reference model, and the structure of the e-business survey. The conclusions from the literature review are presented in chapter 2.

#### (b) *Sources from the e-business marketplace*

In looking for assistance in creating the detail contents of the initial reference model, (and especially for such a marketing driven domain), it was considered that the primary input to the model should be the functions that e-business solution vendors market under the e-business label. Such material included:

- The e-business functional specifications provided by the top two major ERP vendors (SAP and the Oracle Corporation), probably more focused on selling to the larger organisation;
- An example of an e-business product for the small to medium organisation;
- An example of an e-business exchange vendor developers interested in marketing their products, viz. Covisint;
- A well-known standards organisation active in the e-business (The Organisation for Date Exchange and Tele Transmission in Europe).

A commentary on this material is included in chapter 5, as the primary source for the development of the detailed e-business model.

#### (c) *Prior Experience*

Some of the genuine subject knowledge to be exploited (for example Kotnour, 2001; Stirling *et al*, 2002) resides with the researcher, who has worked in the e-business field and related fields for some 20 years. This prior experience was used to suggest possible concerns and to direct attention to the most likely sources of good information from e-business solution vendors, and in suggesting rationales to link these e-business functions to possible characteristics.

(d) **Survey of e-business activity**

As a fourth source of input, a survey was undertaken of the detail e-business activity that is actually occurring in real life in organisations relevant to this research. An e-business questionnaire was designed to capture four basic types of information:

- The e-business activity currently being undertaken or envisaged;
- Levels of satisfaction with what is being done (or not done);
- Concerns that may be inhibiting e-business;
- Benefits that have been achieved with e-business.

The survey questionnaire was sent to a mailing list containing every manufacturing company of any size in the UK West Midlands, and the responses were analysed. The survey is described in detail in Chapter 4. Based on the results of this survey, a paper was published in the "Manufacturing Engineer" magazine (Dilworth and Kochhar, 2004). The survey provided inputs primarily to initial identification of the possible management concerns.

### **3.2.4 Development of E-business functional model**

From the source primarily of the e-business marketplace material, it was possible to construct a comprehensive identification of the detailed functionalities covered by the general "e-business" label. 254 such functions were initially identified and these were structured into 3 levels within 15 functional domains. A number of explicit reasons were proposed that could link these e-business functions to possible characteristics, thus allowing a preliminary list of characteristics to be produced. Possible management concerns influencing these functions were created from the literature review, prior experience and the conclusions of the survey. These were distilled into a preliminary list of concerns. Together these functions, reasons, characteristics and concerns were combined into a model containing the rules that linked them all together.

It was recognised at an early stage that using the model with or without concerns could produce interesting results. Without concerns would theoretically provide a totally objective analysis. Including concerns would bring in more subjective factors. By analysing the difference between the two, the potential was recognised for achieving extra insights, for example:

- What are the real needs of the organisation as opposed to what can be reasonably expected to give benefits assuming current attitudes;
- Which areas of e-business are most adversely affected by current attitudes and concerns;

- How difficult might be the implementation of e-business functions.

### 3.2.5 Technical implementation of the model

The model relating the functional requirements, reasons, characteristics and concerns was implemented using Microsoft Excel and "visual basic" macros. A basic facility was thereby created whereby a researcher can automate the input of characteristics and concerns, the running of the model and the creation of a resulting Microsoft "word" report. This means that the processing of a case study can be achieved in minutes rather than hours or days.

### 3.2.6 The Testing and Refinement of the model

- (a) The testing, refinement of the model of the model was undertaken by means of recursive case studies. This process consisted of three phases:
- **Phase one – Testing.** An initial test of the model to test and debug the basic concept and process was first undertaken with a manufacturing organisation active in e-business.
  - **Phase two – Refining.** This process was oriented towards getting the model right. This was done by a process of running the model for a case study instance, comparing the predictions with those that are "considered" reasonable by an appropriate person in the organisation concerned; "post hoc" rationalisation of the reasons for discrepancy; and correction and/or further development of the model as required.
  - **Phase three – Re-testing.** This was focused on confirming that the model after refining was good enough to predict the functional requirements of new situations not previously involved in its development. Again the technique was one of relying on the judgement of an appropriate person in the organisation concerned as to whether the prediction is reasonable.
- (b) The process is described in detail in chapter 6. In all three of these phases the process was fundamentally the same. Each individual case study was conducted along the following structured lines:
- The case study contact was interviewed and the input questionnaire completed;
  - The model was processed and an e-business functional report produced containing the predictions of the model;
  - The functional report was then worked through with the original interviewee. "Post hoc" rationalisation of the reasons for discrepancy was then undertaken and areas of disagreement were exposed and analysed;
  - Based on this feedback, the model was corrected and/or further developed as required.

- (c) A technique was developed to analyse all changes made to the model as a result of each case study and to monitor the evolution, and (hopefully) the improving stability and accuracy, of the model as the research progressed. The results of this analysis and monitoring are described in section 6.5.

### **3.2.7 Conclusions and Evaluation of the Research Design**

- (a) In terms of the four different types of research identified by Cooper and Schindler, there are elements of all four in the research that is attempted here:
- Reporting - there is certainly an attempt to collect data;
  - Descriptive - because an attempt is made to relate the data collected to the characteristics of the organisation;
  - Explanatory - because an attempt is made to explain why the characteristics relate to the requirements experienced by an organisation;
  - Predictive - because the outcome from the research is an attempt to use the model, developed as part of this research, to predict the e-business requirements of an organisation based on its characteristics.

The design strategy issues described by Cooper and Schindler are detailed in figure 3.5 and commented on in the context of this research.

Category	Options	Strategy Chosen
Degree to which the research question has been crystallised	<ul style="list-style-type: none"> <li>• Exploratory Study</li> <li>• Formal Study</li> </ul>	<p>There are elements of both types.</p> <ul style="list-style-type: none"> <li>• The exploratory activities included the literature reviews and a survey that was aimed at a cross section of West Midland manufacturing industry. This was considered desirable in view of the fact that the e-business domain is less established as a concept and its detail functionalities similarly less worked through</li> <li>• The formal study started from the formulation of the research question and the determination of the procedures and data requirements have been decided.</li> </ul>
Method of data collection	<ul style="list-style-type: none"> <li>• Monitoring</li> <li>• Interrogation/ communication</li> </ul>	The interrogation method is applicable, based on a structured questionnaire. The data collected is both factual (consisting of information expressed verbally by the interviewee) and subjective (based on the interviewee's judgement as to the existence or non-existence of concerns)
Power of the researcher to produce effects in the variables under study	<ul style="list-style-type: none"> <li>• Experimental</li> <li>• Ex post facto</li> </ul>	The design is ex-post facto because what is happening or has happened is observed. A certain degree of simulation is possible because the model allowed hypothetical testing, for example what would the model say if this concern was / was not present. The only way that the results could be tested however the test of "do the results seem reasonable".
Purpose of the study	<ul style="list-style-type: none"> <li>• Descriptive</li> <li>• Causal</li> </ul>	There are descriptive elements in this study because the rules are based on the observation that certain types of company with different characteristics have certain requirements. It is causal in the sense that an attempt is made to explain why the requirements are caused by the characteristics. It is only accepted that a characteristic leads to a requirement if the rules that link the two can be rationalised. It is a prime objective to be able to predict that this characteristic leads to this requirement for a given new situation.
Time dimension	<ul style="list-style-type: none"> <li>• Cross sectional</li> <li>• Longitudinal</li> </ul>	This research is primarily of cross-sectional characteristics in that it is observing the state of the art of e-business at a particular time measured to within a year or two in the early decade of the 21 <sup>st</sup> century. It was possible to do some limited exploration of the development of one studied case over a period of time.
Topical scope - breadth and depth of the study	<ul style="list-style-type: none"> <li>• Case Statistical</li> <li>• Survey</li> </ul>	The research is foreseen to be case study based, because it will rely on the in-depth study of a relatively small number of organisational conditions. If there are opportunities for the statistical treatment of certain issues, these will be exploited
Research environment	<ul style="list-style-type: none"> <li>• Field setting</li> <li>• Laboratory research</li> <li>• Simulation</li> </ul>	This research is primarily carried out in field conditions because it deals with real life organisations with real life requirements.
Participants' perception of research activity	<ul style="list-style-type: none"> <li>• Actual Routine</li> <li>• Modified Routine</li> </ul>	This is not a disguised study. The participants are aware of what is going on. There are dangers that participants may influence results consciously or unconsciously by wishing to conform to fashion or being excessively cynical. An attempt is made to minimise this by insisting on a rationale for the results (X cannot be accepted as leading to Y unless the link can be justified)

Figure 3.5 - Design strategies adopted by this research

(b) Since this research is based on a case study approach, it is appropriate also to evaluate the suitability of the research design according to the criteria established by Yin (1994). According to Yin (1994), the quality of a research project and its case study design can be tested in four areas. Figure 3.6 presents the results of such an evaluation indicating the suitability of this research design.

Criteria	Definition	Main research tactics used
Construct validity	Establishing correct operational measures for the concepts being studied	The use of triangulation principles using multiple sources of evidence: <ul style="list-style-type: none"> <li>• Literature</li> <li>• E-business marketplace material</li> <li>• A survey of current and planned e-business activity</li> </ul> To ensure that a good preliminary definition of e-business scope for manufacturing companies.
Internal validity	Establishing causal relationships between research variables (certain conditions are shown to lead to other conditions)	The construction of an e-business characteristic/reason/function model creates the basic cause-effect links.  From a set of input characteristics a set of e-business functions (i.e. answers) are generated. These are associated with a rationale that justifies the answers given by the model.
External validity	Establishing the domain to which a study's findings can be generalised	Demonstrated by repeated case studies, where the results are discussed with the key participant. Taken overall, over a number of case studies, the justification of the model is based on the results being judged "reasonable" by a group representing a cross-section of knowledgeable persons capable of assessing the likely e-business requirements of their organisation.
Reliability	Demonstrating that the operations of a given case can be repeated with the same results	A standard questionnaire is used each case study and the model generates the same results automatically on each occasion from the same inputs

Figure 3.6 - Evaluation of research design

(c) The main objective of this research is to provide a method whereby organisations interested in the e-business concept can understand their requirements with relatively little time and effort. Although there are "softer" inputs to a requirements definition process (for example special circumstances, politics), the objective in this research was to create a model good enough to be a useful animator and guide for such a process. The conclusion of this review of the design of this research is that the case study methodology so described was an acceptable way to go forward as a way of achieving the research objectives. The process was the subject of a paper published in the Journal of Manufacturing Technology Management (Dilworth and Kochhar, 2007).



## **4 Survey of e-business activity**

### **4.1 Introduction**

As indicated in the research methodology (Chapter 3), a survey was conducted in order to provide more indications of what detailed e-business activity is actually occurring in types of organisations relevant to our research. An e-business questionnaire was designed to capture four basic types of information:

- What e-business activity is currently being undertaken or envisaged;
- Levels of satisfaction with what is being done (or not done);
- Concerns that may be inhibiting e-business;
- Benefits that have been achieved with e-business.

### **4.2 Design of the Survey**

#### **4.2.1 Sources for the e-business questionnaire**

(a) A preliminary structure was developed that enabled the construction of an e-business questionnaire at a useful level of detail. From the earlier literature review it was clear that such a questionnaire of necessity emphasised issues commonly thought of belonging to the supply chain and ERP domain. Firstly it was recognised that supply chains are typically modelled at three levels (Graham and Hardaker, 2000):

- Strategic;
- Tactical; and
- Operational.

(b) The notion was adopted that a fully functional ERP system can be defined as performing eight major types of business function (Rondeau and Litteral, 2001):

- Engineering, part and BOM control;
- Engineering change and documentation control;
- Purchasing;
- Materials management;
- Manufacturing planning and control;
- Cost management and control;
- Finance;
- Marketing and sales systems.

(c) The concept was adopted that an integrated supply chain is commonly (for example McCormack and Kasper, 2002) described at three levels:

- Level one is information sharing, the foundation of SC integration;

- Level two is coordination; and
- Level three are organizational linkages.

#### **4.2.2 Development of the e-business questionnaire**

- (a) From the above structure as a starting point, two further distinctions were introduced:
- To differentiate between unstructured information sharing (for example these are our plans) from defined business transactions that perform universally understood functions (for example deliver this part at this time);
  - The distinction between the use of the Internet and that of EDI as defined earlier (for convenience referred to as "traditional EDI").
- (b) Major functions were structured according to different types of information "linkage", as follows:
- Information functions, typified by the simple use of the Internet (e-mails, web sites);
  - Traditional EDI transactional functions, with both suppliers and customers, using EDI for the transmission of formal business transactions;
  - Internet-based transactional functions, with both suppliers and customers, using the internet for the transmission of formal business transactions;
  - Co-ordination functions, again involving both suppliers and customers, typified by participation in collaborative industry exchanges.
- (c) Within each of these major functions, the relevant inter-organisational business processes were specified, selected according to context from:
- Pre-product / product development;
  - Demand management;
  - Planning;
  - Procurement;
  - Inbound logistics;
  - Outbound logistics;
  - Finance.

#### **4.2.3 The e-business survey target population**

The survey questionnaire (see appendix F) was sent to a mailing list of 1500 organisations believed to be a fair cross section of manufacturing companies in the UK West Midlands. It was addressed to the chief executive of the organisations in the belief that it would then gravitate to the most appropriate level. 51 valid responses were obtained. From the smaller organisations the responders tended to be from the chief executive/main board level; from

the larger organisations from senior IT management level. Information to indicate the size and type of organisation (for example turnover, number of employees, number of customers and suppliers, number of sold and purchased items) was also captured.

#### **4.2.4 The Data Captured**

##### **(a) Current and Planned Activity**

Responders to the survey were asked to indicate what they were currently doing, and what they anticipated doing within the next 2 years. Looking in both the customer and supplier direction, our e-business functions were structured as follows:

- Information functions, typified by the simple use of the Internet (e-mails, web sites);
- Transactional functions, typified by the transmission of formal business transactions;
- Co-ordination functions, typified by participation in collaborative industry exchanges.

Against each of the business processes within each of the major functions, responders were asked simply to indicate:

- Whether the business process was currently being undertaken;
- Whether plan existed to undertake this process within the next two years.

##### **(b) Satisfaction**

Against each of the business processes within each of the major functions, responders were asked for their current level of satisfaction with what they are currently doing (or not doing). They were asked to choose between:

- Low satisfaction;
- Moderate satisfaction; and
- High Satisfaction.

##### **(c) Benefits and concerns**

Responders to the survey were asked two questions relating to their experience of e-business to date:

- If appropriate, could you identify up to three main concerns that you feel may inhibit e-business in your organisation?
- What would you say are the three most important benefits that you have achieved with e-business?

It should be emphasised that these were open questions; there was no attempt to encourage participants to select from pre-defined problem or benefit categories or to put words into their mouths. The freeform responses of the participants were analysed and categorised by grouping together similar problems or comments. For a similar approach see Morrison (1999).

#### 4.2.5 Limitations

As in all surveys, the responders are to some extent self-selecting. It can only be presumed that those who responded were likely to be more interested than those who did not.

Surveys also presume that the responders understand the questions. An attempt was made to avoid the use of as much contentious jargon as possible (for example "ERP", "CRM"), but could not avoid relying on an understanding of the meaning of EDI. An attempt was made to help by specifically differentiating traditional EDI from Web EDI.

In respect of the satisfaction index, responders were asked to choose between only three levels of satisfaction (low, moderate or high). This was for simplicity to avoid having to ask responders to pretend to be able to discern between too many gradations of satisfaction. By doing this there is a danger of potential 'rounding' of views.

In respect of the aspects of the questionnaire involving benefits and concerns, It should be emphasised that the proportion of organisations claiming benefits and expressing concerns is not the proportion of organisations that have experienced this benefit, but the proportion that actually put this benefit in their "top three"! Furthermore, as mentioned earlier, the benefit and concerns questions were open. There was no attempt to encourage participants to select from pre-defined problem or benefit categories or to put words into their mouths. Therefore it would be incorrect to presume that just because a concern or benefit was not mentioned, it does not exist. It is however reasonable to infer that perhaps a benefit or concern not mentioned is one not uppermost in the mind!

### 4.3 Analysis of Survey Results

#### 4.3.1 Data Analysis Issues

Responding companies were classified into 2 categories based on the classical "number of employees" based definition of Small/Medium Enterprises (SME):

- Small/Medium            Less than 250 employees (32 responders);
- Large                      More than 250 employees (19 responders).

Before presenting these results a comment on the data analysis is probably in order. According to Cooper and Schindler (2003, Chapter 16), exploratory data analysis is the search for clues and evidence; while confirmatory analysis is pre-occupied with assessing the strength and significance of what is found. The purpose of this survey was to provide more indications of what detailed e-business activity is actually occurring in types of

organisations relevant to our research. This implies an approach exploratory in nature rather than one designed to confirm a hypothesis.

Furthermore, the sample size was deemed too small to be for formal significance testing to be consistently applied throughout the results. The Chi-square test (which would seem most appropriate for such analysis) should not be used if more than 20% of the expected frequencies are less than 5 or when any expected frequency is less than one (Cooper and Schindler, 2003, Chapter 17). The classification of responders was in some cases too marginal to meet these requirements, the number of responders showing activity in some situations (0, 1, 2 or 3 responders were actually placed in some categories) being deemed insufficient. Although combining adjacent categories could potentially have created the necessary frequencies, it would have done so at the expense of reducing further the usefulness of the analysis.

The combination of small sample size and the exploratory nature of the objectives of the survey led the researcher to reject the inclusion of significance testing in the presentation of these results.

The results of the survey are described below. As indicated above, since the survey's purpose of the survey was primarily to explore the subject not to produce causal inferences, the results should be treated as indicative in nature rather than confirmatory. For example, although comments are made on certain differences between small and large companies, these should be treated as interesting indications rather than statistically significant conclusions.

#### **4.3.2 Current and Planned Activity**

- (a) The responses to the survey on the e-commerce activities that participating organisations were currently undertaking or expecting to undertake within two years were summarised and converted into a percentage (of the number of responders undertaking the given activity) and simplified to a proportional score out of ten. Figure 4.1a below shows the proportional score by detailed business process both now and in 2 years time.

Major Function	Business Process	Now		In 2 years	
		SME	Large	SME	Large
Simple use of Internet	Access customer web sites to access or provide information	9	9	10	9
	Access supplier web sites to access or provide information	8	8	9	8
	Provide information for access on your own web site	7	9	10	9
	Receive or send e-mail notifications from/to customers	9	9	10	9
	Receive or send e-mail notifications from/to suppliers	9	9	10	9
Transmission of data with customers using traditional EDI	Pre-production / product development	3	3	4	3
	Receiving Customer Demand	5	5	7	6
	Planning	3	4	4	5
	Logistics and transportation (e.g. shipping notifications)	3	5	5	6
	Accounting	4	5	6	6
Transmission of data with customers using the Internet	Pre-production / product development	4	3	6	5
	Receiving Customer Demand	6	6	8	8
	Planning	3	5	5	6
	Logistics and transportation (e.g. shipping notifications)	4	5	7	7
	Accounting	3	4	6	6
Transmission of data with suppliers using traditional EDI	Pre-production / product development	2	3	3	4
	Planning	2	4	3	5
	Logistics and transportation (e.g. shipping notifications)	2	3	3	4
	Procurement	1	5	2	6
	Accounting	2	3	3	5
Transmission of data with suppliers using the Internet	Pre-production / product development	4	2	6	5
	Planning	4	4	6	7
	Logistics and transportation (e.g. shipping notifications)	3	3	5	6
	Procurement	5	4	7	7
	Accounting	3	3	5	5
Participation in collaborative industry exchanges	Pre-production / product development	2	2	3	3
	Supply Chain Planning	1	2	3	4
	Logistics and transportation	1	2	2	3
	Procurement	1	3	2	5

Figure 4.1a- Current and planned activity in participating organisations

(b) In view of the small number of responders it seemed more appropriate to draw conclusions from the information at a more summarised level and so these detailed figures were summarised in two ways:

- By major function;
- By business process.

Figure 4.1b provides the summary by major function and figure 4.1c business process.

Major Function	Now		In 2 years	
	SME	Large	SME	Large
Simple use of Internet	9	9	10	9
Transmission of data with customers using traditional EDI	4	4	5	5
Transmission of data with customers using the Internet	4	5	6	6
Transmission of data with suppliers using traditional EDI	2	3	2	5
Transmission of data with suppliers using the Internet	4	3	6	6
Participation in collaborative industry exchanges	1	2	2	4

Figure 4.1b- Current and planned activity in participating organisations – Function Summary

Business Process	Now		In 2 years	
	SME	Large	SME	Large
Pre-production / product development	3	3	4	4
Receiving Customer Demand	6	5	7	7
Supply Chain Planning	3	4	4	5
Logistics and transportation (e.g. shipping notifications)	3	3	4	5
Procurement	2	4	4	6
Accounting	3	4	5	6

Figure 4.1c- Current and planned activity in participating organisations – Process Summary

- (c) These results suggest that organisations are more concerned with the use of e-business functions in the management of customer demand than with anything else. This would tend to suggest that e-business is something that one does primarily because customers demand (or need or request) it. The fact that a technique is most used because one's marketplace demands it should not be a surprise to anyone, and there are similar conclusions in other research (for example Fillis et al, 2004, Croom, 2005)

For small/medium companies, there is expected to be growth in all areas, in these cases mostly in the procurement and accounting domains. Somewhat surprisingly, pre-production / product development seems to be the least popular e-business process for large companies.

Large companies also expected growth in all business process areas but, again somewhat surprisingly, least in the pre-production / product development and supply chain planning domains.

- (d) Generally speaking, especially in relation to the small/medium companies, the centrality of the Internet (Pant et al, 2001; Van Hoof et al, 2001) to the definition of the e-business concept would seem to be supported. Most organisations that responded make some simple use of the Internet. The Internet can be thought of as an equaliser, bringing customer facing EDI use in smaller companies to the same level as in larger companies.
- (d) There is evidence that a significant number of companies are achieving, or proactively considering, the implementation of applications that use the Internet to transfer messages between companies within the same supply chain. Not surprisingly, it would seem that the largest companies have made the most progress, and have least to do in the next two years.

As others have found (Wagner et al, 2005; Croom 2005), the most unsurprising observation was that the most "active" areas of e-business are those that are the simplest (e-mails and web pages). Overall there appears to be more support for the incremental improvement rather than revolution hypothesis (Coltman et al, 2001).

- (e) The use of traditional EDI seems still very underdeveloped although among the less expected observations were the suggestions that:
- The use of EDI with customers is almost as prevalent in the smaller companies as in the larger companies;
  - The use of traditional EDI is still expected to expand among small and medium enterprises.

The weakest area seems to be in using EDI with suppliers. Although the use of the Internet will increase more than the use of EDI within the next two years, "large" companies are still interested in broadening the use of classical EDI with their suppliers (for example to logistics and product development).

A significant increase is expected within the next two years in the proportion of larger companies using the Internet to work with suppliers. Within 2 years, the majority of all sizes of company expect to use the Internet for significant communications between customers and suppliers.

- (f) There seems little current activity in the collaboration functions (for example collaborative exchanges) and what there is comes mostly from the larger companies. The large companies have the major interest in procurement exchanges. A reason could be that they have most to gain from the use of auctions. These results seem similar to those reported by



Auramo et al (2005), who also came to the conclusion that EDI was alive and well even within progressive companies.

There seemed little evidence of the amorphous supply chain (Ritchie and Brindley, 2001), although companies in the "large" category have the most significant current activity in the Pre-production, supply chain planning and logistics exchanges. Indeed it seems that collaboration functions will not grow that much in the next 2 years and therefore the penetration of exchanges would still be limited in two years time.

#### **4.3.3 Satisfaction**

- (a) In reporting their current level of satisfaction, responders were asked to choose between low, moderate or high satisfaction. The responses to the satisfaction question were converted into a score out of 10 (0=dissatisfied, 5=moderately satisfied, 10=very satisfied). These were then summarised to produce a composite satisfaction index by size of company. Figure 4.2 below shows the index by detailed business process.

Major Function	Business Process	Satisfaction Index	
		SME	Large
Simple use of Internet	Access customer web sites to access or provide information	4.8	5.3
	Access supplier web sites to access or provide information	4.3	5.3
	Provide information for access on your own web site	5.0	4.7
	Receive or send e-mail notifications from/to customers	7.0	6.1
	Receive or send e-mail notifications from/to suppliers	6.2	6.1
Transmission of data with customers using traditional EDI	Pre-production / product development	3.9	5.0
	Receiving Customer Demand	5.2	5.0
	Planning	3.9	5.0
	Logistics and transportation (e.g. shipping notifications)	3.9	5.5
	Accounting	5.0	4.6
Transmission of data with customers using the Internet	Pre-production / product development	5.0	5.0
	Receiving Customer Demand	5.8	4.3
	Planning	5.0	3.8
	Logistics and transportation (e.g. shipping notifications)	4.5	5.0
	Accounting	3.1	4.1
Transmission of data with suppliers using traditional EDI	Pre-production / product development	3.0	6.4
	Planning	3.0	6.3
	Logistics and transportation (e.g. shipping notifications)	3.0	5.0
	Procurement	2.8	5.9
	Accounting	3.0	5.6
Transmission of data with suppliers using the Internet	Pre-production / product development	4.4	5.0
	Planning	5.0	5.6
	Logistics and transportation (e.g. shipping notifications)	5.3	4.4
	Procurement	4.5	4.6
	Accounting	3.7	4.4
Participation in collaborative industry exchanges	Pre-production / product development	4.4	5.0
	Supply Chain Planning	3.8	3.3
	Logistics and transportation	4.4	3.0
	Procurement	4.3	3.1
Overall		4.7	5.0

Figure 4.2a- Satisfaction Index by Detailed Process by size of company

- (b) As with the function analysis it seems more appropriate to draw conclusions from the information at a more summarised level and so the satisfaction index was summarised in two ways:
- By major function;
  - By business process

Figure 4.2b provides the summary by major function and figure 4.2c by business process.

Major Function	Satisfaction Index	
	SME	Large
Simple use of Internet	5.5	5.5
Transmission of data with customers using traditional EDI	4.5	5.0
Transmission of data with customers using the Internet	4.8	4.4
Transmission of data with suppliers using traditional EDI	3.0	5.9
Transmission of data with suppliers using the Internet	4.6	4.8
Participation in collaborative industry exchanges	4.2	3.6

Figure 4.2b- Satisfaction Index by Major Function by size of company

Business Process	Satisfaction Index	
	SME	Large
Pre-production / product development	4.3	5.3
Receiving Customer Demand	5.5	4.6
Supply Chain Planning	4.3	4.8
Logistics and transportation (e.g. shipping notifications)	4.3	4.8
Procurement	4.0	4.7
Accounting	3.8	4.6

Figure 4.2c- Satisfaction Index by Business Process by size of company

- (c) It was interesting to discover that, although pre-production / product development was the least active area in large organisations; it was the one that generated the most satisfaction. One could explain this by suggesting that large organisations can choose how much to invest in with this e-business process, whereas small organisations tend to be driven by their customers. Large organisations are therefore more likely to be satisfied with what they do.

Overall it seems that large companies are slightly more satisfied with e-business than all the others. For small/medium organisations particularly, it can be said that the simpler the use, the greater is the satisfaction. The use of e-mail generates the most satisfaction.

- (d) This overall verdict does, however hide some differences; some expected, some unexpected.

For the small/medium organisations the least satisfactory performing aspect of e-business is the establishment of EDI links with suppliers. By contrast, for the larger organisations, supplier EDI was the e-business domain attracting the most satisfaction. This contrast can

be explained by the somewhat obvious observation that the larger organisations find it easy to dominate their supply chain and enforce commercial practices and communication methods that suit them. This also could be related to the findings of Min and Galle (2001) that small firms still do not regard a supplier's capability to perform electronic commerce as a critical prerequisite for supplier selection.

In fact whereas small organisations were more satisfied with Internet EDI than with traditional EDI, the situation was reversed with the larger companies. This contrast can be explained by the fact that the Internet gives the smaller organisation "e-possibilities" that it otherwise would not have. By contrast, larger organisations have more sophisticated systems, are more likely to appreciate the EDI values of structure and standards and therefore they may perceive that less benefit can be achieved by the unstructured "advantages" of the Internet. Nevertheless it was unexpected that large organisations would be less satisfied with participation in collaborative industry exchanges than smaller companies.

- (d) The summary by e-business process produces the interesting result that the satisfaction ratings for the large organisations are higher than those for small organisations in every business process except the management of customer demand. Perhaps this is the one aspect of doing business that no organisation, however large, can totally dominate!

#### **4.3.4 Concerns**

- (a) The responses to the open question relating to the concerns potentially inhibiting e-business were reviewed and clustered into 11 areas of concern. The numbers below (see figure 4.3) reflect the percentage of the responders that raised issues relating to the given area of concern.

Area of Concern	Summarised Concern Assessment	
	SME	Large
Need for/availability of IT skills/advice/resources, special programs and integration with existing systems	34	42
Security Issues	19	26
Constrained by capabilities of Customers	31	5
Poor awareness of possibilities, management bandwidth, management of change, lack of time	25	0
Benefits dubious; Justification of costs in relation to benefits	13	21
Communication issues – ease, speed, broadband availability	22	11
Cost issues	6	16
Need to maintain pre-existing relationships / deal with customers/suppliers personally	13	11
Problems with existence of / adherence to standards	13	21
Constrained by capabilities of Suppliers	9	11
Availability of reliable technology/appropriate software products	3	11

Figure 4.3 - Concerns inhibiting e-business – Significance by size of company

- (b) There seemed to be support for the sceptical view (Coltman et al, 2001; Croom, 2001; Wagner et al, 2005) of the value of e-business in most companies. This scepticism manifested itself in a number of concerns, the analysis of which (as can be seen in Figure 4.3) varied somewhat according to size of company. There are some aspects of these results that are not surprising. Among the concerns that one would expect to be more prevalent among the smaller organisations include the observations relating to:
- Management awareness of possibilities being more of an issue for the smaller organisation (Wagner et al, 2003, discovered a similar effect)
  - Communication issues being more of a concern for the smaller organisation;
  - Small companies feeling more constrained by the capabilities of their customers.
- (c) It is also unsurprising that problems with the existence of, and adherence to, standards are more of an issue with "large" companies. Large companies are of sufficient size to need complex integrated systems. They are therefore interested in automatically integrating data flows from their customers and suppliers. Standards exist so that one does not have to continually invest in special programs to accommodate the practices of each new business situation; one can use standard software. The larger companies are also likely to have

more customers and suppliers. It is perhaps possible to link this issue with that of concerns with the availability of IT skills. It perhaps need not be a problem for smaller companies because they have less need for complex and integrated systems and maybe fewer customers. It seems reasonable therefore to suggest that smaller companies can therefore be more flexible in dealing with non-standard behaviour, because they work more by manual intervention than relying on automatic systems integration.

(d) The issues of integration and availability of IT skills and resources seems to be the number one issue for all sizes of company. This would probably not be unexpected by anyone, but the category summarised under this heading does perhaps mask the different types of problem faced by different sizes of organisation:

- “Small/Medium” companies typically were more concerned about the cost and availability of advice and the lack of technical knowledge and skill available to them;
- The “large” organisations show signs of being more concerned with the costs of the creation and maintenance of the databases, special programs and customised systems to deal with the demands of their customers and programs in an ever changing and advancing world.

There are similarities here with the issues raised by Angeles and Nath (2007). In a survey on business-to-business e-procurement they identified lack of system integration and standardisation immaturity of e-procurement-based services as challenges to implementation:

(e) Among observations that were, on initial consideration, less expected included the suggestions that:

- Larger organisations were more sceptical of the benefits than smaller organisations;
- One would have expected (Fillis, 2004) to find small companies more concerned about the e-business threat to personal contact with customers and suppliers;
- The availability of reliable technology and appropriate software products more of an issue for larger organisations;
- Cost issues were more of a concern for the larger organisation (contrary perhaps to Fillis, 2004).

On reflection, some of these “less expected observations” could be explained by the more sophisticated and complex requirements that would be characteristic of e-business for the larger organisation. There could also be a relationship with the suggestion (Zhu et al, 2004) that the structural inertia associated with large firms may retard the impact of e-business on their performance more than would be the case with small firms.

#### 4.3.5 Benefits

- (a) The responses to the open questions relating to the benefits achieved with e-business were reviewed and clustered into 10 areas of benefit. The numbers in figure 4.4 reflect the percentage of the responders that raised issues relating to the given area of benefit.

Area of Benefit	Summarised Benefit Assessment	
	SME	Large
Reaction to change; timeliness of processing; flexibility; better communications	34	68
Better information, speedier information availability; better vision; better visibility and availability	22	42
Improved processes; improved efficiency; better ability to manage	16	26
Cost savings; reductions in manning levels; inventory	19	26
Accurate recording of information; less mistakes	9	26
Convenience of E-mail	22	0
Better customer knowledge, contact with potential customers; PR advantages; better image	25	5
Access to new customers, markets	13	0
Locking in customers by giving better service	16	16
Negative experiences; general cynicism; waste of time, forced to do it by business partners	16	21

Figure 4.4 - Benefits mentioned as achieved by e-business – Significance by size of company

- (b) Some of the benefit picture painted here is unsurprising. For example, tending to support Ritchie et al (2000 and 2002), small companies find that access to new customers and markets is a significant e-business benefit. Improved connection with customers is something for the smaller company rather than the larger. There are similar indications in the work of Wagner et al (2003).
- (c) Issues around information accuracy (quantity, availability, accuracy) are issues for all but again especially for the larger companies This would seem to support the recognition of the value of the diffusion of timely information throughout the supply chain (Kehoe and Boughton, 2001a and 2001b). It seems reasonable that this recognition is especially characteristic of larger companies, as a consequence of the fact that larger companies rely more on their systems and systems rely on good information.
- (d) Improved reaction time was an issue of interest for all but especially for the larger company. The most likely explanation is that small companies are reactive by nature and do not really require technology to make them so. As companies get bigger, they often lose this

reactivity and at this stage e-technology may start to make a contribution to solve what is now a significant problem.

- (e) Less expected was the observation that large companies were just as likely as smaller companies to be cynical about the benefits of e-business. Large companies seem to have achieved significant benefits in process improvements but have scored highly in negative experiences. These “negative” benefits were comments made explicitly under the benefits heading, comments that portrayed negative feelings about the value of e-business. Such comments include “I cannot honestly say that we have seen any net benefits”, “We have to participate because our customer's insist we do”, “EDI had great potential but the aims of the process have been destroyed by incompetent use”, “None to date”, “Not a lot so far”. The explanation for this attitude in the larger organisation is probably the same as that for a somewhat similar observation under the heading of concerns. Any information technology related project for the larger organisation will involve a corresponding degree of sophistication, complexity, and difficulty, and this itself is likely to compromise the enthusiasm of the participants.

#### **4.4 Conclusions of the Survey**

- (a) The survey demonstrated that organisations are more concerned with the use of e-business functions in the management of customer demand than with anything else, thus suggesting that e-business is something that one does primarily because one's customers demand it.
- (b) Most organisations expect to be making some moves in some aspect of e-business in the next two years. For companies of all sizes, most of this progress is expected to be by using Internet based facilities. In this sense it seems that the concept of e-business can for most practical purposes be equated with the use of the Internet (Pant et al, 2001; Van Hooft et al, 2001). Notwithstanding this (and perhaps surprisingly for some), it seems that the use of the more traditional EDI technology is also likely to expand and continue to be relevant for the foreseeable future, especially for the larger organisation.
- (c) Overall it seems that large companies are slightly more satisfied with what they have achieved using e-business technology than all the others. The most “active” areas of e-business are those that are the simplest (e-mails and web pages). For small/medium organisations particularly, it can be said that the simpler the use, the greater is the satisfaction, and the use of e-mail, being the least ambitious (and also probably the most



reliable) generates the most satisfaction. This is a useful reminder of the "Keep it simple" principle.

- (d) The use of EDI techniques shows the most striking difference between the attitudes of large organisations with those of the small/medium companies. The weakest area seems to be in using EDI with suppliers. Supplier EDI is clearly the domain of larger organisations that can dominate their supply chain and enforce practices that suit them. Such companies remain interested in broadening the use of classical EDI with their suppliers (for example to logistics and product development). For smaller organisations, it is likely that the use of the Internet for supplier links will increase more than the use of EDI. It is interesting to compare this with the situation of EDI with customers. Here it has been suggested (Riggins and Mukhopadhyay, 1994) that small suppliers could be more flexible and adapt more easily to new technology than larger, more established companies.
- (e) There seems little current activity in the collaboration functions (for example collaborative exchanges) and what there is comes mostly from the larger companies. If anything large organisations tended to be less satisfied with participation in collaborative industry exchanges than smaller companies. There seemed little evidence of the amorphous supply chain (Ritchie and Brindley, 2001), and it seemed that collaboration functions will not grow that much and therefore the penetration of exchanges will be limited.
- (f) There was evidence of the achievement of benefits from the adoption of e-business techniques. Improved access to new customers and markets was a benefit experienced especially for small companies (For example Ritchie et al, 2000 and 2002; Wagner et al, 2003). The value of the diffusion of timely information throughout the supply chain (see Kehoe and Boughton, 2001a and 2001b) was recognised especially for larger companies, more reliant as they are on systems and information. Similarly larger companies were likely to find that e-business technology help them regain their flexibility and reaction time.
- (g) The survey demonstrated that, although there was recognition of some benefits, there was, throughout all sizes of organisation, scepticism about the scope and value of many of the functionalities that come under the heading of the "e-business" concept. It was surprising that large companies were just as likely as smaller companies to be cynical about the benefits of e-business. Large companies seem not surprisingly to have done more and achieved more benefits, but also to have more negative experiences.

- (h) On a positive note, it seems that organisations are able to ignore oversold solutions, and choose the most likely areas that will benefit them. The simpler functionalities were generally seen as the most satisfactory. The survey results supported the view that, in practical terms, e-business represents incremental improvements rather than a revolution in the conducting of business. There was also support for the initial proposition that there is a need for more unbiased advice and support to organisations contemplating or embarking on e-business initiatives. Useful input was provided into the e-business functional model especially in the area of likely relevant management concerns.
  
- (i) It was possible to show that organisations selling information technology tools under the banner of "e-business" should not assume that they can easily persuade their prospective customers into spending money chasing technological fashions. The possibility of a tool, to enable an organisation objectively to assess what potential "e-business" opportunities could be of value, is therefore actually of potential benefit not only the organisation "buying" but also the organisation doing the "selling". It is surely valid to suggest that the knowledge, that one actually is armed with an objective way of assessing the value of an initiative, can give one the confidence to embark upon new initiatives.
  
- (j) As a shorthand way of categorising some of the applications described in this paper, the label e-business may have some merit. However, the survey confirms the conclusion of the literature review that the "e-business" label is vague and terminologically muddled from a variety of causes. It is therefore more useful to consider functionalities at a more detailed level. There are technologically enabled facilities that are of some use to some businesses at some times and some of these involve using the Internet (or similar) to improve the links with customers and suppliers (or within one's own organisation). Projects involving the use of such facilities can be justified in the same way as any other project, and sensible organisations can and do "cherry pick" the most likely areas of benefit.

## 5 Development of the e-business functional model

The sources for the development of the e-business model are considered under two main headings:

- Sources for the structure, these being mainly derived from the literature reviewed earlier (Chapter 2);
- Sources for the content of the model, these being derived primarily from material from organisations that provide products for sale in the e-business marketplace.

### 5.1 Sources for a Model Structure for E-business

(a) Some aspects of the extended enterprise highlighted by Edwards, Peters, and Sharman (2001) include:

- Structural flexibility;
- Collaborative relationships;
- Co-ordinated planning;
- Operational alignment;
- Technology integration.

This is useful to highlight the importance of collaboration and co-ordination functions in the e-business model.

(b) Pant and Ravichandran (2001) create an "e-Business cube" (Timeliness, integration, and community), and suggests that positioning an e-business model on this cube should be a starting point in developing a differentiated information infrastructure design strategy. This would have been an interesting idea to pursue further in the "classification" direction, but would have needed to be taken down more levels of detail to be useful. The e-business models of interest to this project (supply chain/procurement and exchanges) are positioned as high integration, moderate to high timeliness and moderate community.

(c) Graham and Hardaker (2000) introduce a "virtual organising grid" (individualization of output versus integration). It has the classical supply chain business model in the Network quadrant (low individualisation of output/ high integration). This could be an interesting way of looking at supply chain management, but like many other such models, appears to operate at two "broad brush" a level of detail to be useful to this exercise. What can be used, however is the suggestion that supply chains are typically modelled at three levels:

- Strategic;
- Tactical; and
- Operational.

(d) Rondeau and Litteral (2001) define a fully functional ERP system as performing eight major types of business function:

- Engineering, part and BOM control;
- Engineering change and documentation control;
- Purchasing;
- Materials management;
- Manufacturing planning and control;
- Cost management and control;
- Finance;
- Marketing and sales systems.

(e) The eight defining characteristics of modern thinking on identified by Cox (1999) based on Toyota thinking (which he does challenge) are to

- Strive for perfection in delivering value to customers.
- Only produce what is pulled from the customer just in time and concentrate only on those actions that create value flow.
- Focus on the elimination of waste in all operational processes, internally and externally, that arise from overproduction, waiting, transportation, inappropriate processing, defects and unnecessary inventory and motion.
- Recognise that all participants in the supply chain are stakeholders and that it is necessary to add value for everyone in the business.
- Develop close, collaborative, reciprocal and trusting (win-win), rather than arms-length and adversarial (win-lose), relationships with suppliers.
- Work with suppliers to create a lean and demand-driven logistics process.
- Reduce the number of suppliers and work more intensively with those given a preferred long-term relationship.
- Create a network of suppliers to build common understanding and learning about waste reduction and operational efficiency in the delivery of existing products and services.

(f) McCormack and Kasper (2002) introduce the concept of an integrated supply chain that makes smart use of information to orchestrate the activities of the chain. They describe it at three levels, namely,

- Level one, i.e. information sharing, the foundation of SC integration,
- Level two, coordination, and
- Level three, organisational linkages.

They selected a number of more or less useful measures of Supply Chain Management. These cover the concept of extending outward to suppliers, for example

- Do you share planning and scheduling information with suppliers?

- Do you collaborate with suppliers to develop a plan?
- Do you have electronic ordering capabilities with suppliers?

They also cover the concept of extending outward to customers, for example

- Does your demand management process make use of customer information?
- Is your customers planning and scheduling information included in yours?
- Are the projected delivery commitments given to customers credible (from the customer's view)?

Other proposed measures seem less useful (ranging from the over-vague to the over-obvious), for example

- Does the operations strategy team participate in supplier relationships?
- Do you have strategic suppliers for all products and services?
- Are the customer's satisfied with the current on-time delivery performance?
- Has the business defined customer priorities?
- Do you track the percentage of completed customer orders delivered on time?

They also employed the following measures that attempted to encapsulate how organisations were using of technology, for example:

- Do customers gather information about the company's products through the Internet?
- Do customers place orders for goods and services through the Internet?
- Does the company gather information about suppliers' products through the Internet?
- Does the company place orders for suppliers' goods through the Internet?

(g) Bhatt et al (2001) suggest a set of e-commerce tools, namely:

- E-mail;
- EDI;
- World Wide Web;
- Mailing lists and newsgroups.

And attached these to a series of what they called "virtual value chain activities", example of which include:

- Streamline distribution operation;
- Automate order-entry and inventory support services;
- Share knowledge on product designs for collaboration;
- Provide support information;
- Allow people to check their order status;

- Automate support services;
- Promote products and services with essential features and catalogues about the products and services;
- Obtain customer feedback and comments about companies' products and services;
- Set up feedback systems to generate ideas or test new products;
- Networks with potential buyers.

(h) The Supply-Chain Operations Reference model has been introduced earlier (2.6.2) in a discussion of the structure of Supply Chain Management. Although this suffered from the problem of being at a superficial level of detail, some of the level 2 and 3 material was useful as input to the initial model.

## **5.2 Sources for the Content of the Initial Model**

### **5.2.1 Introduction**

It has been established earlier that there is a need for the development of an e-business functional model, and in chapter 4 the methodology to be adopted is described. However before considering such a methodology, it must be established that there is sufficient source material for it actually to be possible to develop an initial definition of e-business functionalities for it to be possible to produce an initial model starting point.

It is appropriate to review material relating to what the market place is trying to sell under the e-business banner. The material reviewed here represents organisations involved in influencing, guiding or selling products or services into organisations embarked upon e-business initiatives. They include material from:

- The e-business functional specifications provided by the top two major ERP vendors (SAP and the Oracle Corporation), probably more focused on selling to the larger organisation;
- An example of an e-business product for the small to medium organisation;
- An example of an e-business exchange vendor developers interested in marketing their products, viz. Covisint;
- A well-known standards organisation active in the e-business (The Organisation for Date Exchange and Tele Transmission in Europe).

The problem with such organisations in general (and those selling solutions in particular) is that they are fundamentally self-serving and therefore encourage the bandwagon effect. Taken as a whole, however, their material will hopefully set the scene as to what the aspirations of the industry are (i.e. what e-business should be).

## 5.2.2 The ODETTE Organisation

### (a) *Introduction*

The ODETTE (Organisation for Data Exchange and Tele Transmission in Europe) organisation is an example of the kinds of organisations that exist to promote standards and good practice in specific types of industry

ODETTE International is an organisation formed by the automotive industry to set standards for "e-business communications, engineering data exchange and logistics management, which link the 4000 plus businesses in the European motor industry and their global business partners.

### (b) *Detailed Processes*

The ODETTE organisation describes the following processes that are relevant to electronic communications between trading partners. Their purpose in so doing is to create standards for how such communications should take place. The business processes defined are as follows:

- Engineering Data Transfer control - Used to transmit information referring to one or more accompanying files with technical content, for example CAD files;
- Enquiry - Used by the buyer to request the seller to give prices and other terms and conditions for the supply of goods and/or services;
- Quotation - Used by the seller to inform the buyer of prices and other terms and conditions for the supply of goods and/or services;
- Blanket Order - Used by a buyer to initiate a transaction with a seller that involves the supply of goods and/or services over a specific or open-ended time period. Details about exactly what will be ordered on a given date are provided in separate delivery instructions;
- Stand-alone Order - Used by a buyer to initiate a transaction with a seller that involves the supply of goods and/or services specifying definite requirements including quantities and times;
- Order Change - Used by the buyer to inform the seller of any changes made to a purchase order;
- Outstanding Order Status - Used by a seller to report on the status of outstanding orders;
- Order Status Enquiry - Used by a buyer to ask a seller for information on the current status of purchase order(s);

- Price List - Used by a seller to notify a buyer of the current applicable prices of its goods and/or services;
- Reply to Order - Used by the seller to respond to a buyer concerning a purchase order or orders received, typically to confirm quantities and Dates;
- Delivery Instruction - Used by a buyer to provide both short term firm delivery instructions and medium to long term firm or forecast requirements to the seller;
- Delivery Call-off - Sent from the consignee (the sender of goods) to the consignor (the receiver of the delivery) giving short-term delivery information instructions;
- KANBAN Signal - Sent from the consignee to the consignor to give authorisation to the consignor to ship material to them based upon receiving a KANBAN signal;
- Instruction to Despatch - Used to direct deliveries from a warehouse at a distance; typically when the seller owns stock managed remotely by a third party, and wishes to effect a despatch from this warehouse;
- Response to Delivery Instruction - Used by a seller to respond Delivery Instruction previously issued by the buyer;
- Synchronised Delivery - Used by a consignee to authorise shipments of material from a consignor in sequence based on actual production requirements, relating the consignment to a specific production sequence;
- Synchronised Packaging - Used by a consignee to give authorisation to the consignor to transport material in sequence with an agreed packing pattern based on actual production requirements;
- Despatch Advice - Used by the consignor to advise the consignee that the goods have been despatched. Sent at the same time as the goods are despatched, it shows details about the contents of the consignment;
- Forecast of Despatch - Sent by the consignor to advise the consignee that the goods required are available and ready for despatch;
- Advice of receipt - Sent by the recipient of the goods to confirm to the sender of the goods to inform what has actually been received;
- Stock Activity Report - When a warehouse is managed by a third party, this is sent, by the third party to advise stock activity to the stock owning company;
- Pro-Forma Invoice - Sent prior to shipment to assist with issues such as obtaining import licences, foreign exchange allocations, or letters of credit;
- Commercial Invoice - Sent by a seller to a buyer, containing the claim for payment of goods supplied under the financial conditions agreed between the buyer and seller;
- Self Bill Invoice – Sent from a buyer to a seller to inform that goods have been received and that payment will follow under the agreed financial conditions;



- Null Invoice notification - When a self-billing system is in operation, used to inform the invoice recipient that no invoice will be issued;
- Credit Note - Sent by the seller to the buyer or vice-versa to credit all or part of an unacceptable invoice or invoices or to correct one or more debit notes;
- Debit Note - Sent by a buyer to a seller or (vice-versa) to debit all or part of an unacceptable invoice, or charge the seller for goods which have been returned;
- Remittance Advice - Sent from a buyer to a seller specifying all payments to a seller at specific dates;
- Reply to Invoice - Sent by a buyer to a seller (or vice versa) to show errors in previously received invoices or credit notes, debit notes or self bill invoices;
- Statement of Account - Used for reconciliation of accounts through between trading partners;
- Sent by the seller to the buyer (or by the buyer to the seller) detailing the financial transactions and the resulting outstanding balance at a specified date;
- Transport Advice / Forwarding Instruction - Sent from a consignor party to a freight forwarder to give a forecast or detailed instructions about requested transport services;
- Consolidation Summary- Sent by freight forwarders to inform a consignee about the departure of a single consolidated consignment (cargo manifest).

**(c) Comments**

This list is of particular interest as an example of those transactional communication processes that are considered to be "reasonable" in relationship to a major global engineering based industry sector. For the purposes of this research they therefore represent a good checklist of those potential electronically supported processes that have been proposed in a real life organisation in the real world. This is a theoretical list - there is no suggestion that all of these theoretical messages/processes have actually been used in practice. In fact sources quoted above (for example Murillo, 2001) comment that among the limitations of EDI is the expense involved in implementing it and hence the relatively low take-up rate of potential trading partner interactions.

Nevertheless as a business credible potential e-business transaction process checklist, the ODETTE list is invaluable. This value is reinforced by the potential of e-commerce/e-business related technology to reduce the cost threshold of introducing such interactions.

### 5.2.3 The SAP E-business view

#### (a) *Introduction*

As befits an organisation that claims to be the market leader in application software for moderate to large organisations, SAP have invested effort into presenting an e-business vision. They have produced a number (in excess of 100) of so-called "c-business" ("c" for collaboration) maps purporting to describe how the use of modern techniques can improve the efficiency of business operations. These are accessible to all on their web site ([www.sap.com](http://www.sap.com))

This represents an attempt to translate the e-business into meaningful detailed functionality that can actually be examined critically. Of course in making the effort to go deeper one exposes the concepts to criticism, and such criticism enables an engagement with the reality (or otherwise) of the e-business concept, which can only be constructive. Two representative examples, chosen at random, are analysed in depth

#### (b) *Example 1 - Collaborative Controlling on Cost Centres*

The first example is an example from the financial applications, and describes the interaction between a controller and a manager in the to and fro of developing a budget. To quote "Currently the process of budget planning a cost controlling is hugely cumbersome both for managers and controllers making use of a wide variety of applications, tools, and company-specific spreadsheets. This leads to huge costs for maintaining the interfaces as well as for integrating the diverging data sources.

SAP delivers a solution which integrates information and services from a multitude of systems, and sorts them into task- and theme-oriented work sets so that managers can call up relevant, organized information from their desktop."

The c- business scenario describes the sequence in which planning is done, where the rules to be applied are set, the communications between the relevant parties and how the process is monitored, managed and adjusted

The primary question to address is why this function being thought of in an e-business context? The concepts here appear to be as follows:

- The integration of information from multiple sources;
- The concept of self service data input and monitoring of other peoples activity;
- The concept of workflow guiding people through a defined sequence of actions;
- The use of web based forms.

There is no concept of integration here with other business partners - the participants clearly belong to the same organisation, though they could be in different physical locations. The use of the web therefore gives them the ability to connect participants with the "budgeting system from anywhere with Internet access. As for the other concepts, these are not particularly tied to an e-business concept, although they do represent properties of modern systems.

From this one is forced to the conclusion that a software vendor must continually re-brand its products according to the current fashion. The current fashion is e-business and the software must be made to sound modern. Therefore the system components now become e-business system components irrespective of whether they have anything to do with any reasonable definition of e-business.

The conclusion is that the evolution of each fashion causes every one to play the "me to" game. Therefore the fashion becomes useless because it becomes a non-differentiator. Therefore everyone who wants to differentiate their product must discard the old fashion and create a new one; and the circle starts again.

(c) ***Example - Advanced Shipping Note***

The second example comes from the logistics area and relates to the process by which an organisation despatching goods gives advance notice to the organisation receiving goods that the despatch has taken place (for another view on this see the description on the ODETTE organisation in section 5.2.2).

In the "new" c-business world, the process is described as this....

"Vendors can utilize inbound delivery processing using the Internet to create and process shipping notifications for the customer. The system ensures that a vendor can only select purchase orders that belong to him/her. The user can create and change shipping notifications, which are reflected in the customer's system as inbound deliveries and contain basic data such as the delivery date or delivery quantity of these inbound deliveries.

At the point of shipping notification entry, a list appears to the vendor that displays all purchase orders and scheduling agreements that are relevant to that vendor. After the delivery date and the unique identification number have been entered, an inbound delivery for the customer is generated. The customer and the vendor can also modify these deliveries at a later stage, and all parties can view any changes in real time.

This process is an alternative to the previous order notification method through EDI and produces the same result. "

Various benefits of this process are claimed for both Buyer and Seller, including:

- Easier communication with all related parties;
- Less administration in goods receipt processing reduces costs;
- Real-time transparency of shipping notifications from the supplier;
- Reduced information technology costs;
- Better customer service;
- Saves setting up of EDI Interface.

This example is an excellent illustration of a major issue that is at the heart of trying to understand the true nature and scope of e-business. What the process basically amounts to is this:

- The seller logs on to the buyer's web site;
- The seller brings up the orders and selects what is being despatching;
- The seller creates an advanced shipping notice for the order in question.

The "previous" alternative method quoted is one where the advanced shipping note is produced as a by-product of the operational shipping process. However what is not clear is why this is an advance on the "previous" method where the advanced shipping note is produced and sent (by EDI) automatically as part of the shipping process? Why is the previous method not "e-business"? When benefits for the "new method" are claimed (as they are) what are they being claimed in comparison to?

The buyer benefits claimed may be justifiable in comparison with an alternative of having nothing. But they are ridiculous in comparison with a "previous" method where the advanced shipping note is produced and sent automatically as part of the shipping process. The claimed benefit to the seller where one reduces information technology costs (which include the costs of setting up an EDI interface) may indeed be fair, but what about the additional costs of extra clerical effort, of transcription errors?

The reality is that this so called "c-business map" represents a low cost option for those small businesses that cannot cope with the effort of setting up an integrated EDI set up. These tools have been available for many years as proprietary tools provided by customers in some industries. Unless they are integrated seamlessly into the operational transactional

systems of both the buyer and seller, they do not deserve to be considered an advance. Arguably they do not even deserve to be considered as "e-business".

**(d) Summary**

Overall, the SAP e-business "maps" represent a creditable attempt to translate e-business "blue sky" vision and exhortation into meaningful detailed functionality. As already observed, in making the effort to go deeper one has exposed the concepts to criticism. The material is at one level useful (and this research was able to use it) as a checklist of functions not to be missed. At another level it is useful as a way of animating the assessment as to whether these e-business concepts are real, or merely a marketing inspired re-packaging of old material in the general business systems domain. The jury remains out on this point.

**5.2.4 The Oracle e-business view**

**(a) Introduction**

The Oracle Corporation is the second largest software company in the world (second to Microsoft). Their primary business is in the provision of Database Management software and other technical products. The corporation is also, by its own claim, the second largest applications software company in the world (second to SAP). It has been active in the application software space for some dozen years.

**(b) General Marketing Stance**

The up-front description of "Applications" provided by Oracle on their web site as at January 2004 described something called an "e-business" suite, as follows:

*Oracle E-Business Suite offers your business a complete set of applications capable of automating any function of your daily business processes. Available for purchase by module or as a complete suite, Oracle applications assist you in everything from running your supply chain operations to managing your employees to marketing, selling, and providing customer service. Oracle E-Business Suite applications help you know more about your business; do more with your resources, and spend less."*

There is nothing in this definition as such that differentiates such a suite from that of ERP in general. In fact one would be surprised to see any of this material not included in any definition of any ERP system. One could conclude from this that Oracle have re-labelled its ERP system as an "e-business suite" in order to conform to a fashion.

In fact the material in the (slightly older) brochure gives a little more of a clue by using the "I" (for "Internet"!)

*"Companies that seek to manage costs while increasing profitability must make decisions based on a timely analysis of accurate data. Oracle E-Business Suite is a complete set of business applications that runs entirely on the internet, enabling you to cut costs; increase revenues across front- and back-office functions; and access current, accurate, and consistent data."*

It then goes on to develop its themes of

- A unified information architecture that has the potential to consolidate and present up to date data from Oracle and non-Oracle applications
- A consistent definition of data across the entire enterprise, resulting in
- The availability of all types of performance and financial information that roll up across all departments, products, and geographies.
- Integrated applications that significantly reduce the need for software integration and customisation, and hence IT expenses.
- The use of the internet to simplify one's IT structure, in effect by being able to centralise

It then somewhat spoils this picture by suggesting that

*"Whether you implement one module or the entire Suite, Oracle E-Business Suite can help you make smarter decisions with better information, share unified information across the enterprise, reduce IT expenses, and run your business more efficiently".*

Clearly no intelligent marketing person wants to adopt an "all or nothing" stance towards his prospective customers, but really one cannot have it both ways! One cannot claim the benefits of consistency and completeness and integration on the one hand, and then suggest that one only has to buy one module! And of course whether or not one can save money by reducing software customisation rather depends on whether the software provided as standard fits adequately the use to which it is to be put.

**(c) *The four Transformations***

A more focused and coherent portrayal of Oracle's e-business vision is given by what are described as the "four transformations". These are as follows:

- The transformation from Administration to Self-Service - This is about the Internet Browser changing the way in which information is distributed and transactions are conducted. All employees, from executives to sales people, enter and control all the information that is important for the conduct of their work responsibilities. They themselves take complete responsibility for the accuracy and timeliness of their transactions. The idea is that there are no more administrative intermediaries, no more paper documents and no more delays. It is asserted that this can only be done with the use of Internet technology, because only this gives the opportunity to deploy applications anywhere, accessible at any time. The assumption is that it is appropriate

for people (perhaps expensive professionals) to spend time doing their own administration, instead of what they were hired for (see also above section 2.2.5c).

- The transformation from Internal to External Focus - The point here is that the Internet improves how an organisation can manage its supply chain, increases the service level of suppliers, and builds loyalty among customers. Ideas include improved communication and collaboration, concurrent engineering, self-service demand capture and electronic marketplace techniques. Most of these ideas have been discussed in the academic literature review (chapter 2).
- The transformation from Transactions to Business Intelligence– the use of the Internet to allow the centralisation of IT and business management. The idea here is that Internet Computing solves the problem of lack of timely information as a barrier to decision making by providing instant access to enterprise-wide information, to all employees, at all locations, around the world by allowing potentially a world wide organisation to keep all its information in a single place. This means almost by definition that systems become better integrated. And as a by-product, ERP systems therefore move from simply being systems that process transactions to systems that integrate and present information.
- The transformation from Local and Regional to Global – again based on the use of the internet to allow IT centralisation, The idea is that IT staff can be located centrally servicing a global user community, and the number of physical computers and distributed databases are reduced, and business processes can therefore be shared to help standardise business practices and simplify decision support and simply the roll out of new and upgraded systems. In principle a large centralised system can be set up to which anyone in the world equipped with a PC and web browser can easily access, without any of the costs of setting up a private communications network

**(d) Summary**

In contrast to SAP, Oracle seems to take a more impressionistic view of e-business. Unlike SAP, it has little to say on functional detail, but (as one might expect) emphasises the Internet, information and database issues.

First and foremost it emphasises the concept of a (so-called) suite as representing an integrated and unified concept of all the applications necessary to run a business. Oracle emphasises the benefits of consistency and completeness and integration.

Providing that the software provided in the standard software suite fits adequately the use to which it is to be put, then such consistency and completeness and integration is a

realistic possibility and the benefits are clear. If however a real implementation in practice requires the need for significant modification and/or additional bolt-on software, then such an idealistic approach will fail.

In either event, for the purpose of this research there was little of useful detail in the material provided.

### **5.2.5 The Net Schedule product**

#### **(a) Introduction**

The Net Schedule product is a web-EDI application marketed to medium size companies with a need to attach such an application their ERP system. It appears to be typical of a number of similar products

#### **(b) Description**

Net Schedule is an attempt to address the issue of why, despite an awareness of the advantages and profits that can be gained by using EDI, many suppliers of many companies are still not using it. One of the reasons for not using EDI in a larger extent is a conception that it is too expensive and too complicated to install and use. This is especially true for small and medium sized manufacturing companies.

Net Schedule is marketed as a complement to traditional EDI. It makes it possible to connect all suppliers regardless of having an EDI connection or not. Therefore, all suppliers can be connected and communicate via electronically. The only equipment needed is a PC connected to the Internet. By this, the supplier can get immediate access to a planning and notification tool with shipping notes and dispatch labels according to the EDI standard in a very cost efficient way.

All suppliers are set up as EDI suppliers. The schedule is sent to the EDI system. There a switchboard decides whether true EDI or Net Schedule is used. The schedules directed to Net Schedule will then be, instead of being sent to the supplier, published to the Internet. The supplier would then log on to the Net Schedule application and work with the schedule. Functions provided include the ability to compare schedules with previous. They can create shipments, print barcode labels and dispatch the goods in that application. Information of the dispatched goods is then sent as an EDI dispatch advice notes, thus enabling the customer to receive the physical goods in the context of the expected receipt information.



(c) **Comments**

The way that concept normally would be implemented involves the suppliers having to choose between true EDI and web EDI. If they choose web EDI, and are given access to the Net Schedule application, they are invoiced a fee for the use of it. That means that the suppliers normally pay the investment.

This concept of web EDI is being marketed to companies as a "no cost" initiative because all the cost will be born by the companies' suppliers. So however much trouble this causes (for example with each supplier having to deal with a different "net schedule" system from each customer), it is not a problem for the organisation imposing the system on its suppliers.

So this sort of product is purely for the benefit of the customer. He is able to run the system as if all the suppliers are using EDI. This would be of great benefit if a customer for instance wished to automate its goods receiving using EDI transmitted advanced shipping notes from all its suppliers, and it wanted this to be 100% even from small suppliers.

The benefit of web EDI looking at it from the supplier's side is really none. Unless specific (i.e. specific to this software product) is undertaken, the supplier will have to read the information on the web site and re-key all the information into his own system (unless the supplier is too small to run any sort of system at all). Whether this is a good idea from the standpoint of the total supply chain must depend on how easy it is to integrate these schedules into the systems controlling the individual businesses (if any).

The sort of Web-EDI represented by this product adds nothing to our understanding of the functionality of e-business because the functions supported are already defined within the EDI context. Web-EDI provides a simpler cheap access to EDI functions in those situations where organisations would not otherwise be able to afford them. As such therefore it can provide the justification for the model suggesting EDI functions for the smaller organisation for which EDI would otherwise be considered to expensive an option.

**5.2.6 Covisint**

(a) **Overview**

The introduction of exchanges, as a practical manifestation of a more interactive approach to supply chain partnering, has been commented on in chapter 2.7. "Covisint" (derived from **communication, visibility, integration**) is a pioneering example of such an initiative. Covisint

claimed to be "the technology services company whose business-to-business applications and communication services connect the global automotive industry". The idea was:

- To provide customers with a common connection to their suppliers and customers based on common business processes".
- By working with manufacturers, suppliers and industry trade groups worldwide, to define and implement effective common processes for the industry
- By connecting through Covisint, to reduce costs, increase efficiency, enhance quality and improve time to market

A more detailed examination of the facilities that were actually provided at a point in time (2002/2003) follows.

The fluid nature of such initiatives should be emphasised again. Applications seemed to come and go, presumably depending on the number of takers. Because this is a relatively new and untried area it is only to be expected that ideas will evolve and objectives and scope will change as some ideas succeed and others fall by the wayside.

**(b) Covisint Functions**

- (i) *Portal* - The provision of "web-page" functionality to provide notifications, information distribution and access to other services (including access to the other functions listed below), for example
- Presentation of a notification appearing on homepage (new Advanced Ship Notice (ASN) to "check").
  - Use of the "Supply Connect" (in effect the EDI application) to "review" (presumably view it and take a hard copy) the document
  - Use of supplier directory to locate potential suppliers of a new component.
  - Noticing a news article describing a new quality initiative at a trading partner
  - Direction to online training relating to a new feature on their applications menu
- (ii) *Collaboration Manager* - The classic domain of Product Engineering Exchange functions, essentially a clearinghouse for project documents, assisting the coordination throughout an engineering multi-disciplined project team including the supplier's organisation. The functions performed include:
- Creation of a workspace for the project;
  - Recording the members of the team;
  - Management of relevant documents (for example marketing specifications, project-specific);

- Management of notifications to team members;
- Reviewing documents;
- Conducting virtual design reviews;
- Assigning and track issues.

(iii) *Fulfilment* - Functions to optimise supply chain performance by exchanging and sharing all relevant supply chain management information. Specific functions performed were

- Real time visibility into the buying organization. This involves the display of consumption and production information on a live electronic dashboard. Examples include inventory levels, min/max levels, in-transit Inventory, usage rates and trends, last received shipments and Supplier Ratings;
- Automatically generated notifications if inventory levels or other items stray out of predetermined boundaries.

(iv) *Quote Manager* - As the name suggests a tool to manage a quotation process, namely:

- Assists assembly of a package containing all the documents that define a requirement requiring quotation, including images, statements of requirements, delivery and shipping terms and quality goals;
- Makes this package available to potential suppliers;
- Issues Request for Quote (RFQ);
- Provides tool for suppliers to develop and assemble RFQ responses and finally to route their submissions;
- Provides notification mechanism (e-mail) if buyer has to modify a document in the package.

(v) *Catalogues* - With Auctions, the two most mature functions in e-business, the essential feature being the use of the Internet to host catalogues and to order based on such catalogues. The functions involved include:

- Provides tools and services to convert product information into an electronic catalogue;
- Manage catalogue data creation and approval online;
- Access to catalogue via tool to do a keyword or category search for the required material;
- Order items from external seller websites using open interface;
- Creation and submission of requisitions using customisable forms;
- Use of company's pre-determined workflow for approval;
- Request item information to create purchase orders for non-catalogued items;
- Electronic creation and sending of a purchase order to the supplier;

- Ability to check order status and item availability in real time;
- Minimize the physical and paper intensive tasks and streamline your process.

(vi) *Auctions* - The idea here is the use of electronic auctions to source components and materials in a wider variety of situations that would previously have been the case, predicated of course on the concept that price is the dominant factor in most if not all purchasing decisions. The functions include:

- Creation of an on-line auction event by the buyer;
- Notification of invitations to potential sellers;
- Monitoring of the auction progress on-line, by the buyer;
- Submission of bids by the bidder through a simple user interface;
- (Subject to the auction rules), monitoring of the auction progress on-line, by the seller.

(vii) *Advanced Quality Planner* - A system of relevance to Automotive Original Equipment Manufacturers (OEM's) which supports the communication and reporting of APQP (Advanced Product Quality Planning) requirements, changes and status between customers and suppliers. The functions include:

- The provision of an audit trail of actions;
- The captures and reporting of quality document evidence.

(viii) *Problem Solver* - An odd little OEM system that seemed to have been included at random into the exchange. The functions included a method of documenting analysis and reporting added-cost activities, such as inspection, sorting, re-work, lost production units and downtime expense, presumably caused by quality issues.

(c) **Comments**

The success and or relevance of the concept of exchanges will rely totally on the success and usefulness of the individual functions provided by them. These functions seem to be a mixture of the sophisticated and the marginal. Scepticism about the potential value of some of these functions is already clear from the literature quoted earlier.

Many of the functions described here seemed to have disappeared by 2006. Nevertheless as an indication of what the e-business community is aspiring to, the functions provided by Covisint at the point in time referred to here provide a useful checklist. The relative lack of success of some of the functions serve to emphasize further (if such emphasis were needed) the value of having some way of targeting e-business functions based on some

objective assessment of their suitability to a specific situation (rather than just assuming that everyone will buy anything providing it contains the e-business label).

### 5.3 Development of E-business functional model

#### 5.3.1 Introduction

- (a) Primarily from the e-business marketplace sources, it was possible to construct a comprehensive identification of the detailed functionalities covered by the general "e-business" label. These functions were structured into a number of functional domains as illustrated in Figure 5.1 and described in detail in 5.3.2.

Demand Side	Product Development and pre-production
	Demand Management
	Supply Chain Planning
	Outbound Logistics
	Customer Accounting
	Service
Supply Side	Product Development and pre-production
	Supply Chain Planning
	Purchasing and Procurement
	Inbound logistics
	Manufacturing
	Supplier Accounting
	Maintenance
"Inside"	General Finance
	Administration

Figure 5.1 - E-business functional domains

Within these domains, the general structure suggested by McCormack and Kasper is helpful in designing the structure of functions appropriate to E-business. To this should be added the extra distinction between unstructured information sharing (for example these are our plans) from defined business transactions that perform universally understood functions (for example deliver this part at this time). The e-business functions were therefore structured, (for both the customer direction and the supplier direction, including sub contractors) into:

- **Informational Functions** - Envisaged as the one way accessing of information (or the provision of information for other parties to access);
- **Transactional functions** - Envisaged as the one way routine transmission of information, ideally in an automated form, linked to the specific business process that generated that information;
- **Control and Co-ordination functions** - Envisaged as (often) two-way processes, which prepare for, manage, or deal with issues arising from the operation of the business processes associated with, or made possible by, the other e-commerce

functions. In many situations this will describe those processes involving collaborative interaction between partners.

### 5.3.2 Description of the functional domains

#### (a) Demand Side Functions

##### (i) Product Development and pre-production

In product design and development an organisation frequently need to operate in partnership with customers. There are projects that need to be managed jointly and support is required for these collaboratively managed project environments. In addition design and engineering information and change requests that need to be formally communicated between the partners.

##### (ii) Demand Management

This encompasses all the communications relevant to the process of creating and recording customer demand within the organisation's systems. It ranges from the provision of product and pricing information, through enquiries and quotations to the setting up of contracts and orders and potentially the calling off of shipments against such orders.

##### (iii) Supply Chain Planning

In the customer facing direction, supply chain planning is the process responding to the customer's supply chain planning requirements of your company as a supplier. Your company may need to operate within collaborative processes communicating capabilities or plans to the customer. Your company will certainly want to be aware of and use forecast demand from the customer when this is available.

##### (iv) Outbound Logistics

Outbound logistics describes all communications to and from the customer and other external partners that are relevant to the despatch of goods. It encompasses the organisation of transport (where necessary), the instructing of remote consignors to despatch (where appropriate), the advising of the customer that a despatch has taken place, and the monitoring, management and control of whatever logistics process is necessary to get the goods to the customer.

##### (v) Customer Accounting

This encompasses the set of possible electronic communications between a company and its customers or other financial organisations relating to the management of the credit given to customers, and the subsequent payment for goods supplied under the financial conditions agreed between the buying and selling parties.

(vi) Service

For those organisations that provide post sales service, there is the need to manage service activity in situations that either involves external partners, or where the service personnel of the company operate in locations remote from those covered by the internal systems of the organisation. Electronic communication with such personnel may be involved in planning, executing, reporting and analysing service activity.

(b) **Supply Side Functions**

(i) Product Development and pre-production

As a mirror image of product design and development with customers, there is sometimes a need to operate in partnership with suppliers and potentially other partners. As in the case of customers there is also the need for collaboratively managed project environments with suppliers, and also for the formal communication of design and engineering information and change requests between the partners.

(ii) Supply Chain Planning

In the supply side direction, supply chain planning, in its simplest form, is the process of planning what needs to be supplied by external suppliers and other partners in order to allow the company to meet the demand of its customers. In more complex situations this may involve a more collaborative rather than prescriptive process where one has to plan with recognition of the capabilities of external partners.

(iii) Purchasing and Procurement

This encompasses all the potential interactions relevant to the monitoring and management of the supplier base and the communication of demand to the supplier. It ranges from access to product and pricing information from current or potential suppliers, through requests for quotations and the management of reverse auctions to the setting up of contracts and orders and the calling off of shipments against such orders.

(iv) Inbound logistics

Inbound logistics are the mirror image of the logistics process from the point of view of the customer and describes all communications to and from the supplier and other external partners that are relevant to the receiving of goods. It can involve the organisation of and monitoring of transport where the customer takes this role, and the processing of communications from/to the suppliers relating to incoming goods.

(v) Manufacturing

E-business in manufacturing relates to a "network" situation where communication is necessary between partner plants and sub contractors. This communication may relate to materials being transferred or planning and capacity information.

(vi) **Supplier Accounting**

This encompasses the set of possible electronic communications between a company and its suppliers relating to the request for payment, and subsequent payment, for goods supplied under the financial conditions agreed between the buying and selling parties.

(vii) **Maintenance**

Even for companies that manage plant maintenance in-house, external maintenance partners are involved in many peripheral areas. There is the need to manage maintenance in situations that involve external partners. Electronic communication with partners may be involved in planning and executing maintenance activity, and in reporting and analysing such activity.

(c) **"Inside" Functions**

(i) **General Finance**

This encompasses those financial management, planning, budgeting or treasury activities conducted by separated groups within an organisation that need to be co-ordinated and consolidated. Communication between such groups potentially needs to be supported outside the coverage of the internal systems of the organisation.

(ii) **Administration**

Within an organisation there are administration systems that potentially need to be managed on a centralised basis (for example personnel records, time recording). Whether because of geographic dispersion of sites or the need to support home or other off-site working, it is necessary to create administration systems that can operate outside the coverage of the internal systems of the organisation.

**5.3.3 Functions**

- (a) Within these domains, and within the 3-level structure, the individual functions were identified, using the sources for the content described above. A detailed List of all the e-business functions is included in appendix A, and to illustrate the size and scope, figure 5.2 summarises the number of functions of each type within each of the domains.



		Number of Functions		
		Information	Transaction	Control
Demand Side	Product Development and pre-production	5	7	6
	Demand Management	10	18	7
	Supply Chain Planning	3	3	5
	Outbound Logistics	4	15	4
	Customer Accounting	3	8	6
	Service	4	8	4
Supply Side	Product Development and pre-production	4	7	6
	Supply Chain Planning	3	3	6
	Purchasing and Procurement	7	17	6
	Inbound logistics	4	11	4
	Manufacturing	3	7	3
	Supplier Accounting	2	7	3
	Maintenance	3	5	7
"Inside"	General Finance	1	3	3
	Administration	4	3	4

Figure 5.2 - Number of functions within e-business functional domains

#### 5.3.4 Model Structure

- (a) Having identified the potential e-business functions, the next step was to create the reasoning that could trigger them. From prior knowledge and the inherent logic of the situation, a preliminary rationale (i.e. a set of explicit reasons) was proposed, and these were linked to possible characteristics, thus allowing a preliminary list of characteristics linked to e-business functions to be produced. Together these functional definitions, reasons, and characteristics were combined into a model containing the rules that linked them all together. The model rules reflected both intrinsic *a priori* reasoning (for example if a company produces many invoices, then electronic invoicing may be indicated) and organisation size (for example "Function X is theoretically of value to a company with these characteristics but the size of the company probably makes it an impractical or non-cost-effective to consider"). An example of a function, a reason and characteristics is given below (Figure 5.3).

Example of a function	The reception of product design information from customer
One of the reasons that impact these functions	Significant design activity in partnership with customers (could be complexity or quantity)
Three characteristics that impact this reason	<ul style="list-style-type: none"> <li>• Number of projects per year</li> <li>• Percentage of Customers involved in pre-production projects</li> <li>• Average number of items to design per project</li> </ul>

Figure 5.3 - Example of a function, reason and characteristics

(b) In principle, company characteristics were intended to be as objective and factual as possible (such as number of items despatched per year). For example there is no point in asking whether a customer wants EDI invoices (or whatever) and then saying that this is a reason for specifying EDI invoices as a relevant function - this is obvious and of no use. The model needs to predict that a customer is likely to require EDI invoices - even if he has not thought of it. A simple approach was preferred whereby characteristics were on/off, high/low or significant/not significant. This avoided the use of arbitrary thresholds that could never be theoretically justified and could only be validated by considering the results achieved

(c) The management concerns now needed to be added to the theoretical reasoning between characteristics and end result of function triggered. Possible management concerns influencing these functions were created primarily from the literature review, prior experience and from the conclusions of the survey. These were distilled into a preliminary list of concerns. At the outset of the development of the model, it was felt that concerns could theoretically have one of two effects:

- They could represent a problem that ought to be a motive for interest in an e-business function (for example excessive clerical activity);
- They could represent a problem that would tend to prevent an e-business function from being usable and successful in practice (for example suppliers cannot cope with e-business oriented communication with them).

Although the primary sources of the management concerns were as described above (literature review, prior experience, and survey, they were also augmented (as with the characteristics) by the intrinsic logic of the situation. For example, concerns about the competence of the Information Technology function within the organisation will have an obviously negative effect on an e-business initiative requiring complex program development expertise.

(d) A list of all the reasons, concerns and characteristics is given in appendix B. In order to illustrate the structure, the following figures take an example of one function within one functional domain and illustrate the reasons characteristics and concerns that impact this. Firstly, figure 5.4 illustrates the functions within one functional domain.

<b>Functional Domain - Supply Chain Planning</b>	
<b>Information functions</b>	Access to customers planning data
	Provision of capacity information for customers
	Provision of current forecasts for the customer
<b>Transactional functions</b>	Status of vendor or 3rd party managed inventory
	Transmission of production schedules to customers
	Reception / integration of customer forecasts
<b>Control and Co-ordination functions</b>	Comparison of demand with constrained supply plan
	Collaboration on forecast exceptions
	Establishment of parameters for partner managed inventory
	Notifications and planning alerts from customers
	Collaborative performance data collection and presentation

Figure 5.4 - Illustration of the functions in one functional domain

Within this domain, figure 5.5 gives an example of one function, its description and the potential reasons why it could be relevant.

<p><b>Function Title</b> <i>Collaboration on forecast exceptions</i></p> <p><b>Function Description</b> This is a refinement of the process of sending exception messages between you and the customer. The idea is that you both collaborate on exceptions more interactively, enabling problems with the model of the supply network and the production plans to be solved more quickly. This type of collaboration uses Internet-based facilities (typically using a supply chain exchange) to share data more effectively and turn around exception situations more frequently.</p> <p><b>Reasons for the relevance of this function</b> The planning/master scheduling task is of significant size Forecasts are necessary to plan production Forecasts are potentially reliable enough to be useful The market is susceptible to abnormal demand patterns (i.e. spiky demand is common). Scheduling and promising of demand is dictated by manufacturing schedules reflecting capacity utilisation of key resources</p>
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Figure 5.5 - Illustration of the reasons for the relevance of a function

- (e) Figure 5.6 illustrates the characteristics that potentially could trigger one or more of the potential reasons relevant to this function.

**Characteristics that affect this function**

Total number of master scheduled items (i.e. total number of items for which MPS is carried out).  
The average number of customers delivered to per week.  
Percentage of products where demand can be considered as seasonal (peak in demand twice the value of the trough).  
Period of time for which the forecasts are accurate enough to base the manufacturing planning on (as a percentage of customer demanded lead time).  
Percentage of production that can be considered sell-from-stock (i.e. forecast driven, order point driven or similar).  
Percentage of production that is not started until the customer orders are received (i.e. make-to-order).  
Period of time for which the forecasts are accurate enough to base the manufacturing planning on (as a percentage of customer demanded lead time).  
Percentage of production that is geared towards fashion products (total market for the products can change unpredictably).  
The average percentage of the master schedule changed within the lead-time horizon due to demand changes.  
Period of time for which the forecasts are accurate enough to base the manufacturing planning on (as a percentage of customer demanded lead time).  
Percentage of customers who are loyal in the medium term (i.e. do not shift to other suppliers within medium term planning horizon).  
Percentage of production where planning is significantly capacity constrained (including labour)  
Average number of spot orders received per week (as opposed to schedule call-offs).

Figure 5.6 - Illustration of the company characteristics that can affect the function

- (f) Finally, figure 5.7 illustrates the concerns that potentially could trigger one or more of the potential reasons relevant to this function.

**Concerns capable of impacting this function**

We cannot rely on our customer's forecasts  
Customer lead time expectations are a significant management issue for us  
We currently consider that we have an insufficient forward view of demand  
Our customers dictate requirements without concern for the problems they cause  
Customers fail to communicate requirements clearly or respond effectively to queries  
We incur expense because of our customer's non-adherence to industry standards  
We are constrained by the e-business capabilities of our Customers  
Our relationship with the customer depends on a personal relationship  
We have poor data accuracy  
IT investments generally fail to achieve their objectives because we do not use the software well  
We usually find that the costs of introducing e-business functions cannot be justified in relation to the benefits obtained  
We do not have the management determination to exploit e-business

Figure 5.7 - Illustration of the Concerns that can affect the function

**5.3.5 Model Reasoning**

The model reasoning was created to give a verdict for each of the e-business functions identified in a given case study situation. In effect the model gives a verdict for each function using the following codes:

- H - This function is likely to have a high relevance to your organisation
- R - This function is likely to have some relevance to your organisation
- N - This function is unlikely to be relevant to your business
- X - This function is very unlikely to be relevant to your business (and may possibly be counter productive)
- ? - There are positive AND strong negative indications for this function in your business. Detailed examination of the reasoning is required

In order to for the model to arrive at these verdicts it relies on combining the verdicts for a number of reasons, each one of which has the ability to influence the verdict in one way or the other. The verdict for each individual reason is derived from considering the characteristics and reasons, and the individual relevance rating of each reason is established using the following codes:

- H - This reason has been triggered and should have a highly positive influence on the assessment of the relevance of the function
- R - This reason has been triggered and should have a positive influence on the assessment of the relevance of the function
- This reason has not been triggered by the model and has therefore no influence (positively or negatively) on the assessment of the relevance of the function
- N - This reason has been triggered and should have a negative influence on the assessment of the relevance of the function
- X - This reason has been triggered and should have a highly negative influence on the assessment of the relevance of the function

In order to develop an overall verdict for the function from the individual verdicts for each potentially contributing reason, a logical method for combining the reasons was developed. This logic is explained in detail in appendix E, but the essential points were that highly relevant (that is, "H") reasons force the function to be considered relevant to the organisation whatever the other reasons indicate, and the highly negative (that is, "X") reasons cause the function to be "black-balled", again irrespective of the verdict for the other reasons. As will be seen below (section 6.4.1), the testing and validation of the model tended to reduce highly relevant (that is, "H") characterised reasons because in practice they were found to overwhelm other relevant reasoning in the model.

The report presenting the results of the model in an individual case gives the overall verdict for each function in the main body of the report and the detailed verdict for each reason in an appendix.

- (b) In order to give a picture of the detailed model results, Figure 5.8 shows an example of the model output in one case study in relation to one of the 257 possible functions. It shows the overall “decision” of the model and also the reasons that contributed to this decision. Reasons that contributed to the function being considered potentially relevant are indicated with “R”. ‘N’ indicates reasons that contributed to the function being considered potentially irrelevant. Reason that were not triggered and have therefore had no effect are indicated by ‘-’. The overall “decision” was “uncertain because potentially positive reasons based on characteristics were outweighed by negative factors derived from management concerns.

ADP210	Reception of product design information from customer	Overall: ?
The formal transmission (via EDI or similar web based methods) of product data (e.g. product structures), design content files (e.g. drawings) from customer		
<i>Reasons associated with this activity</i>		
DP01	Significant design activity in partnership with customers (could be complexity or quantity)	R
DP01N	There is no significant customer partnership in the design of our products	-
DP02	Significant number of complex pre-production enquiries	R
DP03	There are a significant number of complex, one-off, “project” style orders.	R
DP10	Customers do a significant amount of the design and engineering of the products we sell	-
CD02	Our customers fail to respect industry standards	N
CD04	Customers fail to communicate requirements clearly or respond effectively to queries	N
CD25	We are constrained by the e-business capabilities of our Customers	N

Figure 5.8 - Example of an indecisive verdict for one function in the model

- (c) Figure 5.9 by contrast shows an example of another functions, in this case one rated as “Highly Relevant”. Here, although there were also concerns that were triggered, the positive reasons for the applicability of the function were sufficiently great to overcome these.

ADD330

Reception / integration of customer repetitive firm demand

Overall: H

The customer transmits to you (normally in the form of a delivery schedule against a long term contract or blanket order) the details of the deliveries that he wants. The contract or blanket order will have established the terms and conditions of supply, and also the normal delivery rules. All that is normally required here is a statement of quantities and dates (with perhaps some delivery reference data)

*Reasons associated with this activity*

DD03	There are stable medium term relationships with important customers.	R
DD04	Schedule call-offs are used for customer specific, long-term contracts.	H
DD05	EDI is a condition of doing business with the customers.	R
CD02	Our customers fail to respect industry standards	N
CD25	We are constrained by the e-business capabilities of our Customers	N
CG03	Systems are incompatible and poorly integrated	-
CG09	We are constrained by the shortage of IT skills	-

Figure 5.9 - Example of a decisive verdict for one function in the model

#### 5.4 Conclusions

- (a) The academic literature review, in establishing that the "e-business" and "e-commerce" labels are not actually helpful, concluded that it is better to concentrate on specific functionality and practicality at the detail level. This presupposed that it was possible to establish such "e-business" functionality at a level of detail sufficient to enable the process of developing an e-business model.

The purpose of this chapter was to establish whether one could discern the detail behind the "e-business" concept by studying the e-business products in the market place, products which are designed to deploy functionality of significant benefit to manufacturing and distribution organisations.

- (b) The ODETTE organisation provides a list of those transactional communication processes that have been defined for the automotive industry sector. Although a theoretical list (not all of these processes are actually used by anyone in practice), they represent a good checklist of those potential electronically supported processes that have been proposed theoretically by an objective organisation. Accordingly they provided a useful checklist for the development of the functions of the model, especially those relating to formal business transactions.

- (c) SAP has invested effort into presenting an e-business vision at a useful level of detail. The SAP e-business "maps" represent a creditable attempt to translate e-business into meaningful detailed functionality. These maps were useful as a checklist of functions not to be missed. They were also useful as an indication of the situations in which the functions could be relevant and therefore also useful as indicators of some of the rules that should govern such functions.
- (d) In contrast to SAP, Oracle has little to say on functional detail, but emphasises the Internet, information and database issues. It has adopted the concept of e-business as a suite of software representing an integrated and unified concept of all the applications necessary to run a business. Such an approach seems little more than the notion that the concept of "e-business" in fact equals a modern ERP suite. Whatever the merits of this as a notion, for the purpose of this research there was little of useful detail in the material examined.
- (e) The Web-EDI product discussed was useful in that it showed how EDI functions could be made affordable for the smaller organisation. As such it provided the justification for the model suggesting EDI functions for smaller organisations. Web-EDI did not otherwise add functions to the e-business model (because the functions supported are already defined within the EDI context), but they made more credible the theoretical functions proposed for example by the ODETTE organisation.
- (f) The functions contained by the exchange product examined seemed to represent a curious mixture of the sophisticated and the marginal. Nevertheless they can be taken seriously as a checklist of the possibilities of the e-business concept.
- (g) It is therefore concluded that one can indeed discern an adequate amount of the detail underlying the "e-business" concept from the study of a selection of the e-business products in the market place. It has therefore been established that it is possible to develop an initial e-business functional model, using as a source and partial starting point, the functions that the market place is trying to sell or otherwise define under the e-business banner.
- (h) From the sources described above, it was possible to construct a comprehensive identification of 257 detailed functionalities covered by the general "e-business" label. These functions were clustered into fifteen of functional domains grouped as "Demand Side Functions" (i.e. customer facing) "Supply Side Functions" (i.e. supplier facing) and "Inside



Functions" (i.e. primarily intra-organisation). It was concluded that the e-business functions should most appropriately be structured, into:

- Information functions;
- Transactional functions;
- Co-ordination and Strategic functions.

- (i) A preliminary rationale (i.e. a set of reasons) can be produced in order to link these e-business functions to possible factual characteristics and subjective management concerns. Furthermore it has been demonstrated that it is possible to develop a reasoning structure that links the characteristics and concerns of the company through detailed reasoning to an overall verdict as to the overall relevance of a given function.

## **6 Testing and refinement of the model**

### **6.1 Method**

- (a) The major activity of this phase of the research was the recursive development, testing and refinement of the preliminary model so that a working version suitable for practical application in a manufacturing organisation can be produced. This process of testing and refinement was divided into three phases.

Phase one was regarded as part of the model development process. Running the model for the first case study was regarded as a "system test" in order to execute the process and to get as many technical errors and obvious mistakes out of the model as possible. This case study is referred to as the "system test" case study.

Phase two was oriented towards refining the model. This is done by a process of running the model for a number of case study instances. These are referred to as the "refining" case studies.

Phase three was intended to demonstrate that the model had become reasonably stable; sufficient to give reasonable results in new case studies and demonstrating a significantly lower level of change as a result of the experience of these studies. These are referred to as the "re-testing" case studies.

The phase two case studies were regarded as parallel, whereas the phase three case studies were treated as successive (see below 6.2.3 and 6.2.3).

- (b) In all three of these phases the process was fundamentally the same. Each individual case study was conducted along the following structured lines.

The case study contact (someone who is authoritative on the case study organisation's e-business current activity and future plans) was interviewed. At this interview the input questionnaire was completed interactively. Appendix D contains an example of the input questionnaire.

The model was processed and an e-business functional report produced containing the predictions of the model.

The functional report was then worked through with the interviewee. "Post hoc" rationalisation of the reasons for discrepancy was then undertaken. The views of the

interviewee were not taken uncritically, but areas of disagreement were exposed and explained in terms of the rules contained in the model. An agreement was reached as to whether the correct functions were being recommended or not recommended, and also whether there were functions thought to be relevant, missing from the report.

Areas where the model seemed to be incorrect were studied and any flaws or inadequacies in the reasoning exposed. The model was corrected and/or further developed as required. If after this the answer still not "correct", (this was relatively rare), then such discrepancies had to be accepted as a reasonable difference of opinion.

## **6.2 Description of the case studies**

The characteristics of the case studies are described below. The case studies were to some extent self selecting in the sense that they were organisations that had a genuine interest in the topic. The location of the case studies (UK West Midlands) explains the heavy bias to automotive related organisations, the automotive sector demonstrating both activity and interest in the e-business domain.

### **6.2.1 The Testing Case Study**

Case study A, the "system test" case study, was a company manufacturing high precision, safety critical automotive components. This organisation is part of a major multinational, but for a variety of reasons (historical, market segment addressed), it had its own systems and information strategy. In fact it could be regarded as a medium to large company in its own business sector. The products are safety critical and/or have high technical specification and a significant percentage is exported outside UK.

Relationships with customers tend to be semi permanent. The products are designed for and with the specific customer and then supplied on a regular basis for the product life. The design period typically lasts for around three years, and the supply phase for perhaps five years. During this time it is hoped that future replacement projects for the customer are being worked on. The customer base is therefore relatively stable in the short term. If it breaks down in the medium to long term it breaks down in the form of the customer going elsewhere for the replacement projects. Customers expect a just-in-time flow of products in accordance with their demand, and the company tries to manage both manufacturing and supply along similar lines. Suppliers are also involved in pre-production processes. The purchased items are designed either by the company or by the suppliers themselves, but essentially the same principles and type of relationships apply as with the customers.

The value of this case study consisted of the opportunity to study within one plant a modern supply chain situation, with all of the e-business pressures to which any significant player in the automotive sector would be subject to.

## 6.2.2 The Refining Case Studies

### (a) *Case Study B*

Case Study B was a division of a major multinational involved in the supply of heavy agricultural machinery. In this business everything is configured for the customer. The business can be characterised as configure to order. There are basic models and components, but the precise delivered configuration is configured to customer requirements on an order-by-order basis.

There are a large number of distinct product ranges (i.e. number of different families or major sub-families), and many options within each range. The customers (real or prospective) are not generally involved in the design of the products. The cumulative material lead-time (time to manufacture plus time to purchase the parts) is up to six months. The number of production-related suppliers used is commensurate with the size of the business. Some of the products sold are factored (i.e. purchased from suppliers and sold on).

This company itself does not deal directly with end users. The customers of the company are a large number of dealers in the company's products and it is the dealers that deal with customers. The e-business capabilities of such dealers are a significant constraint.

Among the major interests of this case study was the opportunity to study organisations with complex dealer networks and heavy requirements to configure products from the end user. Also with the company being a large organisation, one could expect the "large organisation" e-business functions to be relevant also.

### (b) *Case study C*

Case Study C was a small UK West Midlands metal forming company that makes metal components for a variety of engineering applications. By coincidence (there was no prior arrangement) it transpired that the company was a supplier to another of the case study organisations.

A large proportion of the company's products are specifically developed for and with the customer and then supplied on a regular basis for the duration of the product life. The

remaining products represent the company's specialised products for which it has multiple customers. Incoming demand is predominant that of customer schedules where regular deliveries are made in the context of a semi permanent contractual relationship, as opposed to one-off spot orders. About 60% of the items sold are subject to just-in-time pull by the customer.

The purchased production items are primarily commodities – in other words standard products. There were some constraints created by the capabilities of suppliers. Suppliers are therefore not involved in product design. A significant percentage of production (up to 50%) is in the context is significant capacity constraints (including labour).

This case study provided the opportunity to test that the model is capable of giving sensible results for a small company. It was also of particular interest to consider a supplier to another case study organisation.

**(c) Case Study D**

Case Study D was a sales company offers a wide range of products for the automotive industry including both original equipment and for the aftermarket. Products include air conditioning, heating systems, and electrical automotive and electronic fuel management systems. A wide range of product variants is involved, usually specifically developed for the customer. Many are of a safety critical nature and/or have high technical specifications.

The particular characteristic of this company lay in the fact that it was a sales and logistics distribution company. Although a wide range of products were sold and distributed, all the products are purchased and most of the purchasing is done from a parent company, in effect from one monopoly supplier who delivers on its own terms, as being the only source. An extensive amount of product design work was nevertheless undertaken with potential customers and the parent supplier.

This company experiences the business issues associated with both the regular supply of high volume products on a contract basis and the more classical managing of occasional spot orders for low volumes.

The particular interest of this case study is that it involved an organisation with no direct contact with manufacturing, but was nevertheless of a large size and with significant "supply chain" issues.

(d) **Case Study E**

Case Study E was a medium size company that produced very low technology products and where the manufacturing was very simple, even trivial. In fact the processes involved little more than repacking. Nevertheless in its business sectors the need to play its part in modern supply chains, communicate electronically with customers and suppliers was just as significant as for much larger businesses. The items sold are developed in partnership with the customer and the supplier in partnership, and then supplied on a regular basis for the product life, with a very short customer demanded lead-time. There were a large number of schedule call-offs received (as opposed to spot orders).

Pre-production projects take about 18 months, and a relatively low number of different products are newly introduced in any year. A significant number of items are subject to just-in-time pull by the customer, Although not currently a significant factor, it was nevertheless envisaged that suppliers in the future will manage the provisioning of a significant proportion of parts (Vendor Managed Inventory) and that significant numbers also will be delivered direct to the point of production.

The value of this case study lay in the opportunity to study a relatively simple company, but one that still had significant e-business pressures.

(e) **Case Study F**

Case Study F was a major multinational and probably the world market leader in one specialist automotive component sector. The products are manufactured and supplied to customers throughout the world including in the UK. The business is global; there are nearly 50 manufacturing locations in more than 20 countries. Almost every car manufacturing location in the world is delivered to, often on a daily basis.

This is high volume repetitive manufacturing company - a single order (in effect a contract for repetitive supply) may last years. The companies within the group in broad terms make a single type of product but every detailed application to a variant of car is unique. Product development and launch phase performance is critical. A defined project management system that has 36 steps is used, with each step having dozens of deliverables.

Suppliers are also involved in the product design. The purchased items are mostly designed either by the suppliers specifically for the application. In this business the objective is to deal with the suppliers using the same methods as the customers use.

The particular value of this case study lay in the fact that the divisions of the organisation throughout the world were highly coherent both in terms of the products sold and the manufacturing processes undertaken.

**(f) Case Study G**

Case Study G was a small manufacturer of mechanical handling equipment that manufactures products to fit specific environments. Approximately 20% of the business by value (although 50% of the volume) represented the application of standard products to a situation. The remaining business represented the customisation of the basic product range to fit the individual customer requirement or indeed the creation of completely bespoke product for a specific circumstance.

There is a significant amount of fabrication work, the availability of skilled labour being a significant constraint. Typically a manufacturing lead-time of two months is involved. A significant amount of sub contract manufacturing was also undertaken. Service of installed products is a significant issue for the company although the scale of the service operation reflects the smallness of the company.

Purchase items are split between standard components (where the supplier has multiple customers) and commodity products. There is therefore no supplier involvement with design and no products designed specifically for the company. Having said that there were long-term semi-permanent relationships with a significant number of suppliers.

The value of this case study was the opportunity to study a situation where the company size is perhaps too small for much IT sophistication to be relevant. It was also important to ensure that (with the company size being small with a few number of employees) one tests that the model does not trigger functions of relevance only when large numbers of people are involved. In addition it was necessary to test that the model did not generate requirements for too much functionality in situations where the theoretical justification might be there but where common sense would rule that the company was too small for sophisticated techniques or facilities.

**(g) Case study H**

Case study H was a UK division of a multinational company selling specialised electrical wiring equipment. The products were typically designed for and with a limited number of major customers. There were a large number of products created in any one year, some 50

projects per year typically involving significant time duration and the control of complex internal and external resources including the customer.

Because manufacturing of wiring equipment is highly labour intensive, this organisation had moved its manufacturing operations outside the UK to take advantage of cheaper manufacturing in Eastern Europe and elsewhere. Significant intellectual front-end design activity remained in the UK, together with all the logistics facilities necessary to service customers.

The commercial and logistics situations is one of many products being sold to relatively few customers in the context of regular deliveries against semi-permanent contract relationships.

The supply chain was organised in a similar contract / schedule basis. With a large number of technical and professional employees and a significant number of remote sites including those situations where employees work from home, one could reasonable expect an interest in the intra-organisational aspects of e-business. The opportunity here was therefore to study a genuinely networked supply chain.

### **6.2.3 The Re-Testing Case Studies**

#### **(a) Case Study I**

Case Study I was a relatively small company of 200 employees, struggling in a tough market place to survive as a smaller version of a company once large. The company makes and services medium size machine tools. The customers are primarily Distributors who themselves deal with customers.

80% of the business is represented by the company's standard products for which there are multiple customers. 20% of the business is "Configure to Order" - primarily based on standard products but configured to customer requirements on an order-by-order basis. The company designs its own products (there is no involvement with customers). There are a handful of design projects in a year, and each one would tend to be significant.

Demand is usually one-off spot orders and a lead-time of 1-2 months is expected. This demand is satisfied against the master schedule. There are significant capacity constraints that affect planning.



There are a significant number of production-related suppliers. These include both "selected" suppliers (where there is a semi-permanent or long term relationship), and from monopoly suppliers (who deliver on their terms as they are the only source). There is also significant sub-contracting.

The management concerns encompass those that would be expected in a company of this type operating in this way (poor due date performance, high finished goods stocks, high level of expediting). As would be expected these also impact the supply side.

**(b) Case Study J**

Whereas Case Study F was from the standpoint of the centre of a major multinational, Case Study J represented one company (plant) within this group. This company deals with one specialist type of component, a component that is safety critical and has high technical specification. In fact it is the largest independent supplier of this specialist component in Europe. About half the production is exported.

Although there is one fundamental type of product, every detailed application to a variant of vehicle is unique to that vehicle. Therefore all products are designed originally for/with the specific customer and then supplied on a regular basis for the product life.

This is high volume repetitive manufacturing company. Demand is by schedules and call-offs from customers against long-term contracts for repetitive supply that normally last several years. Sometimes the call off's will be of the "Syncro" type where individual components are pre-identified to specific vehicles and delivered to the assembly line at a specific time for assembly.

The design effort is undertaken solely by the company (as experts in their domain), but there is a requirement for a lot of communication with the customer. There are about 15 projects per year each of which typically has a duration of 2 years. About 20% of the company's products are newly introduced per year.

The company organises its own transport with external carriers in a significant number of cases. Organisation of emergency transport is also a significant issue. (£20K per month)

There are a significant number of purchased items. The suppliers themselves mostly design these. They can be the standard products of the suppliers, or engineered to order specifically for the application.

The value of this case study lay in the opportunity to study how the e-business view at the group level could contrast with that at the individual company level.

(c) **Case Study K**

Case study K was a company manufacturing high precision components for a number of sectors but also including the automotive sector.

This organisation was a member of the same major multinational as for case study A, but had evolved in a different way as being a division of a large "big company" organisation where decision were made top down.

There were genuine differences in business environment. For example, whereas case study A was able to operate a flow manufacturing and logistics process linked to customer demand, case study K faced issues of the allocation of constrained supply to multiple competing demand streams.

In fact, although these points of difference in business environment did have some effect, the more important factor was that this organisation had developed its systems through a completely different path. It provided an example of "big company" thinking where individual divisions have to conform to a "one size fits all" information systems strategy dictated from on high by group service functions. The result was that it essentially had to adapt and make do with systems dictated by the requirements of completely different businesses in different market sectors. This in turn resulted in a poverty of expectation where it was "expected" that systems would be unable to do the job that needed to be done, and that the gap must be made up with manual effort.

The issue of why the two companies are different was real. The question was being posed: "Why do you need different systems - you are both in Automotive". There was a value in being able objectively to assess objectively where were the differences.

The value of this case study therefore consisted of the opportunity to study how two different businesses within the same organisation that can be viewed as focussed on the same market place (the automotive sector) could perhaps in fact have different characteristics and different e-business requirements.

(d) **Case Study L**

Case Study L was carried out in the same company as case study B, following a lapse of time of four years. The business studied was fundamentally unchanged in that it continued to involve the supply of heavy agricultural machinery. However, with the passage of time, it had been subject to a reorganisation, which had evolved the characteristics of the business and thus the potential e-business requirements.

Characteristics that had become more significant with reorganisation and the passage of time included:

- The percentage of items supplied through third party managed inventory;
- The percentage of production that can be considered sell-from-stock (i.e. forecast driven, order point driven or similar);
- The percentage of supply value from monopoly suppliers (who deliver on their terms as they are the only source);
- The percentage of supplies where planning is constrained by suppliers capacity constraints or fixed cycle schedules;
- The percentage of purchase orders / schedule call-offs received on time.

Concerns had also changed with the passage of time. Concerns about the quality of the internal IT function had systems had reduced, for example:

- Inconsistency of information between departments;
- Existence of informal system mentality within the company (such as private systems and spreadsheets);
- The ability of the company effectively to exploit IT investments;
- Concerns about the security associated with e-business functions;
- Excessive paperwork and clerical activity in the Customer Order Servicing functions.

Other concerns had arisen, for example:

- The reliability of customer's forecasts;
- Quality problems with purchased items;
- The EDI capability of suppliers.

Taken together with case study B this gave a valuable opportunity to study the evolution of e-business requirements with time.

(e) **Case Study M**

Case Study M was again within the same group of companies as that in Case Study B but in this case was in a different type of business, one focussed specifically on the provision of spare parts. The characteristics of the demand side were completely different.

In this business, products are generally standard products for which there are multiple customers, or standard commodity products that are generally available from a number of sources. As might be expected, the parts business is integrated with a service function. A parts service must also include an overnight response to "vehicle off road situations".

Demand side design activity within such an organisation is of necessity low to non-existent (because a spare parts organisation of necessity feeds on the designs of others. There is no significant design activity in relation to purchases items.

There is a complex supply chain with a large amount of purchase activity and a significant percentage of production (by value) that is sub-contracted. There is also a significant proportion of supplies where planning is constrained by suppliers capacity constraints or fixed cycle schedules.

Taken together with case study M this gave the opportunity to study the differing requirements of two different organisations within the same overall parent company, where the organisations operate in a different business environment with completely different characteristics and pressures.

### 6.2.4 Case Study Characteristic Summary

Figure 6.1 shows a summary of some key characteristics of the thirteen case studies the larger the number of asterisks (\*) imply that the characteristic is of more size/significance.

For example, according to context:

- \* Implies small size, volumes or significance;
- \*\* Implies medium size, volumes or significance;
- \*\*\* Implies large size, volumes or significance;
- \*\*\*\* Implies very large size, volumes or significance.

Characteristic	Case Study												
	A	B	C	D	E	F	G	H	I	J	K	L	M
Size	***	****	*	***	**	****	*	***	*	***	***	****	****
Number of Customers	*	***	*	****	*	*	*	*	**	*	**	***	***
Market Share	***	***	*	***	*	****	***	**	***	****	**	***	***
Number of Products Sold	**	***	**	***	*	***	**	***	***	**	***	***	****
Complexity of Products	***	****	*	***	*	***	****	***	****	***	**	****	**
Development Activity with Customers	****		***	***	****	****	***	****	**	****			
Commodity Sold Products		**										*	***
Standard Sold Products			**				***		***		***		***
Engineer to Order Sold Products				***			**						
Customised Sold Products		****					**		***		***	****	
Repetitive Products Designed with Customer	****		****	***	****	****		****		****			
Forward View of Demand	****	***	****	*	***	****	*	**	***	**	**	***	***
One-off Demand		***	*	*			***		**		**	***	****
Repetitive Demand	****		****	****	****	****		****		****	***		
Manufacturing Value Added	**	***	****		*	**	****	***	**	**	**	**	*
Purchased Component content	***	****	*	****	****	***	**	***	****	***	**	****	****
Number of Suppliers	**	****	*	*	****	**	**	**	***	**	**	****	****
Number of Purchased items	**	****	*	****	****	***	***	**	***	***	**	****	****
Development Activity with Suppliers	***			****	***	***				***			
Commodity Purchased Items		*	***				***		***	**	***	*	*
Standard Purchased Items		***					***		**	*		***	***
Engineer to Order Purchased Items		***							***	**		***	***
Customised Purchased Items									**				
Purchased Items Designed for Supplier	****	***		****	****	***		****		**	**	***	***
One off Purchasing		***	**	****	*		***	***	***		***	***	***
Repetitive Supplier Schedules	****	***		****	****	****	***	***	***	****	*	***	***

Figure 6.1 - Case Study Characteristic Profile

It can be seen from this table that a reasonable range of characteristics are represented by the case studies.

### 6.3 System Testing Phases

#### 6.3.1 Phase one – The system test of the model

The first case study, the “system test”, was designed to test the basic concept and was undertaken with a manufacturing organisation active in the e-business. The results were evaluated from a functional standpoint and certain improvements to the process were identified and implemented (for example clarifying the meanings of characteristics). Figure 6.2 illustrates the size of the model at the end of its system test.

Possible e-business functions	254
Reasons	114
Characteristics	120
Concerns	63
Model rules	2226

Figure 6.2 - Model statistics at the end of the system test phase

The version of the model at the end of this process was designated as “Version 1” (the version at the start being “Version 0”).

#### 6.3.2 Phase two – Model refinement

- (a) A further seven case studies (the “refining” case studies) were allocated to the model refinement phase. Although this was a small number in statistical terms, it was possible to visit every functional area and to reflect on the model the impact of company size. Inevitably some functional areas were subject to more examination than others. The purpose of the case studies was to focus attention on the areas where the model gave unexpected answers, and thus to animate the further study of the model reasoning. It was never the purpose to force the model to give “correct” answers; the model was only changed if it became clear that the model reasoning could be improved. Once corrected, the model was rerun and a report produced for the benefit of the case study participant organisation.

Although there was no attempt in this phase to run the case studies consecutively (analysing and correcting the model as a result of one case study before moving on to the next), each case study operated as a starting point from the latest available version of the model as modified based the results of other phase 2 case studies. During this phase the model migrated to “Version 4”, with the two intermediate versions retained for evolution analysis purposes (see below 6.5.2).

- (b) Figure 6.3 illustrates the size of the model at the end of the model refinement phase and illustrates its expansion during this phase.

	Number	Expansion %
Possible e-business functions	257	1
Reasons	131	15
Characteristics	122	2
Concerns	63	0
Model rules	2788	25

Figure 6.3 - Model statistics at the end of the model refinement phase

It can be seen from this that the result of the "refining" process was not significantly to expand the potential outcomes from the model or the potential inputs to it. The original functional specification as to what was meant by "e-business" therefore stood up rather well to scrutiny. What was significant about the "refining" phase was in fact in the expansion of the model reasoning. The rules that lead from characteristics to functions were made more complex as a result of studying the model in practice. This was the expected result and served to justify the model development methodology.

### 6.3.3 Phase three – Model re-testing

(a) A further five case studies (the "re-testing" case studies) were allocated to the model re-testing phases. Although this was also a small number in statistical terms, it was again possible to visit every functional area and to reflect on the model the impact of company size. Inevitably some functional areas were subject to more examination than others. In the discussion of results in chapter seven, further analyses are made of the functional coverage and spread of the case studies in this phase and phase two. The case studies in this phase were operated under the same principles as those of phase two. Where necessary the model was improved where it was felt to be necessary and appropriate. Because, in this phase, the model was expected to perform better, the practice of consecutive case studies was adopted. The results of one case study were analysed and the model corrected before moving on to the next. During this phase therefore the model migrated to "Version 9", with each intermediate version retained for evolution analysis purposes.

(b) Figure 6.4 illustrates the size of the model at the end of the model re-testing phase and illustrates its expansion during this phase.

	Number	Expansion %
Possible e-business functions	257	0
Reasons	145	11
Characteristics	122	0
Concerns	63	0
Model rules	3106	11

Figure 6.4 - Model statistics at the end of the model re-testing phase

It can be seen from this that the result of the "re-testing" process was further to expand and therefore improve the rules that lead from characteristics to functions. The potential outcomes from the model were not changed at all; neither were the potential inputs to it, the characteristics and concerns. The original functional specification as to what was meant by "e-business" therefore continued to stand up well to scrutiny, thus continuing to justify the model development methodology. The quantity of model expansion during this phase was less but still significant. The extent to which the model changed, and the consequences of the changes are subject to detailed analysis in section 6.4.

#### **6.4 Case Study Coverage Analyses**

The purpose of the case study coverage analyses was to attempt establish two things:

- Firstly, that the case studies were testing the entirety of the model and therefore represented a reasonably comprehensive test of the model;
- Secondly, that all the functions contained in the model were actually capable of being triggered (and hence relevant at least somewhere), thus giving confidence that the inclusion of each function in the model could be justified.

For the purpose of this analysis, the latest (final) version of the model was used. In analysing the triggering of functions, a triggered function was scored as 1, a non-triggered function was scored as zero, and a situation where there were contradictory indications was scored 0.5. Three analyses were produced:

- A summary of functions triggered by domain;
- An analysis of functions triggered at least once;
- An analysis of the triggering frequency of each individual function.

##### **6.4.1 Summary of functions triggered by Domain**

A summary of the complete results from the case studies is tabulated in figure 6.5. It shows the percentage of the functions triggered as a percentage of the total possible. These are summarised by type of function and by functional domain for the three testing phases:

- The Testing Case study (case study A);
- The Refining Case studies (Case Studies B to H);
- The Re-testing case studies (Case Studies I to M).



Domain		Type of function	Percentage of Functions Triggered				
			Testing	Refining	Re-testing	All	
Demand Side	<i>Product Development/ pre-production</i>	Information functions	80	66	26	52	
		Transactional functions	64	34	9	26	
		Control and Co-ordination functions	25	70	30	51	
	<i>Demand Management</i>	Information functions	45	59	57	57	
		Transactional functions	8	19	28	22	
		Control and Co-ordination functions	14	42	50	43	
	<i>Supply Chain Planning</i>	Information functions	0	14	20	15	
		Transactional functions	33	24	30	27	
		Control and Co-ordination functions	30	66	50	57	
	<i>Outbound Logistics</i>	Information functions	0	29	63	39	
		Transactional functions	43	20	43	31	
		Control and Co-ordination functions	38	38	68	49	
	<i>Customer Accounting</i>	Information functions	67	50	43	49	
		Transactional functions	63	25	13	23	
		Control and Co-ordination functions	42	27	20	26	
	<i>Service</i>	Information functions	13	32	43	35	
		Transactional functions	0	17	20	17	
		Control and co-ordination functions	0	29	40	31	
	Supply Side	<i>Product Development/ pre-production</i>	Information functions	25	5	15	11
			Transactional functions	6	8	20	13
			Control and Co-ordination functions	50	18	30	25
<i>Supply Chain Planning</i>		Information functions	33	43	67	51	
		Transactional functions	33	36	47	40	
		Control and Co-ordination functions	50	40	58	48	
<i>Purchasing and Procurement</i>		Information functions	57	54	73	62	
		Transactional functions	21	27	44	33	
		Control and Co-ordination functions	42	64	75	67	
<i>Inbound logistics</i>		Information functions	38	29	18	25	
		Transactional functions	9	17	14	15	
		Control and Co-ordination functions	38	36	33	35	
<i>Manufacturing</i>		Information functions	0	5	30	14	
		Transactional functions	0	4	6	4	
		Control and Co-ordination functions	0	10	30	17	
<i>Supplier Accounting</i>		Information functions	50	29	30	31	
		Transactional functions	36	38	29	34	
		Control and Co-ordination functions	33	29	30	29	
<i>Maintenance</i>		Information functions	100	12	33	27	
		Transactional functions	100	13	40	30	
		Control and Co-ordination functions	100	1	30	20	
"Inside"	<i>General Finance</i>	Information functions	100	57	60	62	
		Transactional functions	100	52	67	62	
		Control and Co-ordination functions	100	57	63	63	
	<i>Administration</i>	Information functions	63	48	58	53	
		Transactional functions	33	29	30	29	
		Control and Co-ordination functions	75	55	63	60	
<b>Total</b>			<b>37</b>	<b>31</b>	<b>37</b>	<b>34</b>	

Figure 6.5 - Summary of the Case Study Results

Discussion of the results of these case studies is reserved for chapter 7. The purpose of this summary is to verify that all the functional areas were "visited" by at least some of the case studies, in such a way that the model rules caused at least some of the functions to be triggered at least sometimes. From this summary it can be concluded that, although there was considerable variability in the usage of e-business function by functional domain and by type of function, there was nevertheless activity in each domain and each type of function. It can also be seen that the set of refining and re-testing case studies also in themselves provided a reasonably wide range of functional coverage, a fact important for the validity of these phases individually.

#### 6.4.2 Functions Triggered at least once

Figure 6.6 shows the number and percentage of functions triggered at least once during the 3 testing phases. In this context, a situation where there were contradictory indications was treated as a trigger (because it was in effect a "maybe"). The results over all case studies are also shown. It was also considered appropriate to consider the case studies excluding concerns because they tend to have the effect of increasing function triggering (see chapter 7 for a detailed discussion of the purpose of running the models ignoring concerns).

	No of Functions	Percent of total
Testing Case Study	116	45
Refining Case Studies	212	82
Re-testing Case Studies	217	84
All Case Studies	249	97
All Case Studies ignoring concerns	254	99
Total functions	257	100

Figure 6.6 - Functions triggered at least once

From this it can be seen that, although less than half of the possible functions were triggered during testing case study, more than 80% of all functions were triggered during the refining and re-testing case studies. Overall, in one takes account the option of ignoring concerns, 99% of functions were triggered at least once.

From this it can be concluded that the case studies did succeed in testing almost every part of the model. It can also be concluded that the inclusion of most of the possible functions in the model was justified.

It can be seen that 3 functions out of the 257 were not recommended for triggering in any case study. Since not one of thirteen case studies seems to require these functions, the

question then arose as to whether these functions should still be in the model. The three functions concerned were examined. It transpired that all three functions related to the same situation that genuinely did not occur in any of the case studies, namely relating to the supplier-managed stock being delivered directly to the production line. It was decided that, although it was reasonable to conclude that these three functions would rarely be required (because the situation triggering them is not common), it was proper to continue to include them in the model.

### 6.4.3 Individual function trigger frequency

The purpose of this analysis was to indicate the popularity of the e-business functions. As earlier, a triggered function was scored as 1, a non-triggered function was scored as zero, and a situation where there were contradictory indications was scored 0.5. For groups of case studies it was then possible to assess how often functions were being triggered.

Figure 6.7 shows the frequency distribution of the triggering of the detailed functions, and can best be explained by example. It shows for example that over all case studies 27 functions appeared triggered in more than two thirds of the studies, while 131 functions were triggered in less than one third. For the special case of the testing case study (of which there was only one), the meaning of the tabulation is that 72 functions were selected, 141 functions were not selected, and that there were contradictory indications in 44 functions.

	Detailed functions triggered by percentage range			
	0-33%	34%-66%	67%-100%	Total
Testing Case Study	141	44	72	257
Refining Case Studies	163	59	35	257
Re-testing Case Studies	131	78	48	257
All Case Studies	140	90	27	257
All Case Studies ignoring concerns	107	81	69	257

Figure 6.7 - Individual trigger frequency

This analysis provides a picture of a significant "tail" of e-business functions that (although theoretically appropriate for some situations) are not practically necessary for the majority of organisations. The profile of the requirements for each case study will be explored in more detail in chapter 7.

From this it can be concluded that e-business does indeed contain functional "hot spots" where what is provided is likely to have a wide relevance to a reasonably wide range of organisations. It can also be concluded that there are many functions (the majority in our sample) that are likely to be more rarely invoked.

This analysis also illustrates the effect of running the model ignoring concerns, demonstrating that the impact of management concerns is generally to depress the triggering of functions that would otherwise have been considered relevant. The impact of concerns is dealt with in more detail in chapter 7.

## **6.5 Analysis of the Model Evolution**

One of the key controls on the validity of the case study methodology was the analysis of the evolution of the model as the case studies progressed. The purpose of analysing model evolution was to:

- Verify the extent to which the model was giving reasonable results;
- That as the case studies progressed, the amount of change decreased thus demonstrating that the model was moving towards stability;
- That, as the model is refined by each case study, the results of previous case studies are not significantly degraded.

Two types of analysis were carried out:

- Analysis of changes - What changes were made and for what reason as a result of each case study;
- Analysis of model stability – How the results produced by the model for the system test case study changed as a result of the feedback from subsequent case studies.

### **6.5.1 Change analysis**

(a) All changes made to the model were recorded and are listed in appendix C. These changes were widely different in respect of both the size of the change itself and the wideness of effect in the model. Against each change was recorded the case study stimulating the change, the type of change and the functional domain that stimulated the change. It was therefore possible to analyse these changes by type of change (Figure 6.8), by functional domain (Figure 6.9) and testing phase:

- The system test case study; and
- The refining case studies (using an averaged out figure);
- The re-testing case studies (again using an averaged out figure).

By Type of Change	System Test Case Study		Average for the Refining case studies		Average for the Re-testing case studies	
	Number	%	Number	%	Number	%
Model Expansion - New Characteristic, Reasons, Functions	49	46	6.9	42	5.2	33
Model simplification – for example removal of reasons	14	13	1.9	12	1.4	9
Adjustments to triggering thresholds	20	19	2.3	14	7.0	44
Clarifications, adjustments and rationalisations	18	17	3.7	23	0.8	5
Questionnaire answered wrongly	0	0	0.6	4	0.2	1
Errors in the model	5	5	0.6	4	1.2	8
Model Logic improvement	0	0	0.3	2	0.0	0
Total	106		16.1		15.8	

Figure 6.8 - Changes by type of change

- (b) As can be seen, the most common changes made overall during these three processes can be categorised as model expansion. Typically these would be reflected in additional rules added in order to make the model more sophisticated (see also above section 6.3). Also of note is the significant number of adjustments to the triggering thresholds as a result of the re-testing case studies. The most significant changes made to trigger thresholds were the reduction of “highly relevant” reasons. This was not a reflection of the fact that the reasons were themselves of less relevance, but was the result of a judgement made that characterising reasons as such was counterproductive because they tended to overwhelm other reasoning in the model.

By Functional Domain		System Test Case Study		Average for the Refining case studies		Average for the Re-testing case studies	
		Number	%	Number	%	Number	%
Demand Side	Product Development and pre-production	4	4	2.7	17	1.0	6
	Demand Management	14	13	4.0	25	2.8	18
	Supply Chain Planning	2	2	0.7	4	1.4	9
	Outbound Logistics	6	6	1.1	7	2.4	15
	Customer Accounting	12	11	0.1	1	1.2	8
	Service	0	0	0.4	3	0.4	3
Supply Side	Product Development and pre-production	20	19	0.4	3	0.8	5
	Supply Chain Planning	10	9	0.4	3	0.6	4
	Purchasing and Procurement	9	8	2.9	18	3.0	19
	Inbound logistics	11	10	0.6	4	1.2	8
	Manufacturing	1	1	0.7	4	0.6	4
	Supplier Accounting	8	8	0.1	1	0.2	1
	Maintenance	6	6	0.6	4	0.0	0
	General Finance	0	0	0.6	4	0.2	1
	Administration	2	2	0.4	3	0.0	0
Cross Application	1	1	0.3	2	0.0	0	
Total		106		16.1		15.8	

Figure 6.9 - Changes by functional domain

- (b) Taking the average over the “refining” and “re-testing” case studies, it is clear that the changes during these case studies were significantly less than those made as a result of the “system test” case study. This gave the confidence that the model was moving towards stability and (more importantly!) providing reasonable results.

Although overall, the quantities of changes were significantly less during the refining phase than during the system test phase, the types of change showed in similar proportions. In the “re-testing” phase the changes were more oriented toward adjustments to the triggering thresholds.

When one looks at the changes by functional domain it can be seen that there are a number of “hotspots”. These can probably be explained by virtue of the fact that some functional domains are more active, relevant (and perhaps fashionable) than others. Demand management alone was a hotspot in all three case study phases. With this exception, the hotspots were different. Although too much should not be read into this, it was considered as reassuring that (taking all the case studies together) the major functional domains had been subject to a searching examination.

At first glance it might be considered disappointing that the volume of changes in the “re-testing” studies is not significantly lower than those in the “refining” studies. In fact the large proportion of triggering threshold adjustments perhaps suggested that the changes were on balance simpler even if still of importance. In any event, the number of changes is of less importance than the impact of the changes, and to analyse this a systematic approach to the analysis of model stability was required (see below).

### **6.5.2 Analysis of model stability**

- (a) It was recognised that there was a significant potential problem with the methodology adopted. The danger is that each successive case study can cause corrections to be made to the model. These in effect can change and potentially invalidate the results of prior case studies. And future case studies could have a similar effect on the results of any given case study.

Since all module changes were made as a result of reasoning stimulated by the case study, and not just to make the model “give the right answers”, there was confidence that this danger was minimal. It was however felt to be important to find a way of monitoring the

effect of changes made at the behest of each case study on all previous case studies. A model stability analysis technique was designed for this purpose.

- (b) For the purpose of this analysis, ten versions of the model were examined (Versions 0-9):
- Version 0 was the original first attempt at a model before testing;
  - Version 1 was the model resulting from the system test case study;
  - Versions 2 and 3 were intermediate versions during the "refining" case studies;
  - Version 4 was the definitive version of the model at the end of the "refining" case studies;
  - Versions 5-9 were the five successive versions produced as a result of the experiences of each of the five refining case studies.

The versions were applied to the case studies as follows:

- The system test case study was created in all ten versions of the model;
- The seven "refining" case studies were each created in version 1 of the model to provide a starting point, and in version 4 of the model to provide a "refining phase" end point for each. For the purpose of this analysis therefore the seven "refining" case studies were regarded as operating in parallel with version 1 as a starting point and version 4 as an end point. In order to monitor "post hoc" changes, these seven case studies were also created in versions 5-9 of the model;
- Each of the five "re-testing" case studies were created in the "before" and "after" version of the model and in all subsequent versions of the model.

- (c) As in the earlier case study coverage analysis (see above 6.4), the number of e-business functions triggered or not for each case study was counted. A triggered function was scored as 1, a non-triggered function was scored as zero, and a situation where there were contradictory indications was scored 0.5.

Figure 6.10 illustrates the applications of versions to case studies. The numbers shown represent the percentage of functions triggered for each model version to each case study to which that model was applied.

Case Studies		Model Versions									
		V0	V1	V2	V3	V4	V5	V6	V7	V8	V9
Testing	A	38	44	46	44	42	43	41	40	38	37
Refining	B		49			42	43	42	42	36	34
	C		23			20	20	17	15	15	15
	D		38			37	34	31	28	25	26
	E		37			26	25	23	23	22	22
	F		49			45	44	40	40	38	39
	G		51			33	32	31	31	29	28
	H		30			55	55	53	53	51	52
Re-testing	I					27	22	21	21	19	18
	J						53	49	48	46	47
	K							44	38	36	35
	L								49	41	39
	M									48	45

Figure 6.10 - Percentage functions triggered by version by case study

The versions shaded represent the versions concerned in the actual case study itself (the “before” and “after” version). The versions not shaded represent the model assessed according to the subsequent versions created as a result of modifying the model based on later case studies. For example Version V0 provided the initial results from case study A (“before” modification). Version V1 incorporated the changes made as a result of this study (“after” modification). Because case studies B-H were regarded as running in parallel, in each case the “before” case study was regarded as version V1, and the “after” case study version V4. Two intermediate versions V2 and V3 were applied to Case study A only, in order to test the stability of this first study over repeated model iterations. Case studies I-M were run in series with the modifications from one case study updating the model before it was applied to the next.

- (d) The analysis at this level of detail serves to indicate two things:
- A variable amount of change is triggered by the case studies themselves (shaded), ranging from significant (e.g. G and H) to relatively small (e.g. D);
  - Subsequent case studies did not generate a large amount of change.

From this it can be concluded that most of the case studies continued throughout the process to create the need to change the model. To put it more positively, they continued to make a significant contribution to improving the model. It can also be concluded that there were indications of subsequent stability in model following the changes made at the behest of each case study.



- (e) It was concluded by the researcher, however, that the analysis of function count alone (as illustrated in 6.10) was insufficient to demonstrate stability, because function percentages give no guarantee of function identity. For example there was no guarantee that the actual functions within the 42% triggered for case study B at model version V7 were the same functions as those within the 42% at model version V6. It was felt therefore that a more robust analysis of model stability was required in order to eliminate the possibility of model changes being inadvertently cancelled out in the change analysis.

A more detailed analysis of model change was therefore invented and the term "Delta Analysis" was used to describe it. The Delta analysis was based on the individual identification of whether each detailed function was triggered (on the basis that each function in each version of the model would have the status "triggered", "not triggered", or "contradictory indications"). For these three statuses that score 1, Zero or 0.5 respectively was applied.

When it was necessary to compare one instance of a case study/model version combination, the score for each detailed function was compared and the absolute value of the difference in score established for each function (to avoid positive changes cancelling out negative changes). These absolute differences were summed and a total absolute change established for the case study version. This was then converted into a percentage.

As before, the comparisons were made between the versions concerned in the actual case study itself (the "before" and "after" version), and also between the subsequent versions of the model created as a result of modifications based on later case studies. These percentages are represented pictorially in Figure 6.11a for each case study for each model version.

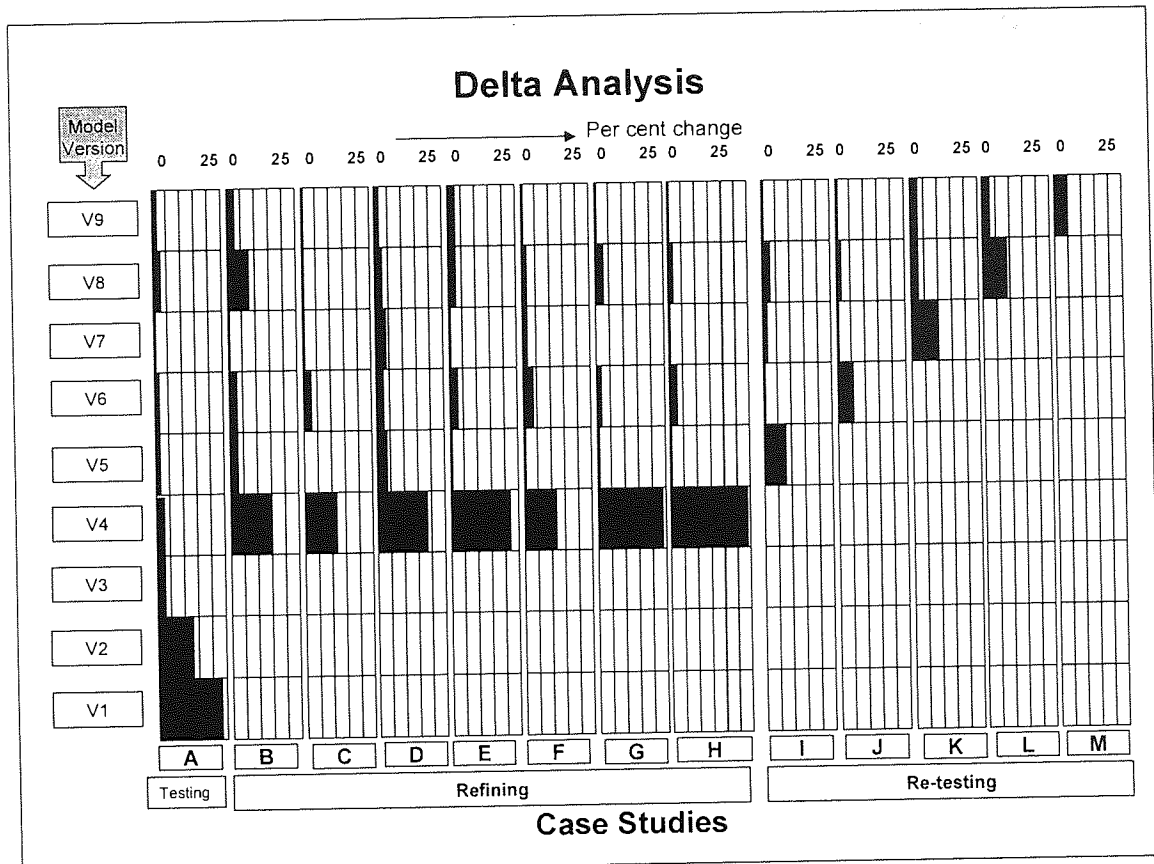


Figure 6.11a- Delta Analysis (Pictorial)

The X-axis represents the case studies and the Y-axis the different model versions. The black infill represents for a given case study the delta percentage between the given model version shown and the previous model version. The same picture is presented numerically in Figure 6.11b

Model Version	Test	Refining							Re-testing				
	A	B	C	D	E	F	G	H	I	J	K	L	M
V9	2	3	1	2	3	1	1	1	1	1	3	3	5
V8	3	8	1	3	3	2	3	2	3	2	3	9	
V7	1	1	1	4	1	2	0	1	2	1	10		
V6	2	3	3	3	3	4	2	3	1	6			
V5	2	3	0	4	1	1	1	1	8				
V4	3	15	12	19	22	12	24	29					
V3	3												
V2	13												
V1	23												

Figure 6.11b- Delta Analysis (Numeric)

As an example on how to read this delta analysis consider case studies H and I. As a result of Case study H, changes were made to the model and as a result of these changes a total absolute change percentage of 29% was calculated for case study H. In other words there

was a change in each answer given as to whether each individual function should be triggered (or not). As a result of case study I changes were made to the model and as a result of these changes a total absolute change percentage of 8% was calculated for case study I. Re-applying the new model created as a result of case study I back to case study H resulted in a total absolute change percentage of 1% for case study H.

The lowest delta for each case study therefore represents the changes made consequent on the conducting of that particular case study. The remaining deltas represent the changes that would be incurred if later versions of the model had been applied to the given case study.

The above presentation of this analysis demonstrates the following:

- Each Case Study conducted resulted in a change to the model. In the testing and refining phase these were usually significant; in the re-testing phase, notably less;
- Subsequent changes to the model based on other case studies did not seriously affect the results for a given case study, and in most cases did not significantly affect the results.

(f) This is to some extent a worse case scenario because it controls only the changes from the previous version, and does not allow for the fact that changes can be both ways with one version reversing out the change of a previous version. Model instability is therefore potentially exaggerated. An alternative view was to calculate the delta of each version not from the previous version, but from the first version applied. This would result in a truer view of model stability because it irons out such fluctuations.

The model results were again scored in detail and, as earlier, the score (Zero, 0.5 or 1) for each function was compared with the first version of the model applied to that case study. The absolute value of the difference in score was established for each function (to avoid positive changes cancelling out negative changes) and a total absolute change established for the case study version. This was then converted into a percentage. These cumulative percentages are represented pictorially in Figure 6.12a for each case study for each model version

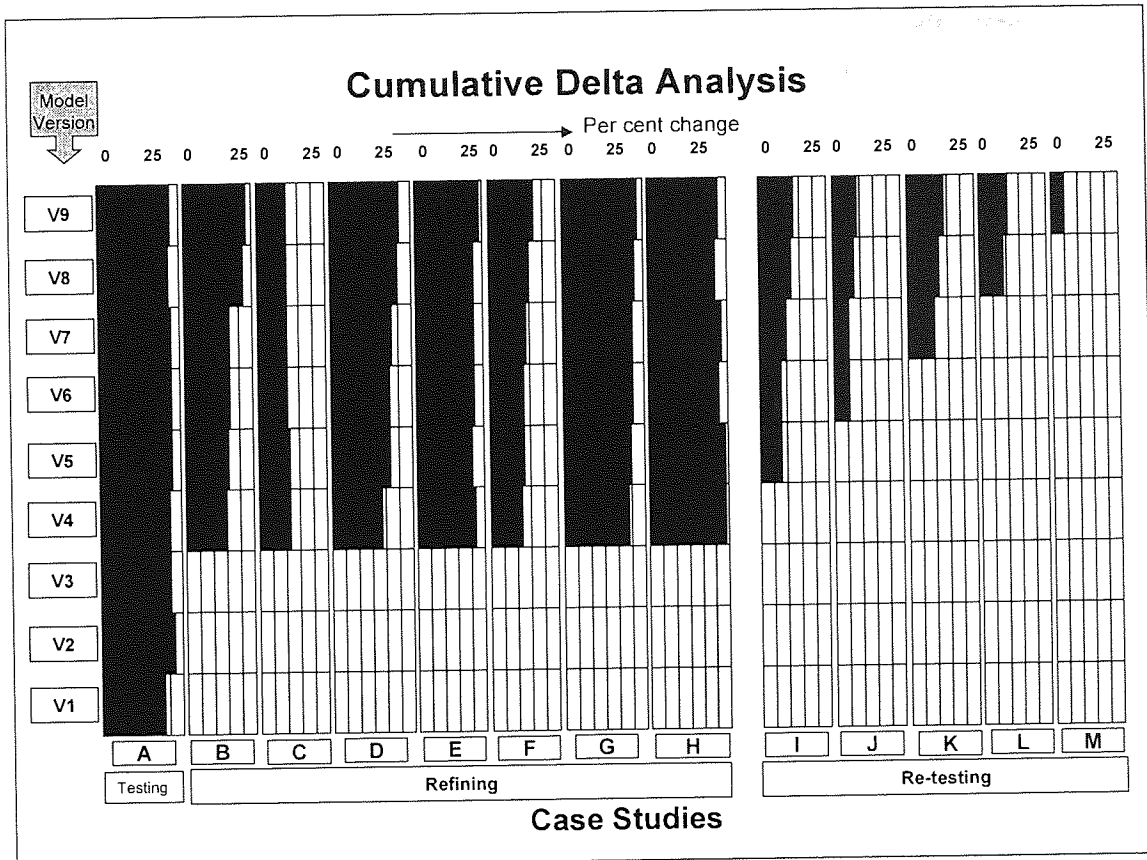


Figure 6.12a- Cumulative Delta Analysis

As before, the X-axis represents the case studies and the Y-axis the different model versions. In this case, however, the black infill represents for a given case study the delta percentage between the given model version shown and the very first model version applied to the case study. The same picture is presented numerically in Figure 6.12b

Model Version	Test	Refining							Re-testing				
	A	B	C	D	E	F	G	H	I	J	K	L	M
V9	27	23	11	26	24	17	28	27	13	9	14	11	5
V8	26	22	11	25	22	15	27	26	12	8	12	9	
V7	27	17	11	23	22	14	26	28	10	6	10		
V6	27	17	11	22	22	13	26	27	8	6			
V5	27	16	12	22	21	13	25	29	8				
V4	26	15	12	19	22	12	24	29					
V3	26												
V2	27												
V1	23												

Figure 6.12b- Cumulative Delta Analysis (Numeric)

This picture shows more clearly the stability or otherwise of the results of each case study across each version of the model applied. As an example on how to read this cumulative

delta analysis consider case studies A. As a result of the changes to the model (creating version V1 from version V0) consequent on case study A, there was a 23% change in the answers given as to whether each individual function should be triggered (or not). The input for the case study was then applied to the other eight model versions and each in turn compared with model version V0. We can see that the cumulative total absolute change from version V0 reached 27% with version V2 and stayed around this figure from thenceforward.

So it can be seen that in case study A, we see a case study that generated a 23% change in the model, but we see that each subsequent change of the model did not significantly change the results of the model. This was extremely reassuring that the strategy of only making “thought through” changes was effective in preserving the validity of prior case studies.

The results for many of the other case studies were broadly similar although there were the occasional imperfections in the picture. A significant error affecting case study B remained unnoticed until version 8 of the model, although there was no reason why it should not have been spotted earlier. This was a demonstration of one limitation of the approach taken (a reliance of value judgements; and people noticing errors)

- (g) The other issue to be dealt with was the issue of model convergence. Put simply, was the model approaching “correctness”? Was there evidence that the changes necessary to the model as a result of each case study were actually reducing in number? One would hope to see that the changes made as a result of the “re-testing” case studies were significantly reduced in number from those made as a result of the earlier studies. In Figure 6.8 presented in section 6.5.1, it seemed that the quantity of changes made as a result of the “re-testing” case studies were not in fact reduced by any significant amount, but the question of how significant were those changes was left open.

The delta analysis can be used to resolve this issue. It is clear from figures 6.11 and 6.12 that the impact of the “refining” case studies on the model was significantly less than that of the earlier case studies. This can be demonstrated more clearly by the composite cumulative delta analysis shown in Figure 6.13.

The Cumulative Delta analyses, as at the final version 9, for case studies B to H and for case studies I to M were summarised and presented alongside that for case study A.

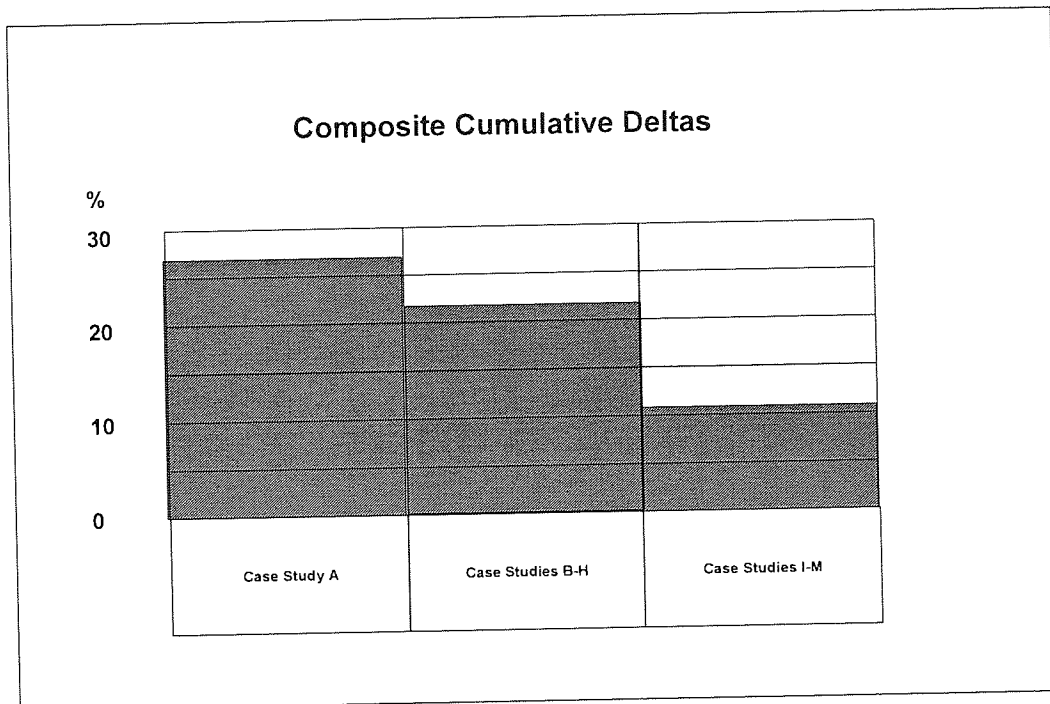


Figure 6.13 - Composite Cumulative Delta Analysis

As can be seen from this analysis, the "refining" case studies generated a lower (22%), but not very much lower, degree of model change that generated by the testing case study A (27%). The "re-testing" case studies by contrast generated a more striking reduction of the model changes (11%) thought necessary as a result of reviewing the results. Therefore, although changes were still necessary as a results of the "re-testing" case studies, the impact of those changes on the results provided by the model were clearly of less significance. So it can be seen that there is indeed evidence that the model is approaching convergence.

## 6.6 Summary and Conclusions

- (a) The model was created initially based on theoretical considerations and the strategy was to refine and improve it using a multiple case study approach. It was demonstrated that a reasonably representative range of case studies was undertaken, with a reasonable range of characteristics. The case studies were organised into 3 phases:
- Phase one (testing), with the objective of testing the process and eliminating as many mistakes as possible;
  - Phase two (refining), with the objective of getting the model to a state where it can be usefully employed;
  - Phase three (re-testing), with the objective of demonstrating that reasonable results could be achieved.

- (b) The result of these case studies, in all three phases, was not significantly to expand the potential outcomes from the model. The original functional specification as to what was meant by "e-business" was therefore little changed at the end from what it had been at the beginning. Similarly the case studies did not result in the expansion of the potential inputs to the model, these being the characteristics and concerns.
- (c) The significant result of both the "refining" and "re-testing" phases was the expansion of the model reasoning; the rules that lead from characteristics to functions. The result of the case study methodology adopted was therefore to make the rules more complex as a result of studying the operation of the model in practice. The case study methodology therefore did the job that was expected of it.
- (d) In the analysis of the functions triggered, it was demonstrated that all the functional areas were "visited" by at least some of the case studies, in such a way that the model rules caused at least some of the functions to be triggered at least sometimes. In the case studies there was considerable variability in the usage of e-business function by functional domain and by type of function. It was demonstrated that both the refining and re-testing sets of case studies each provided a reasonably wide range of functional coverage and therefore, as individual phases, represented a reasonable variety of cases.

From this it can be concluded that the case studies did succeed in testing almost every part of the model. It can also be concluded that most of the functions contained in the model was relevant. There were a handful of functions that were not triggered at all throughout the case studies. On examination, it was concluded that this was reasonable because the situation that justified the function is not common and that the functions should be retained in the model.

- (e) It was clear that e-business contains functional "hot spots", where what is provided is likely to have a wide relevance to a reasonably wide range of organisations. It can also be concluded that there are many functions (the majority in our sample) that are likely to be more rarely invoked. Therefore although all the e-business functions are likely to have some relevance in some situations, only a minority will have general relevance to the majority of situations.

- (f) One of the key controls on the validity of the case study methodology was the analysis of the evolution of the model as the case studies progressed. The analysis of model evolution demonstrated that:
- The model was good enough after the refining case studies to give reasonable results subsequently;
  - The model was moving towards stability as the case studies progressed, generating decreasing amount of change.
- (g) The changes made as a result of the case studies were widely different in respect of both the size of the change itself and the wideness of effect in the model. The analysis of changes also confirmed that overall the most common change made to the model could be considered as model expansion, this corresponding to (c) above. Changes in the "re-testing" phase also frequently involved adjustments to the triggering thresholds.
- (h) The case study approach adopted in effect facilitated an iterative learning process. Not only were the model rules expanded and improved as a result of refinement during the case study processes, but also the basic methodology was refined. The most significant example was the reduction in the incident of "highly relevant" reasons. These started out as being mechanisms for insisting on the inclusion of a given function in certain given circumstances whatever the contra-indicating factors. It was realised during the testing and validation process that this was fundamentally a wrong approach. The purpose of the model was to give a balanced judgement, and to "blot out" all other factors prevented balanced assessment. This was not a reflection of the fact that the reasons were themselves of less relevance, but was the result of realisation that categorising most such reasons as "highly relevant" was overwhelming other reasoning in the model.
- (i) Most of the case studies continued throughout the process to create the need to change the model. To put it more positively, the case studies continued to make a significant contribution to improving the model. In the testing and refining phase the changes were usually significant, representing a model accuracy of less than 80%. Although changes were still necessary in the re-testing case studies, the impacts of those changes on the results provided by the model were less, representing a model accuracy of nearly 90%. It was concluded therefore that the model was approaching convergence. Moreover the overall percentage of functions triggered by version analysis demonstrated that model change tended towards the reduction of e-business functions considered as relevant. The model can now be considered accurate enough to be useful.



- (j) Most importantly it was demonstrated that there was evidence of stability in model results. In other words, following a given case study, subsequent changes to the model based on other case studies did not seriously affect the results for the given case study. This demonstrated that the strategy of only making "thought through" changes was effective in preserving the validity of prior case studies. . It was therefore concluded that the model refinement method was sound.
  
- (l) Any methodology that relies on subjective judgements and the noticing of inconsistencies and errors cannot be perfect. Points can be missed, errors lie uncorrected or judgements can be wrong. Despite these imperfections the analysis demonstrated that the broad picture is one of a model that improves with each case study and tends to give stable results for cases even allowing for such improvements. The experience of testing and refinement of the model described in this chapter has demonstrated that such a case study process has produced a model that gives sound results and tends to improve with usage. It is therefore felt that the basic research method adopted has been validated.

## **7 Analysis of Results**

### **7.1 E-business profiles**

Chapter 6 has described the use of the case studies for the purpose of testing and validating the e-business model. In this chapter we deal with the insights that the operation of the model now give into the role of e-business in the organisations concerned. This discussion uses a method developed during the research project of discussing the results at an intelligible overview level of detail, while being a synthesis of the detailed results of the model.

The concept of the e-business profile started from the realisation that it was relevant to produce a summary picture of the e-business functional coverage relevant to each case study. Initially this was a visual check on the extent to which the case studies were addressing specific functional areas, hence acting as a quality control indicator for the model-testing phase. A simple analysis was produced of the proportion of functions triggered (in relation to the total of those possible) in each functional domain converted to a percentage score and presented visually.

Having produced such a summary picture, it became apparent that what had actually been achieved was a concept of an "e-business profile" – a simplified presentation, of what are in fact very detailed results, in an accessible format. In later case studies, this became useful in the management summary of the reports of the model results and was useful for the communication of the results at a "management" level of detail. Such profiles are now seen as useful as a method of discussing the results broadly enabling more general issues to be exposed. As further explained below, it is also possible to use these profiles to discuss in general terms the potential impact of management concerns in the achievement of e-business possibilities.

Such high level profiles could be open to the objection of settling for "pretty pictures" rather than for useful detail (the very tendency that this research project was intending to fight!). However, it was decided that the use of such summaries was justified because there is always the need to be able to discuss results and insights at an overview level of detail. It is never enough to produce a report with one hundred pages of detail on its own! The key point with the profiles described here is that they are synthesis of the more detailed results, and an entry point into the greater detail that is available to study further any issues or insights that might be suggested by the overview.

7.2 **Summary Profiles**

First of all, it is instructive to examine two composite profiles.

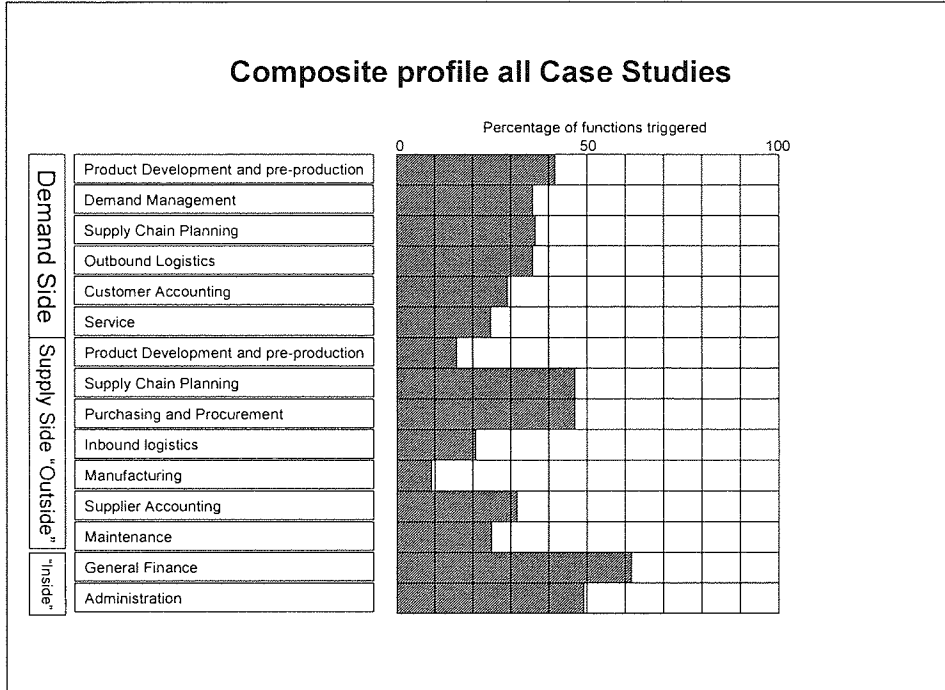


Figure 7.1a- Composite e-business profile

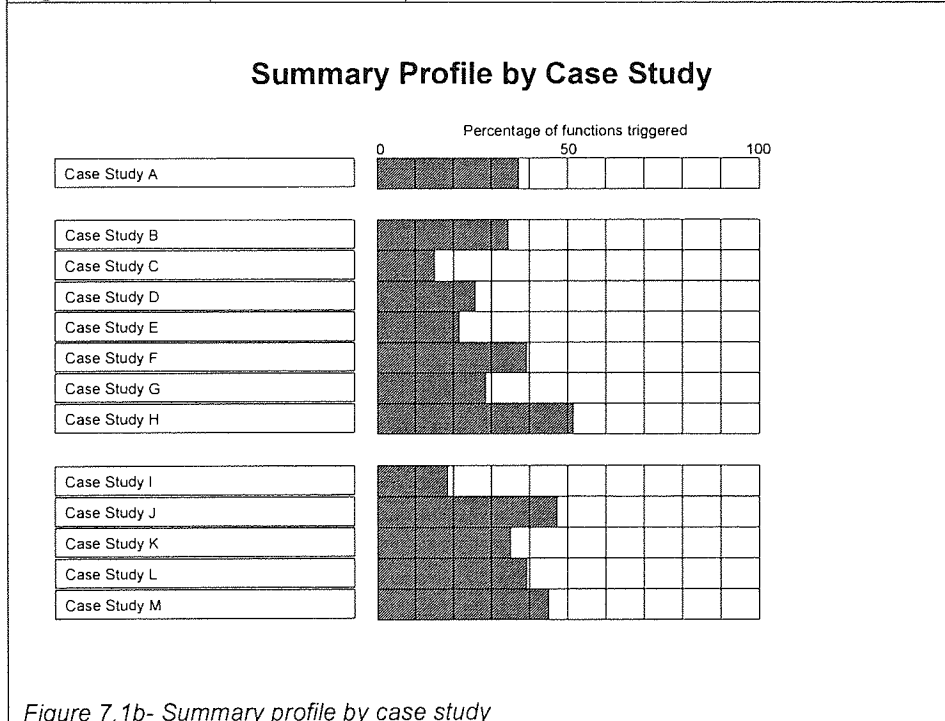


Figure 7.1b- Summary profile by case study

The first (Figure 7.1a) illustrates a notional composite company representing all the case studies. In fact it shows the “average” (over all the case studies) relevance of e-business functions as predicted by the latest version of the model. In the e-business profiles, the functions are organised into 3 broad categories:

- Demand Side Functions;
- Supply Side functions relating primarily to “outside” partners;
- Supply Side Functions relating primarily to “inside” the organisation.

The Supply Side functions are split this way order to understand whether the functions were internal or related externally to business partners.

In effect this composite profile represents a “league table” of popularity of e-business functions at least in so far as it affects the case study participants. The primary reason for producing such a composite profile was as a test of the research methodology. From the standpoint of the methodology, it was important to ensure that all of the functional domains contained functions triggered by at least some of the case studies (otherwise one would have had to question the choice of case studies).

Moving on from the “functional coverage check”, the composite profile is interesting primarily as a weighted assessment of e-business function relevance against the sample of British Industry that our case studies represent. The most relevant functions lay in:

- The General finance and Administration side representing activities largely internal to the organisations involved;
- The supply chain and purchasing activities oriented to the procurement of goods.

On the demand side, there is a more consistent level of coverage among the functional domains. The most popular (just) e-business functions relate to Product Development with customers. For the domains of Demand Management, Supply Chain Planning and Outbound Logistics, roughly one third of the possible functions were considered relevant for the case study sample. Service functions were less triggered, but this relates more to the fact that not all the case studies provided such functions to a significant degree. Of those that did, not all managed these using remote based resources or external organisations for which electronic communication would be relevant.

On the supply side far more variability of functional coverage was encountered. The most popular functions were Supply Chain Planning, Purchasing and Procurement, General Finance and Administration. At first glance it might appear to be anomalous that Product

Development with suppliers were not more popular functions. This actually is explained by the fact that many of such functions depend on the capabilities of suppliers, and in most case studies the suppliers represented smaller, less capable organisations than the case study organisations themselves (the customers).

Manufacturing functions were by contrast the least triggered. This is perhaps to be expected because most manufacturing activity is intra rather than inter organisation, but it also reflects the decreasing importance of manufacturing to some of the case study organisations. Maintenance functions were also less triggered, but this relates more to the fact that not all managed these using external organisations, for which electronic communication would be relevant.

The second profile (Figure 7.1b) illustrates, for each case study, the e-business functions actually triggered as a percentage of all the possible e-business functions that could have been triggered. This can be visualised as an indication of an overview of the relevance of the e-business concept to each of the case studies.

Case Studies C and G were characterised as small enterprises and case studies D and I were medium size companies. This summary shows that these companies triggered the least functions overall. This was perhaps expected on the principle that the more sophisticated IT functions are more likely to be the province of the larger organisation. Interesting, there was little difference between the large and the largest companies. The explanation lies in the fact that most of the multinationals involved represented groups of companies of various sizes and business interests, and the divisions involved in our study were not in themselves "very large".

A different and potentially useful alternative view of the profiles can also help understand the e-business requirement by level of function (Informational, transactional, and control and coordination). The proportion of functions triggered in relation to the total possible by level of function was calculated, and summarised also according to whether the functions were:

- Demand Side Functions;
- Supply Side functions relating primarily to "outside" partners; or
- Supply Chain Functions relating primarily to "inside" the organisation.

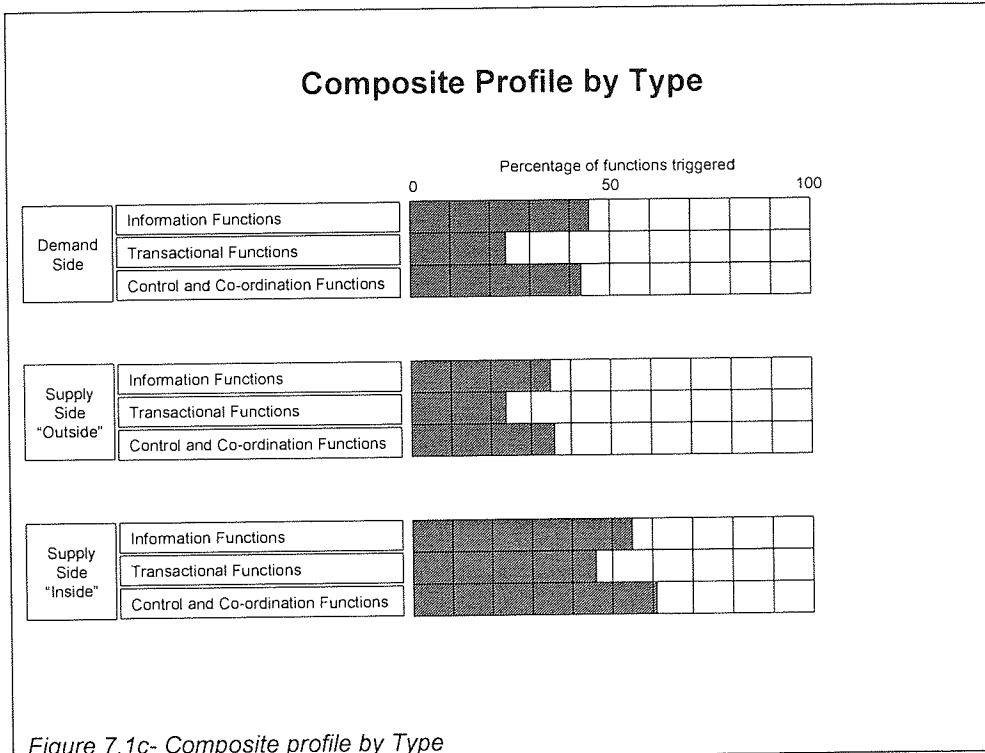


Figure 7.1c shows this alternative view. The analysis shows clearly a preponderance of functional relevance amongst those labelled "Inside". Demand side functions come second, with Supply side "outside" functions a close third.

One could conclude from this that e-business represents firstly internal opportunities, secondly what customers demand, thirdly what an organisation would like to do (if it could) with its suppliers.

Finally on the subject of composite profiles, it is instructive to compare those from the case studies contributing to the phase two testing of the model with those from the phase three testing.

### Case Studies B-H composite profile

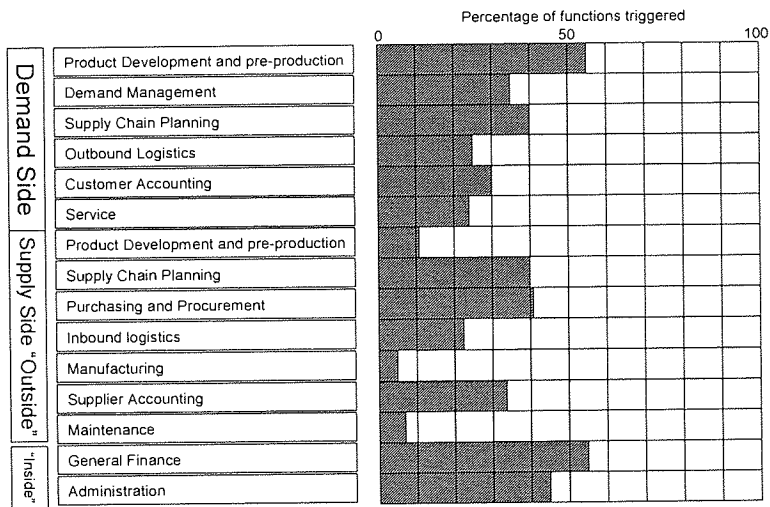


Figure 7.1d- Composite profiles – Phase 2 testing

### Case Studies I-M composite profile

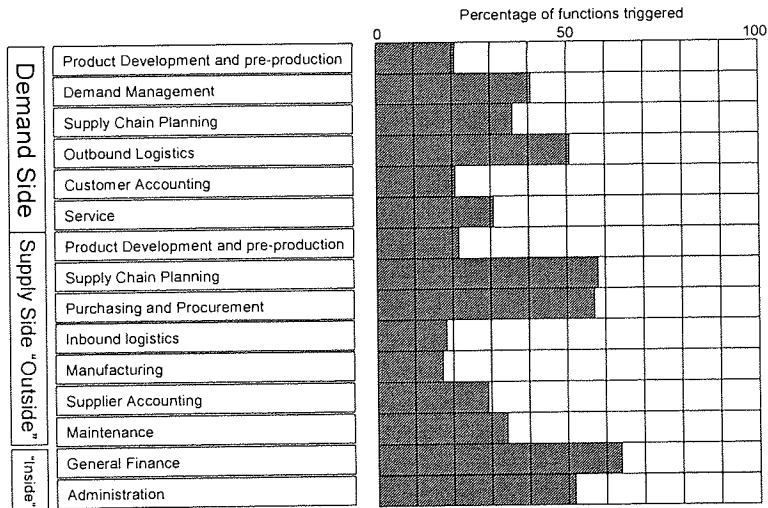


Figure 7.1e- Composite profiles – Phase 3 testing

Figures 7.1d shows the composite profile for case studies B-H, and I-M respectively. As indicated above, the primary purpose of such composites were a form of functional coverage check. It is interesting that in case studies I-M, there was no functional domain with less than a 17% profile – so we can deduce that these 5 studies represented a fairly

broad range of cases with potentially wide (indeed wider than the development case studies) relevance of e-business functionality.

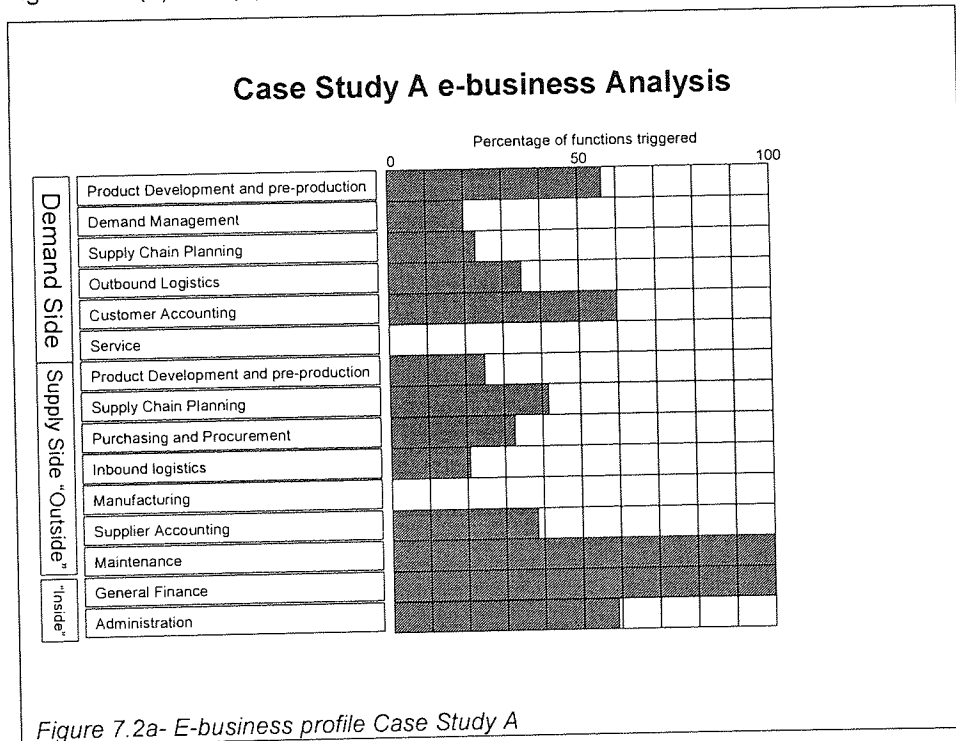
### 7.3 Profiles by Case Study

It is now appropriate to present the e-business profiles of each case study and to make comments where appropriate on points arising from these profiles. For consistency the final version of the model (version 9) is applied to each case study. Two profiles are presented:

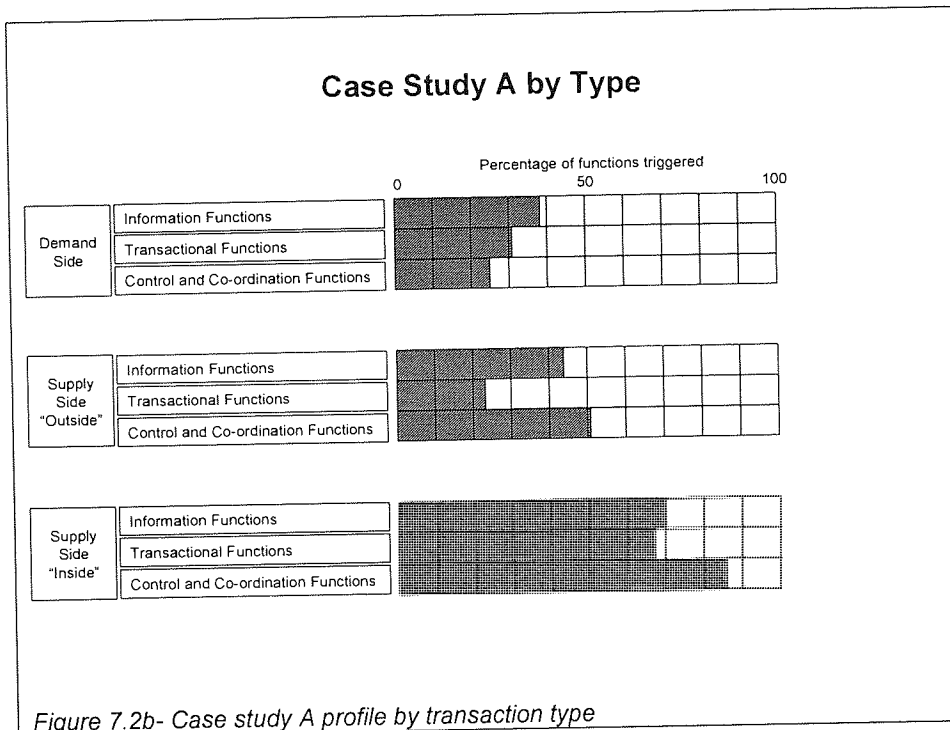
- The standard profile representing the proportion of functions triggered in relation to the total possible by each functional domain;
- The alternative view of the profiles by level of function (Informational, transactional, and control and coordination). As in 7.2 above, these were summarised by,
  - Demand Side Functions,
  - Supply Side functions relating primarily to "outside" partners,
  - Supply Chain Functions relating primarily to "inside" the organisation.

#### 7.3.1 Case Study A

Figures 7.2(a) and (b) show the profiles for case study A.







The first thing to observe is that, in this case study, e-business manufacturing and service functions were not considered relevant:

- In the case of manufacturing only one manufacturing site was involved and sub-contract activity was relatively small;
- In the case of service, the product supplied was not one that required service.

The next thing to observe is supply side e-business functions relating to planning and demand management tended to be considered more relevant than demand side e-business functions. This is at first glance rather surprising given that the automotive industry has for many years been very customer driven in the e-business context. The most likely explanation is that the company operates in a more specialised environment in respect of the demand facing e-business functions, where only a restricted subset of the potential functions could conceivably be relevant (even though this restricted set is very important!). For example a company in this business does not require new order taking functionality because demand is by schedule against a semi-permanent contract. By contrast, a wider range of supply side functions could be relevant because there is more variety in the purchase functions required. An alternative explanation could be that the effect of management concerns may be serving to depress the relevance of otherwise theoretically relevant functions. This possibility is explored below in section 7.5.1.

7.3.2 Case Study B

Figures 7.3(a) and (b) show the profiles for case study B.

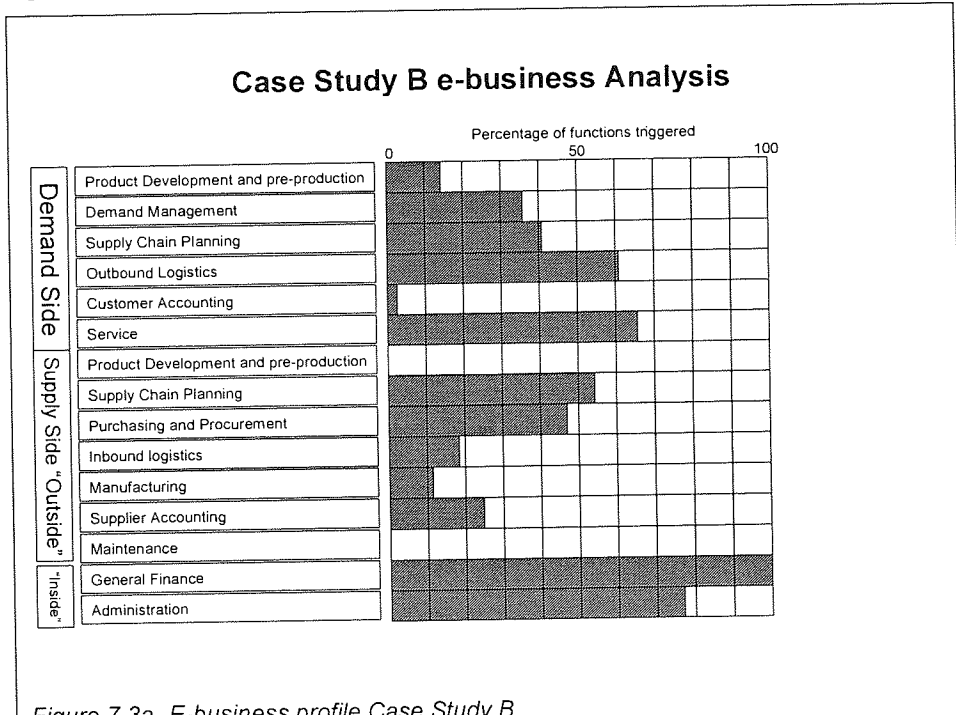


Figure 7.3a- E-business profile Case Study B

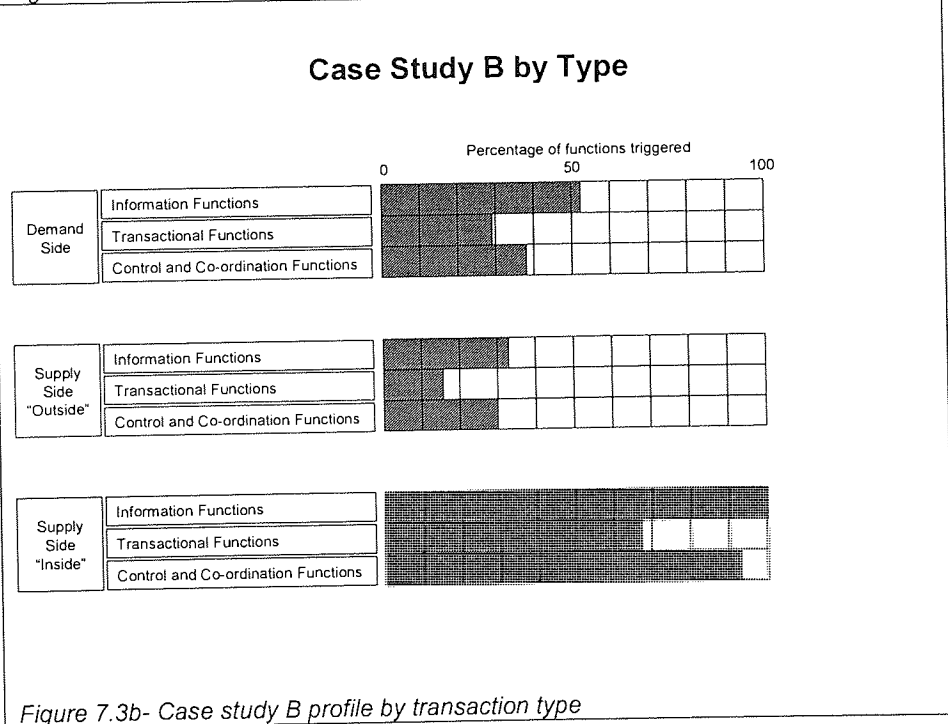


Figure 7.3b- Case study B profile by transaction type

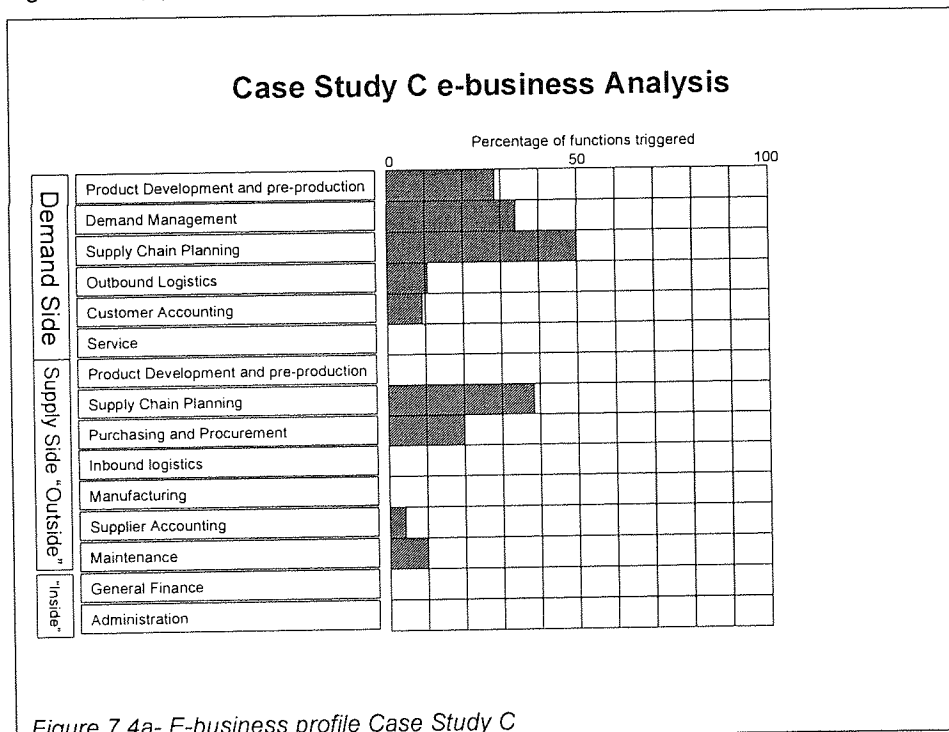
As a large company it was unsurprising that the use of e-business in internal administration was so clearly indicated.

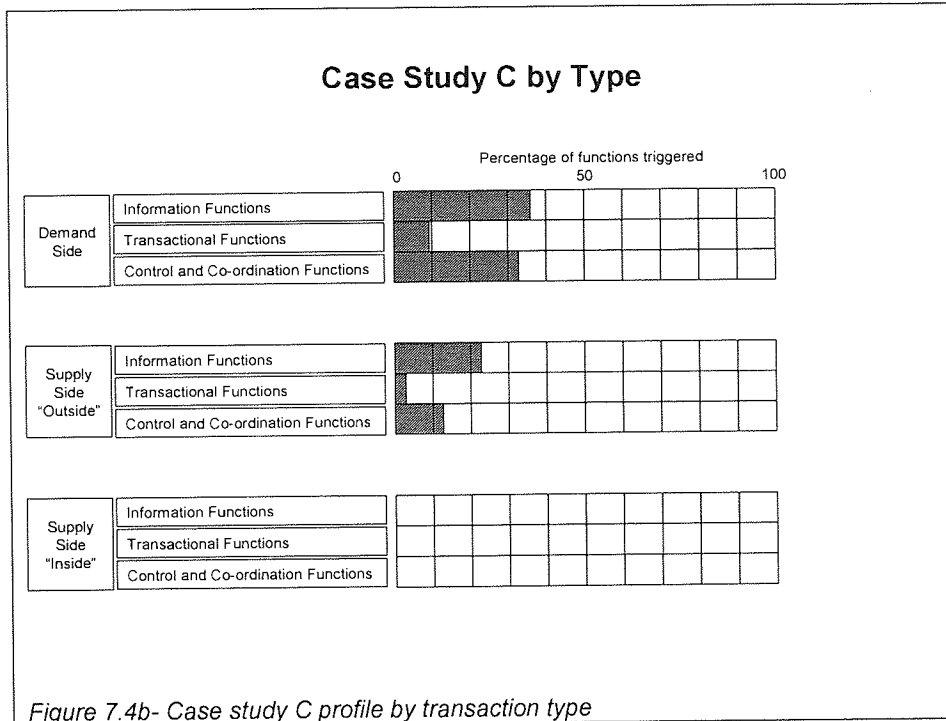
A rather more surprising picture is presented for such a large powerful organisation by the profile by transaction type (7.3b). This suggests a slightly larger level of e-business relevance encountered on the demand as compared to the Supply side. One would have expected it the other way round especially when considering the fact that demand is routed through a dealer network with low e-business capability.

In fact as Figure 7.3a demonstrates this picture is slightly distorted. The demand side "relevance" is weighted towards Logistics and Service, while the absence of any supply-side relevance in the Maintenance and product development causes the supply side to be suppressed. In fact the profile in the Supply Chain Planning and Purchasing and Procurement was quite strong. Consideration of the management concerns (see below 7.5.2) may also offer further insight into this.

### 7.3.3 Case Study C

Figures 7.4(a) and (b) show the profiles for case study C.





This is a profile that seems characteristic of a small company and makes sense for such a company. The weight is towards the demand side because the customers are the ones that dictate what one has to do. The marketplace within which this company operated included big customers with demanding conditions of doing business. It is noteworthy that case study A was a customer of this company, and this shows a weight towards supply-side e-business.

Also the size of the company is seen in the relatively low importance of transactional functions, functions that are only really of value if the information systems exist to process them in some automated way. The e-business value to a company like this lies in the functions that enable those in the company to have access to information and to view things.

7.3.4 Case Study D

Figures 7.5(a) and (b) show the profiles for case study D.

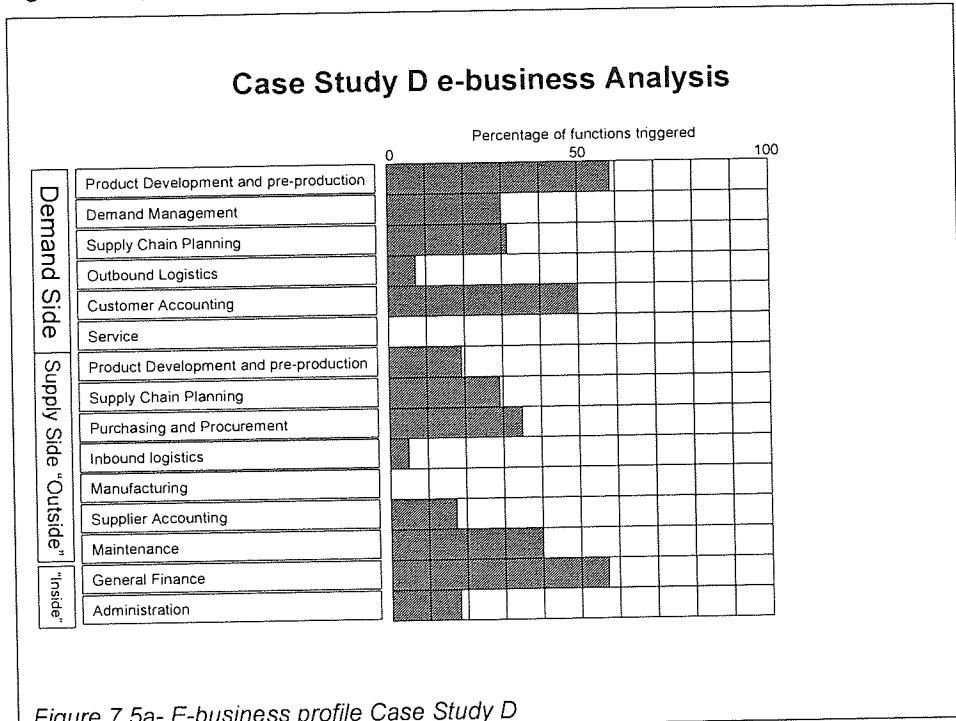


Figure 7.5a- E-business profile Case Study D

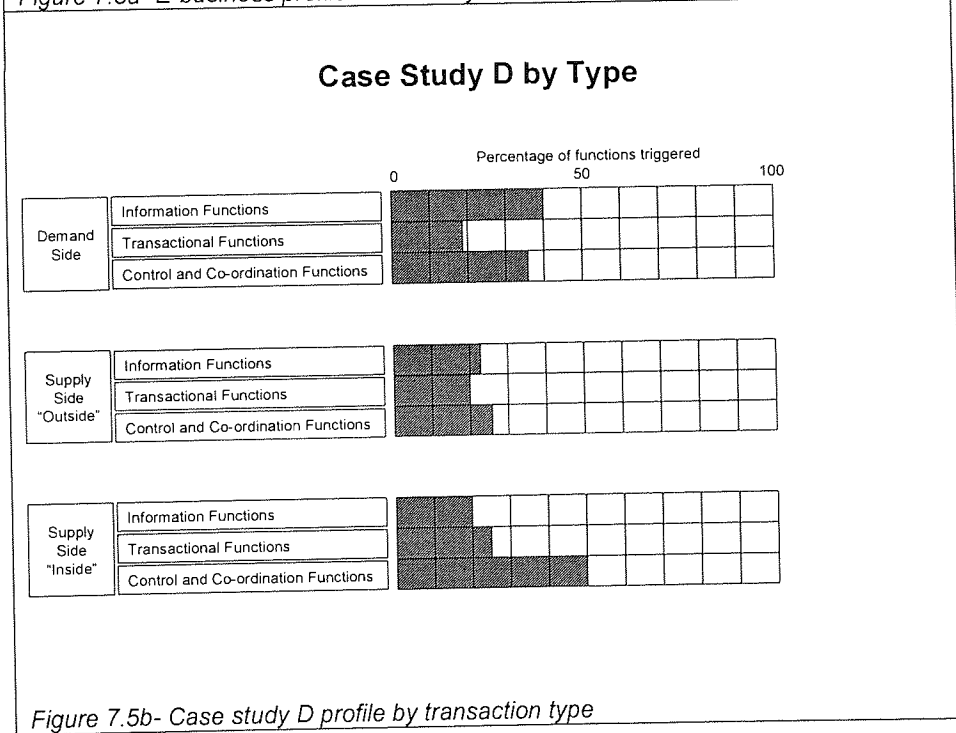


Figure 7.5b- Case study D profile by transaction type

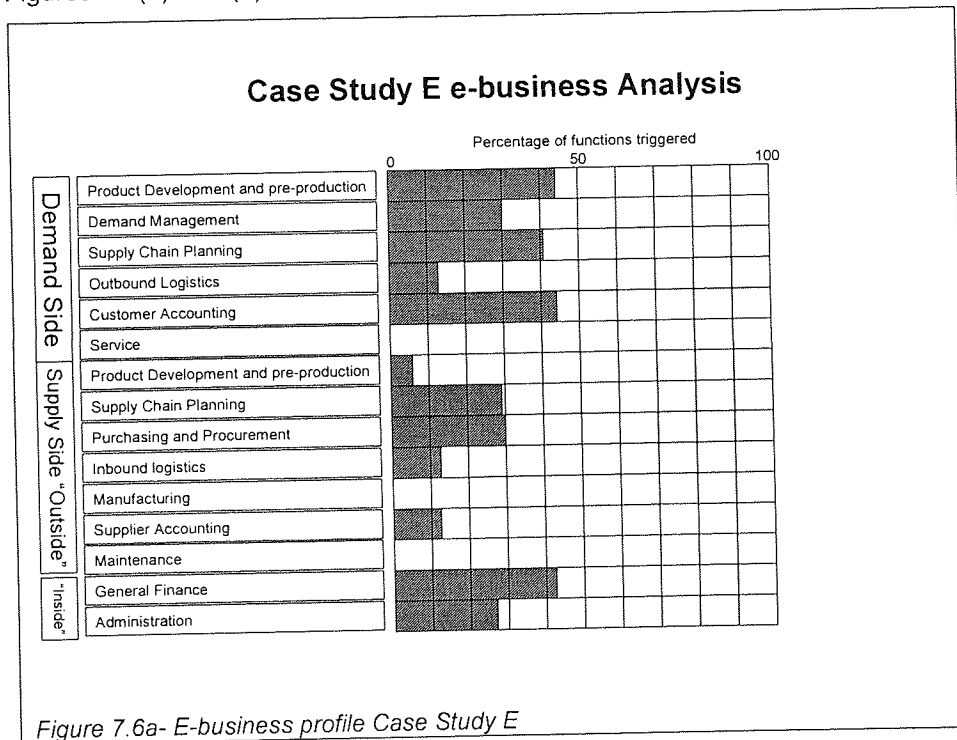
This is an interesting profile of a medium to large size company that, as a sales and logistics distribution company, essentially just buys and sells.

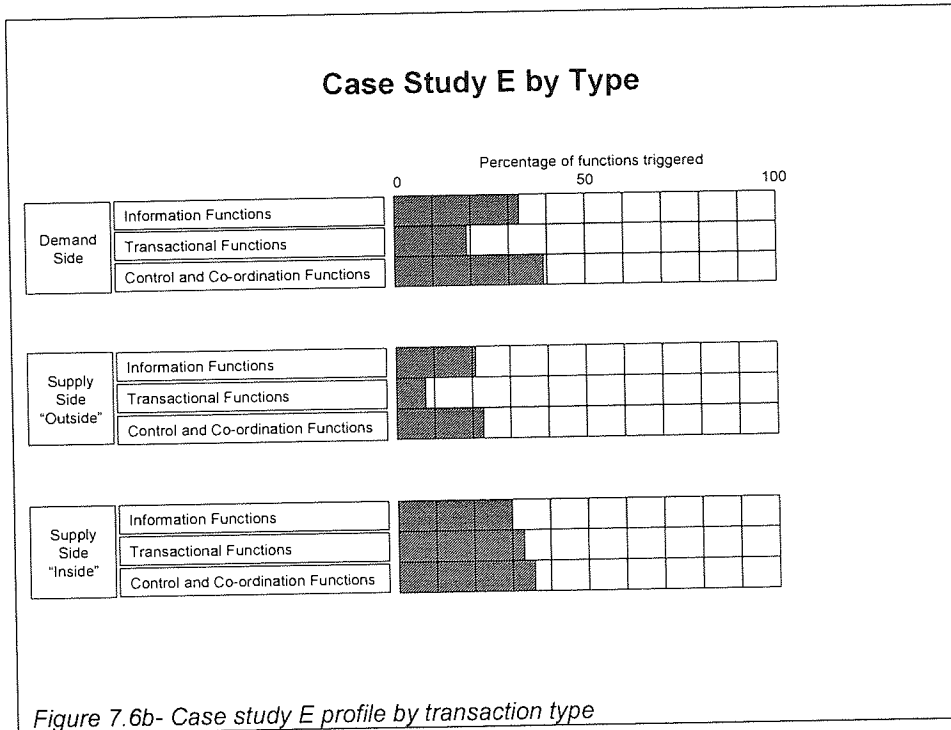
The relatively small coverage of the supply side "outside" functions could perhaps be explained by the fact that most of the purchasing is done from a parent company, in effect from one monopoly supplier, with whom classical e-business may not be necessary (or indeed possible).

Nevertheless this profile seems exceptionally thin for a company of this size, and it is not easy to see why at this level of summarisation. This is one of the situations where it is an advantage that these profiles are a synthesis of a more detailed functional analysis, and that this detail can be open to examination.

### 7.3.5 Case Study E

Figures 7.6(a) and (b) show the profiles for case study E.





Here we see a small/medium size company with a fairly low e-business profile, a fact that is at first glance surprising in the business environment that this company was in. Indeed one would have expected the profile to be a little more like that of case study A.

With case study A, the low e-business profile in a highly demanding business sector was explained as characteristic of the specialised nature of the sector, but this is clearly an inadequate explanation here, because the profile is even lower.

One explanation on the supply side (which was exceptionally low) lay in the exceptional preponderance of very simple very small suppliers in the supply base. In addition this could be another situation where the evaluation of the impact of concerns could be of relevance.

### 7.3.6 Case Study F

Figures 7.7(a) and (b) show the profiles for case study F.

### Case Study F e-business Analysis

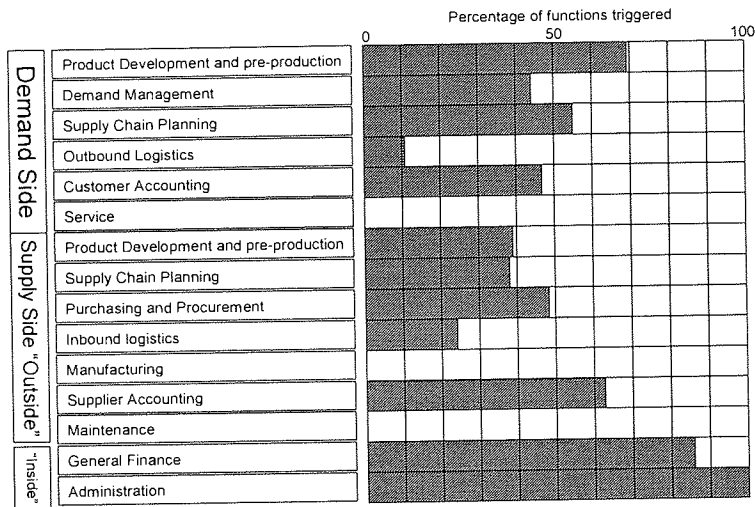


Figure 7.7a- E-business profile Case Study F

### Case Study F by Type

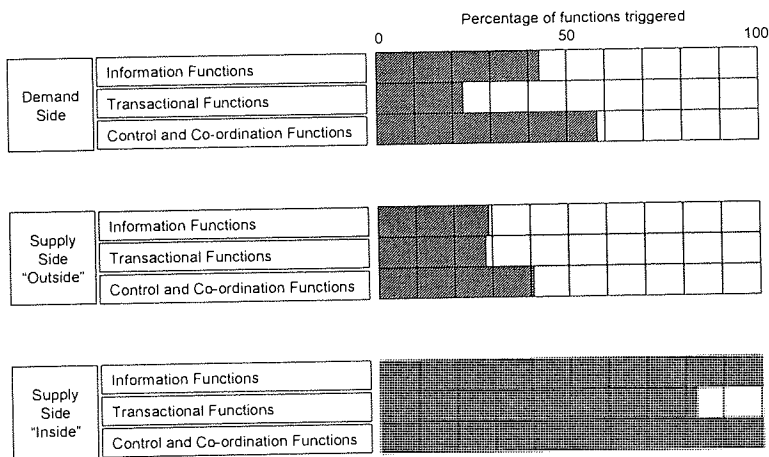


Figure 7.7b- Case study F profile by transaction type

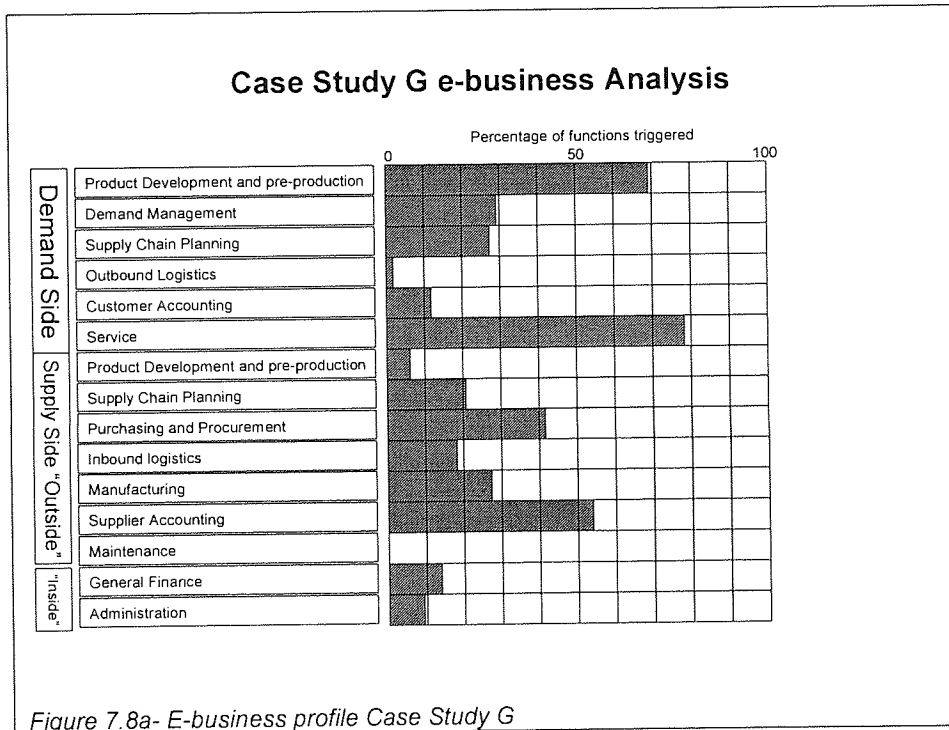
Here we see a large organisation with a significant interest in "inside" e-business functions. On the Demand Side, the relative lack of coverage (for a large organisation) could be explained by the specialised nature of their business and products and the fact that the service function is irrelevant.



On the supply side, the profile by type shows at first sight to be light on the “outside” supply side functions. This is surprising especially in the context of a powerful organisation that should have been able to exert more influence on its suppliers in order to encourage them to do “e-business”. In fact the picture is again distorted by the fact that the maintenance and manufacturing functions are irrelevant. The explanation may simply be that the suppliers (in effect in this industry 2<sup>nd</sup> and 3<sup>rd</sup> tier suppliers) can only do a certain amount, have done it, and cannot be bullied into doing more.

### 7.3.7 Case Study G

Figures 7.8(a) and (b) show the profiles for case study G.



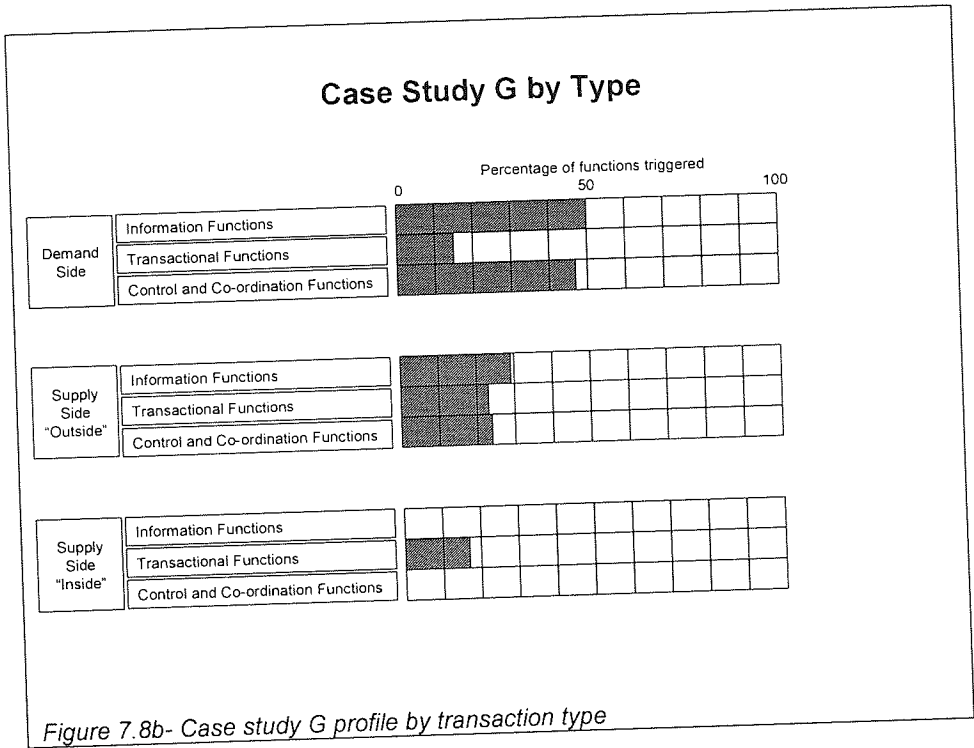


Figure 7.8b- Case study G profile by transaction type

We see here a relatively small company with few requirements for internal e-business functions. However a significant number of demand side are seen including a larger coverage on the development and service side. The small size of the company is seen in the low relevance of the demand side transactional functions, and the relatively high relevance of the more simple information access functions.

**7.3.8 Case Study H**

Figures 7.9(a) and (b) show the profiles for case study H.

## Case Study H e-business Analysis

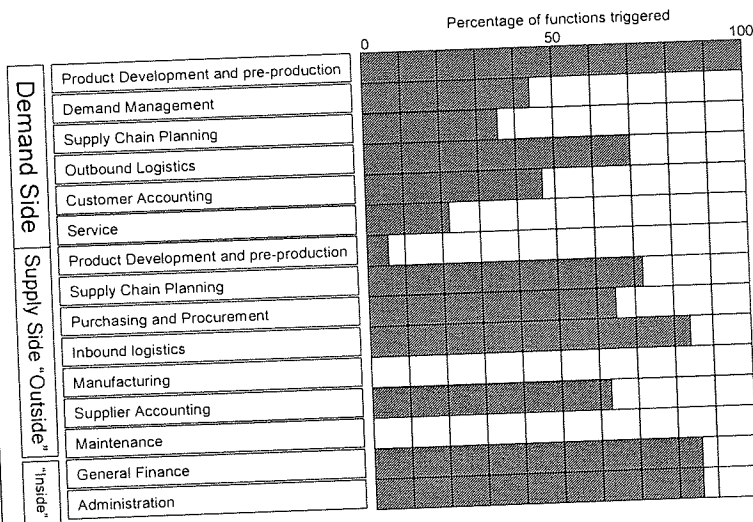


Figure 7.9a- E-business profile Case Study H

## Case Study H by Type

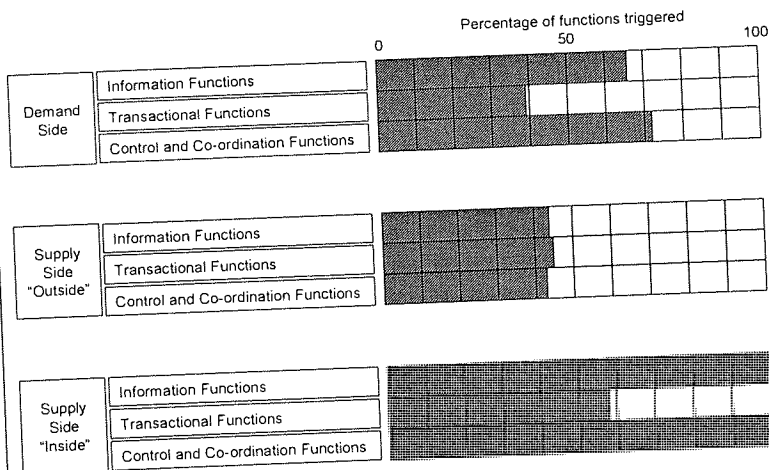


Figure 7.9b- Case study H profile by transaction type

This is a large organisation with some activities definitely not relevant, and little service requirements or requirement to get involved in cooperative design with suppliers. From the remaining domains there are a fair range of functions covered, including the high relevance of inside functions that one would expect from a large organisation. There is seen an exceptionally high significance of e-business functions involving design activities with the

customer. This is a good reflection of the fact that not only is customer participation in the design process essential but that the products are primarily designed around specialised and highly variable customer requirements.

### 7.3.9 Case Study I

Figures 7.10(a) and (b) show the profiles for case study I.

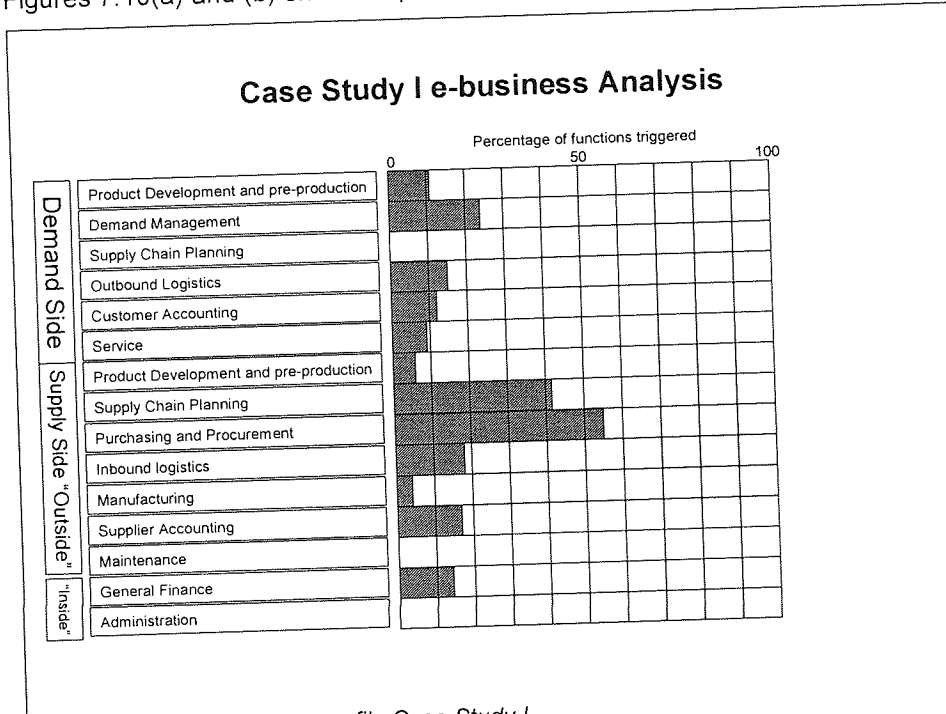


Figure 7.10a- E-business profile Case Study I

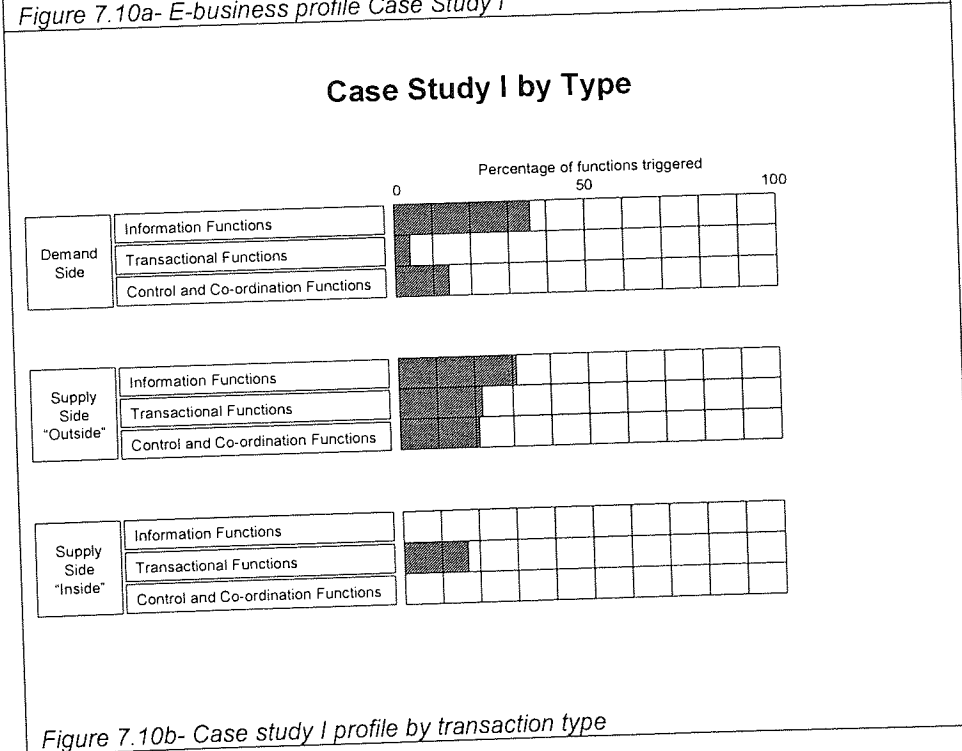
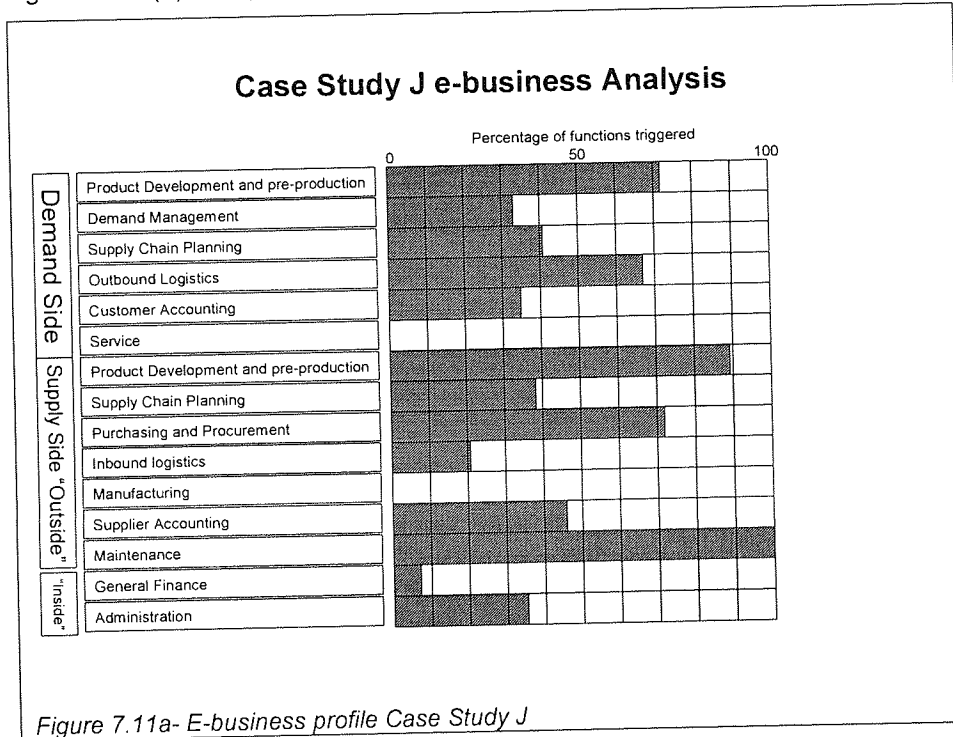


Figure 7.10b- Case study I profile by transaction type

At first glance this could be regarded as a small company with little need for e-business in general and especially relating to the "Inside" functions. Even for such a company it is interesting to note the relevance of the supply chain planning and purchasing and procurement. This would tend to support the notion that e-business has a potential relevance to such organisations providing that the tools exist to do it economically.

### 7.3.10 Case Study J

Figures 7.11(a) and (b) show the profiles for case study J.



### Case Study J by Type

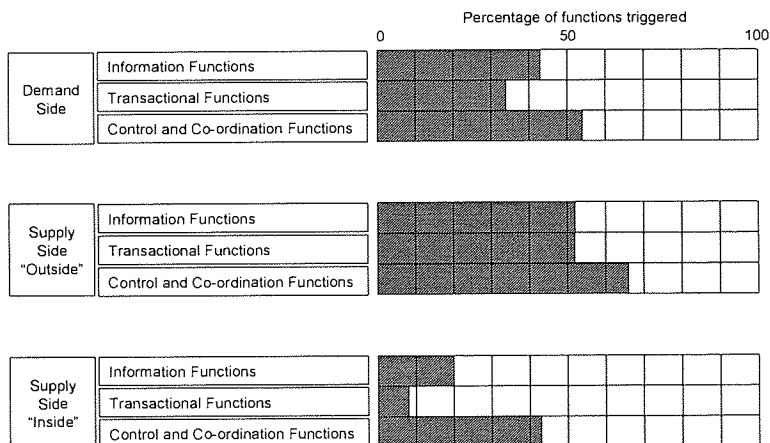


Figure 7.11b- Case study J profile by transaction type

Case Study J represents a company (plant) within the same group that provided case study F. Therefore whereas Case Study F represented a viewpoint from the centre of a major multinational; this case study provided the e-business view at the individual company level.

This profile seems perhaps surprisingly quite light in the supply side "inside" functions and relatively heavy with the supply side "outside" functions. In comparison with case study A, a company in the same type of specialist business, we see a similar effect. The less emphasis on "inside" functions could perhaps partially be put down to company size factors, but the greater level of purchasing seems to require more explanation. The comparison that is particularly interesting is however with the profiles of case study F.

### Case Study F versus J e-business Analysis

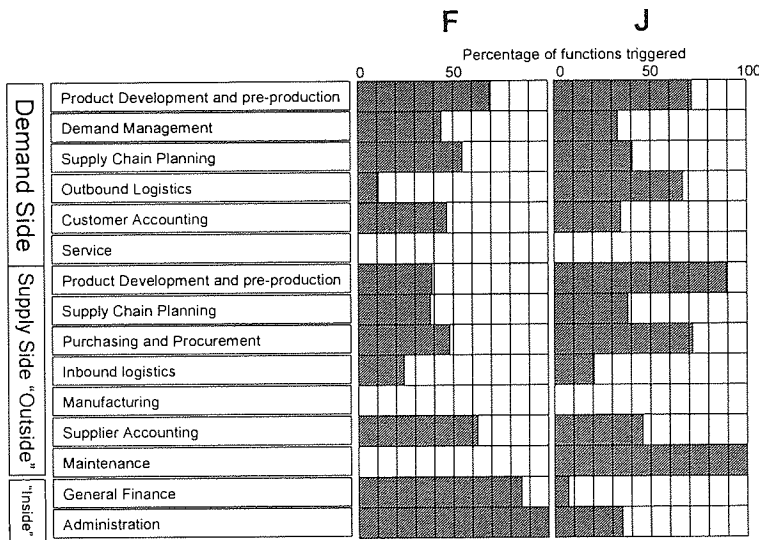


Figure 7.11c- E-business profile Case Studies F and J

### Case Study F versus J by Type

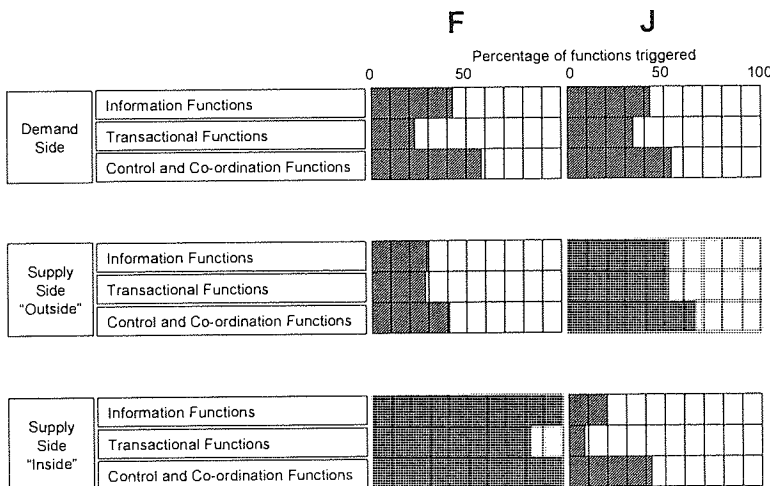


Figure 7.11d- Case studies F and J by transaction type

Figures 7.11c and 7.11d show the profiles of case studies F and J side by side. While some of these differences (for example "inside" functions) obviously relate to a difference in scale in the organisations being considered, there are also differences in perspective on what functional domains are of importance (the maintenance domain being the prime example).

Such a difference reflected a difference in perspective about what the maintenance issue was.

Perhaps the most surprising difference is that for the "plant", supply side ("outside") e-business with suppliers seems to have a higher relevance than from the point of view of the group. On the demand side the major difference lay in the outbound logistics domain.

Overall, it was interesting that the model gave a larger e-business profile when answered from the standpoint of the plant rather than that of the centre. It illustrates that the picture can be different if viewed from different perspectives even within the same organisation.

The value of this in turn could be to serve as a warning to those organisations that think that e-business strategy can be dictated at "Group" level. This can apply, as it does here, even within groups where the constituent companies can be expected to show coherent objectives and style and similar detailed characteristics.

The issue also raised here is the degree of objectivity that can be expected from the model, when the results in some of the domains have clearly been affected by the different perceptions (of what the facts are) on the part of the persons answering the question.

In reality the model has given answers based on inputs, and if the inputs are inconsistent then the model will be correspondingly inconsistent. The discrepancies in results are something that needed discussing when reviewing the outputs of the model.

#### **7.3.11 Case Study K**

Figures 7.12(a) and (b) show the profiles for case study K.



### Case Study K e-business Analysis

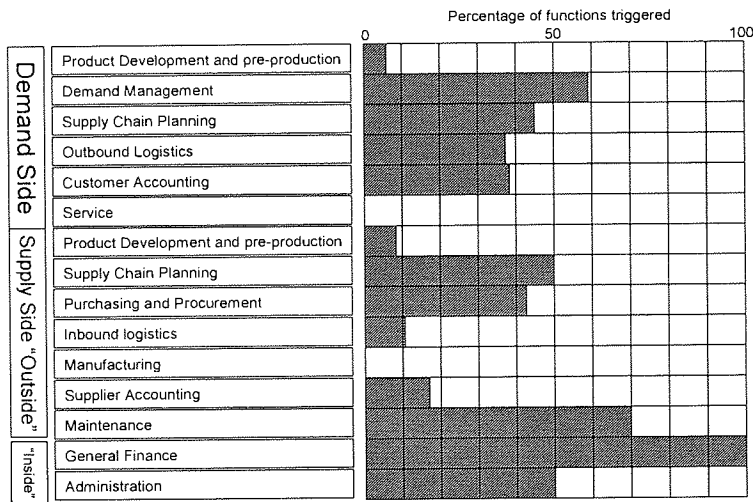


Figure 7.12a- E-business profile Case Study K

### Case Study K by Type

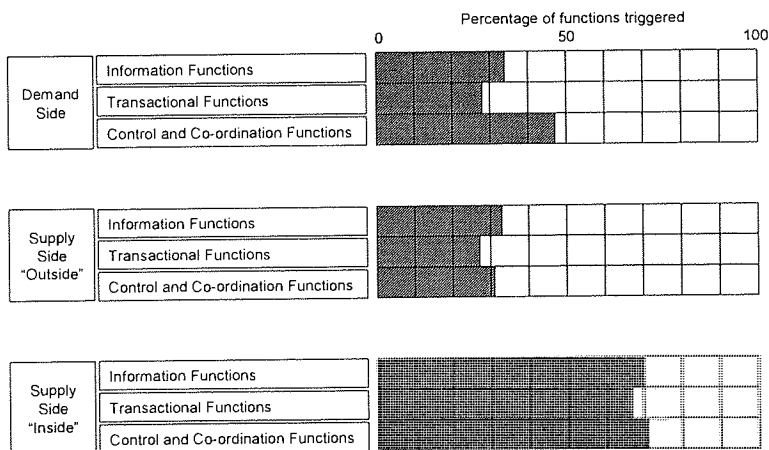


Figure 7.12b- Case study K profile by transaction type

Case Study K represented a company within the same group, and (more importantly) apparently in the same business sector as that represented by Case Study A. The most striking aspect of this profile is the lack of a need to communicate with customers and suppliers in the design of products. Apart from that, a fairly solid coverage of e-business functions in both the demand side and the supply side is shown (excluding the "non-

performed functions of service and manufacturing). In addition as part of a large organisation one sees the "inside" functions as being relevant.

Figures 7.12c and 7.12d show the profiles of case studies A and K side by side.

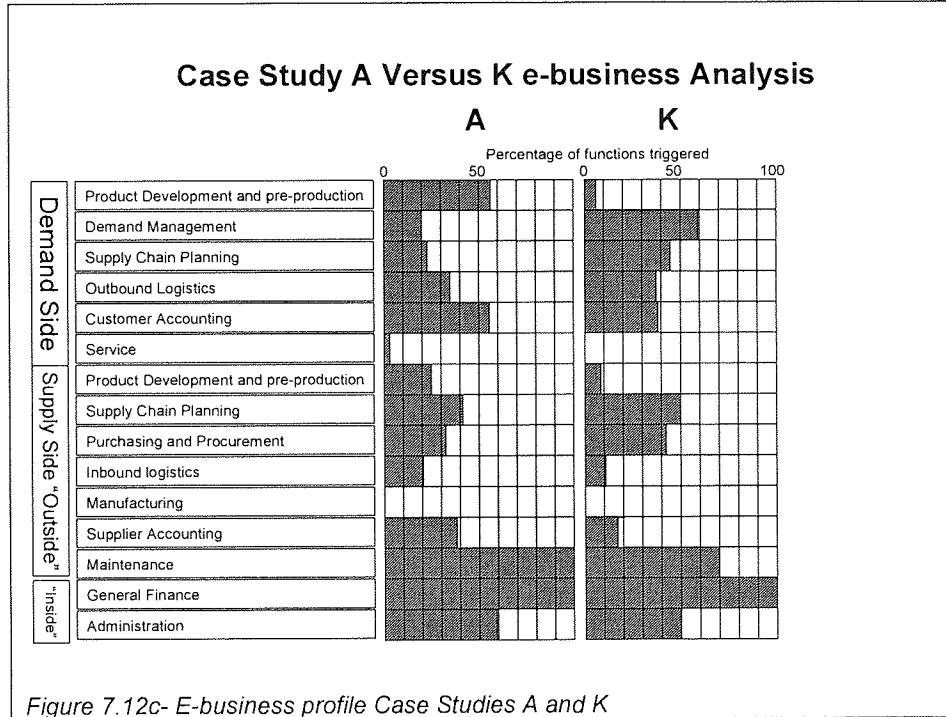


Figure 7.12c- E-business profile Case Studies A and K

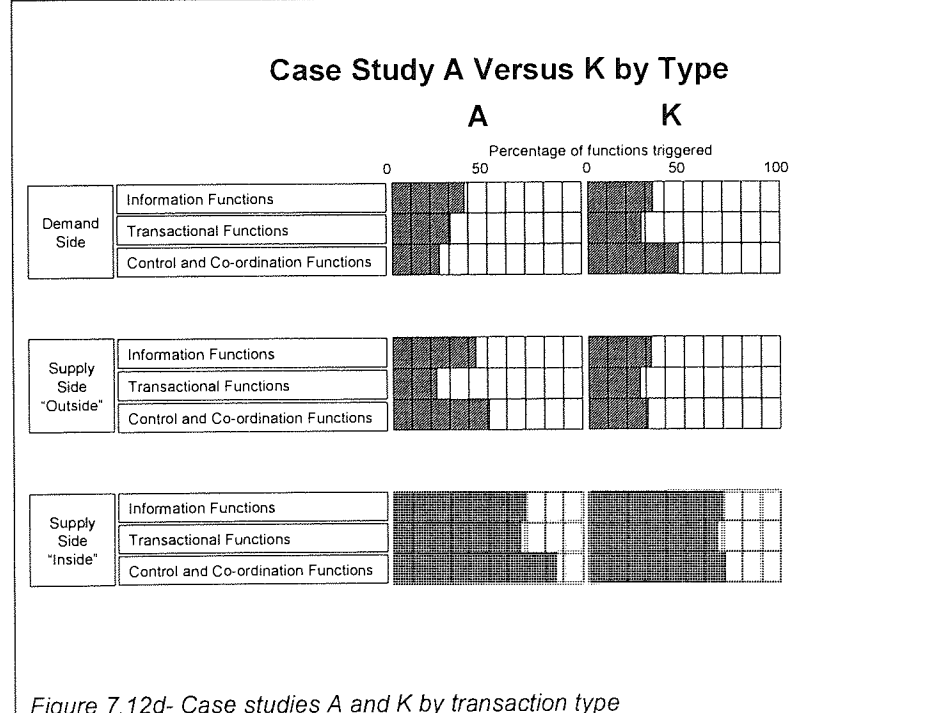


Figure 7.12d- Case studies A and K by transaction type

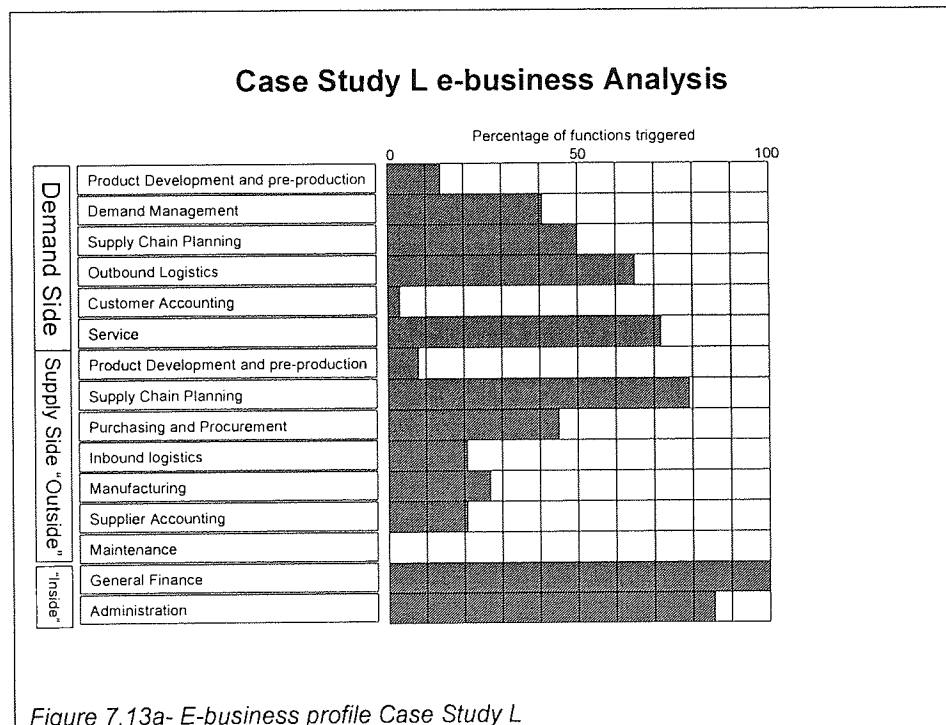
The initial reaction to this comparison might be that the profiles look not too dissimilar. This is to some extent reassuring, because, although there are many differences, many of the fundamentals of doing business in the automotive domain must be similar.

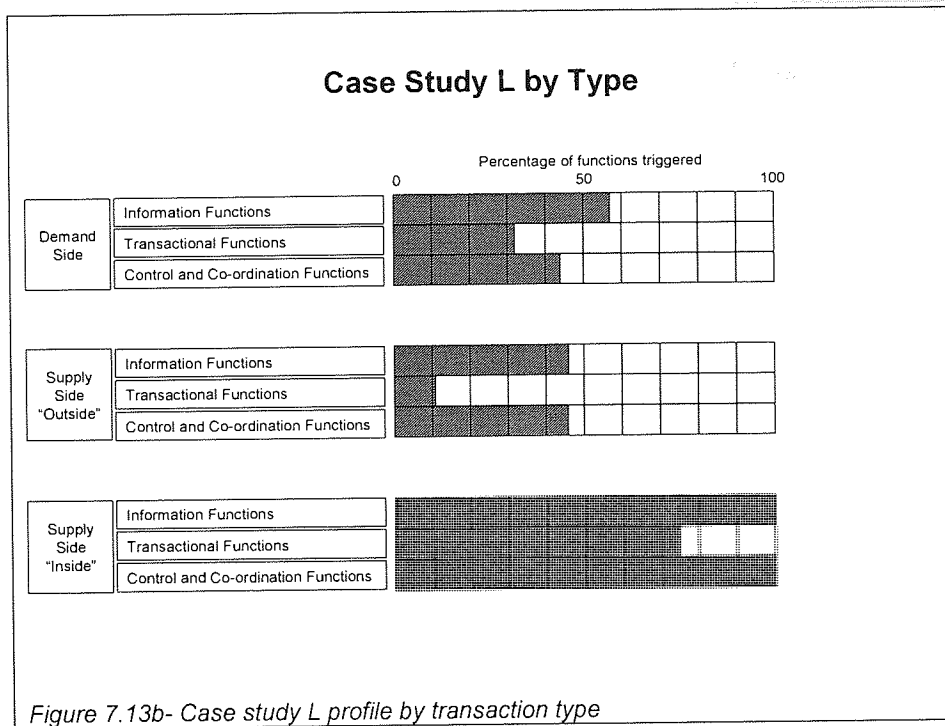
The demand side is the area of most difference and this is shown more clearly by Figure 7.12c. Product design in collaboration with customers is a fundamental part of doing business for Case Study A but not for K. By contrast, Case Study A is in less of a flow/repetitive business and therefore requires a greater variety of demand side e-business functions than does case study A.

A conclusion from this could be that, although some aspects e-business strategy could be dictated at "Group" level, it would be courting disaster to assume that a common demand management system would be appropriate.

### 7.3.12 Case Study L

Figures 7.13(a) and (b) show the profiles for case study L.





Case Study L related to the same business as that involved in case study B, following reorganisation, and the passage of time. As a large company the use of e-business in internal administration continue to be indicated. On the demand side, Service, Outbound Logistics and Supply Chain planning functions seem the most popular while the most significant profile on the supply side is in supply chain planning. Transactional functions on the supply side "outside" seem very low and tend to suggest a supply base that cannot or will not respond to electronic data interchanges.

Figures 7.13c and 7.13d show the profiles of case studies B and L side by side.

### Case Study B versus L e-business Analysis

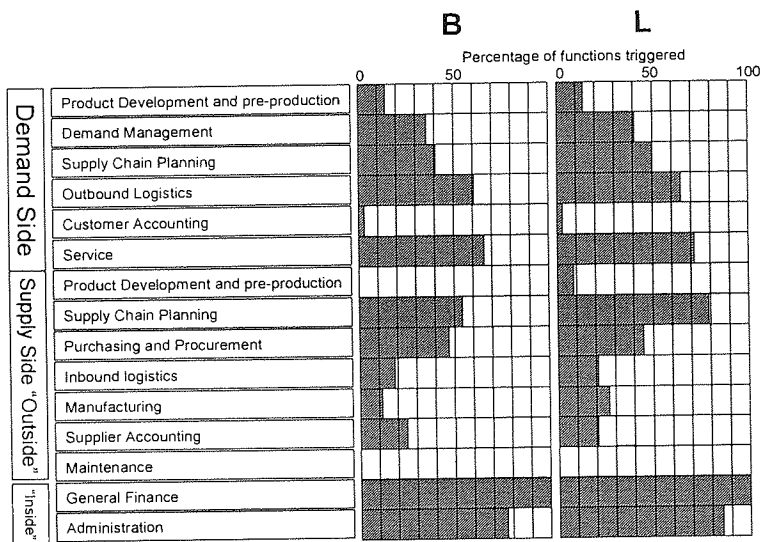


Figure 7.13c- E-business profile Case Studies B and L

### Case Study B versus L by Type

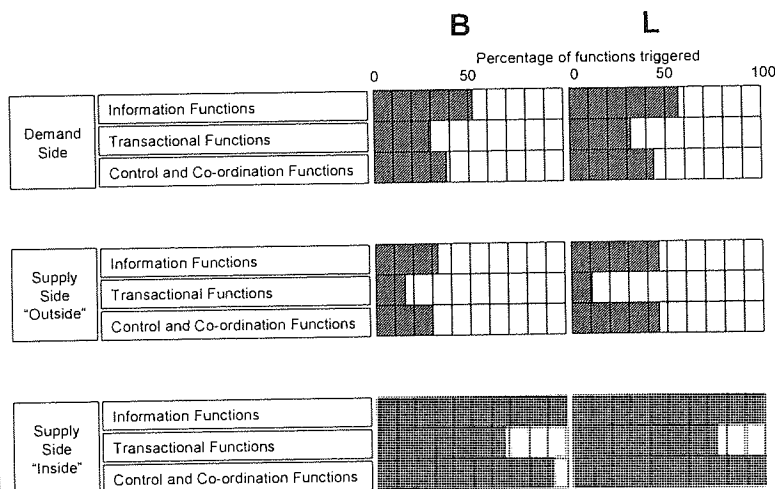


Figure 7.13d- Case studies B and L by transaction type

Although one does not see dramatic differences (it would be worrying if one did!), there are some interesting progressions.

On the Supply Side "Outside" we see an increase in the co-ordination and information functions and a decrease in the transactional functions. We also see increases in the sub-

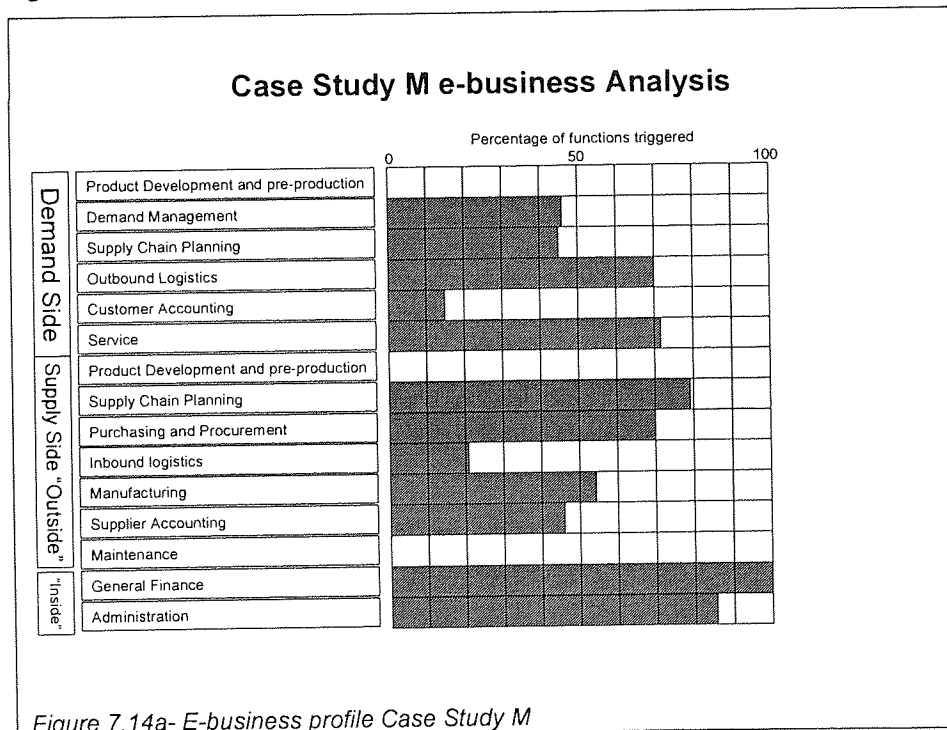
contract (manufacturing) and supply chain planning, but no increase (a slight decrease if anything) in purchase and procurement. This may indeed be tentative evidence for the consequence of a movement towards the networked supply chain (reference to be inserted here). The decrease in the transactional functions may also be associated with an increase in the percentage of items supplied through third party managed inventory.

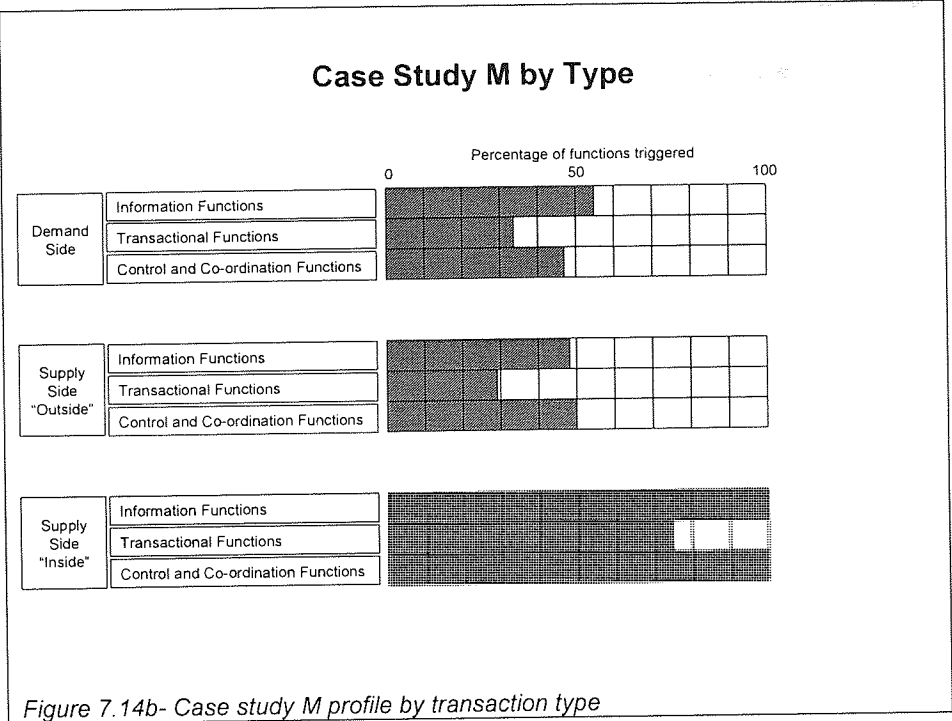
A movement towards supply from monopoly suppliers, who deliver on their terms as they are the only source, and where suppliers' capacity constraints or fixed cycle schedules constrains planning also could have a depressing effect on e-business progress.

On the demand side, a modest increase in the demand fulfilment that can be considered sell-from-stock (i.e. forecast driven, order point driven or similar) could be associated with an increase in the relevance of the Demand Management, Supply Chain Planning and Outbound Logistics functions.

### 7.3.13 Case Study M

Figures 7.14(a) and (b) show the profiles for case study M.





Case Study M was again within the same group of companies as that in Case Study B but in this case was in the spares and service division, an organisation that one would expect to have different characteristics and different e-business requirements.

On the demand side Service and Outbound logistics are the most significantly triggered functions with demand management and supply chain functions significantly indicated.

On the Supply side, the complexity of the supply chain (variety of purchase activity, significant sub-contracting) manifests itself in the popularity of the Supply Chain Planning, Purchasing and procurement and manufacturing functions. As one would expect from a large company most of the "inside" functions are considered relevant. Design activity either with Customers and Suppliers is non-existent.

Figures 7.14c and 7.14d show the profiles of case studies L and M side by side.

### Case Study L versus M e-business Analysis

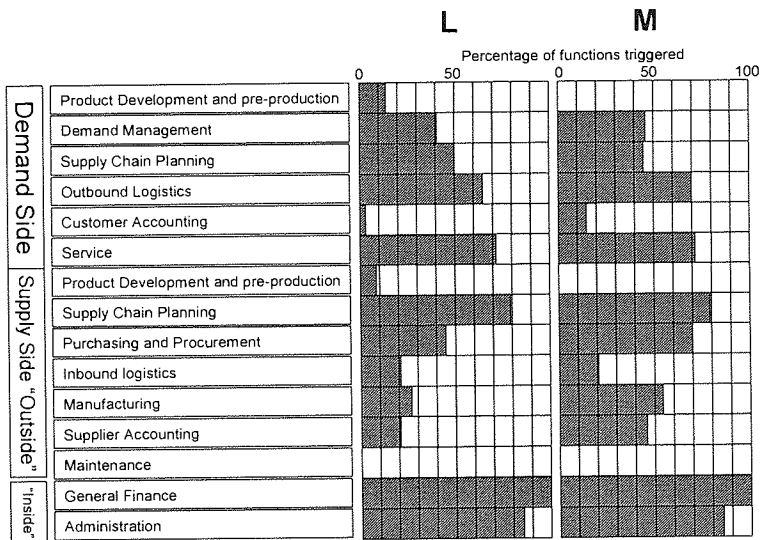


Figure 7.14c- E-business profile Case Studies L and M

### Case Study L versus M by Type

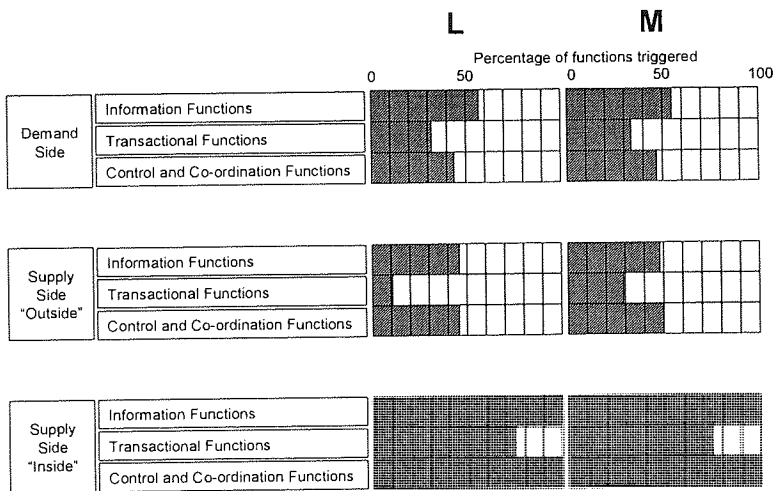


Figure 7.14d- Case studies L and M by transaction type

By and large one sees a slightly heavier e-business profile in case study M, and one could explain this as a consequence of the more complex type of supply situation that one might expect in a spares organisation.



On the demand side there is slightly more weight in the outbound logistics and customer accounting functions (more number and variety of customers), but in reality one would not expect more complex demand management and (demand side) supply chain-planning functions.

On the supply side "outside" functions, one sees much more weight in Purchasing and procurement, manufacturing (sub-contract) and supplier accounting (more suppliers). On the supply side "inside" functions, one would not expect to see any differences and indeed one does not.

#### **7.4 The impact of concerns**

The impact of running the models ignoring the management concerns has already been touched upon in chapter 6 in analysing the function coverage of the model testing. The concept of the "e-business profile" can also be used to produce a pictorial representation of both the results and the impact of management concerns. Running the model without using the concerns makes it possible to gain additional insight:

- A version without concerns potentially provides a more objective analysis, while using the version with concerns brings in more subjective factors;
- By analysing the difference between the two, an indication of how significant may be the difficulties of implementation of functions that might otherwise have a theoretical application to the organisation.

In the model, concerns tended to have one of two effects:

- They represent a problem that ought to be a motive for interest in an e-business function (e.g. excessive clerical activity);
- They represent a problem that would tend to prevent an e-business function from being useful (e.g. our suppliers cannot cope with our e-business oriented communication with them).

The model run without concerns can therefore be regarded as an indication of the theoretical relevance of the functions to the organisation, whereas the version with concerns represents the relevance of the functions in a practical world where theory cannot always be perfectly applied! The concept could also be used as an indication of the barriers likely to be encountered in an e-business implementation, and the consequent ease of implementation and probability of success.

The effect of this can be illustrated by re-examining the two composite profiles discussed in section 7.2, with the concerns added.

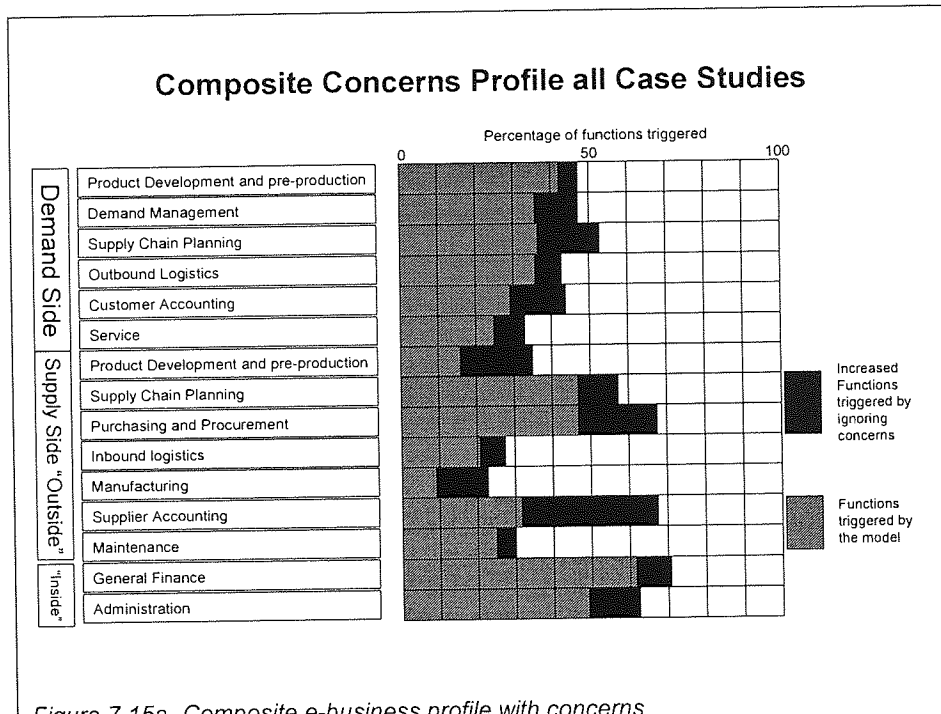


Figure 7.15a- Composite e-business profile with concerns

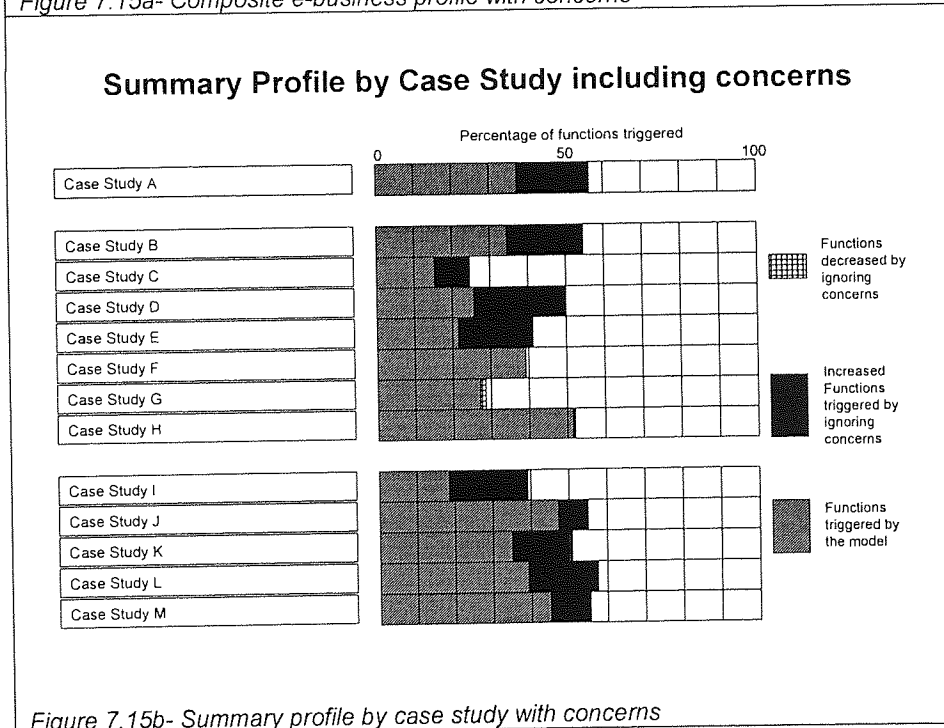


Figure 7.15b- Summary profile by case study with concerns

The first (Figure 7.15a) illustrates a notional composite company representing all the case studies. The second profile (Figure 7.1b) illustrates, for each case study, an overview percentage the percentage of the e-business functions triggered as against all possible e-

business by each of the case studies. The area shaded in black illustrates the additional degree of functionality that would have been considered relevant if the business concerns were ignored. The area shaded in check indicates the situation where ignoring concerns would tend to reduce the functions considered relevant.

As can be seen overall, removing the concerns tended to increase the number of e-business functions that were considered relevant, but within that generality there was a wide variation of impact. For some case studies (D, E and I) concerns in effect wiped out some 50% of the e-business functionality that would otherwise have been relevant, and the impact was significant in most of the others. Only in three case studies did concerns have little or no impact, and in one of those three (G), they tended to represent reasons for doing things rather than the reverse.

A different and potentially useful alternative view of the impact of the concerns is provided by the analysis by level of function (Informational, transactional, and control and coordination). The proportion of functions triggered in relation to the total possible by level of function was calculated. As in 7.3, these were summarised by:

- Demand Side Functions;
- Supply Side functions relating primarily to "outside" partners;
- Supply Chain Functions relating primarily to "inside" the organisation.

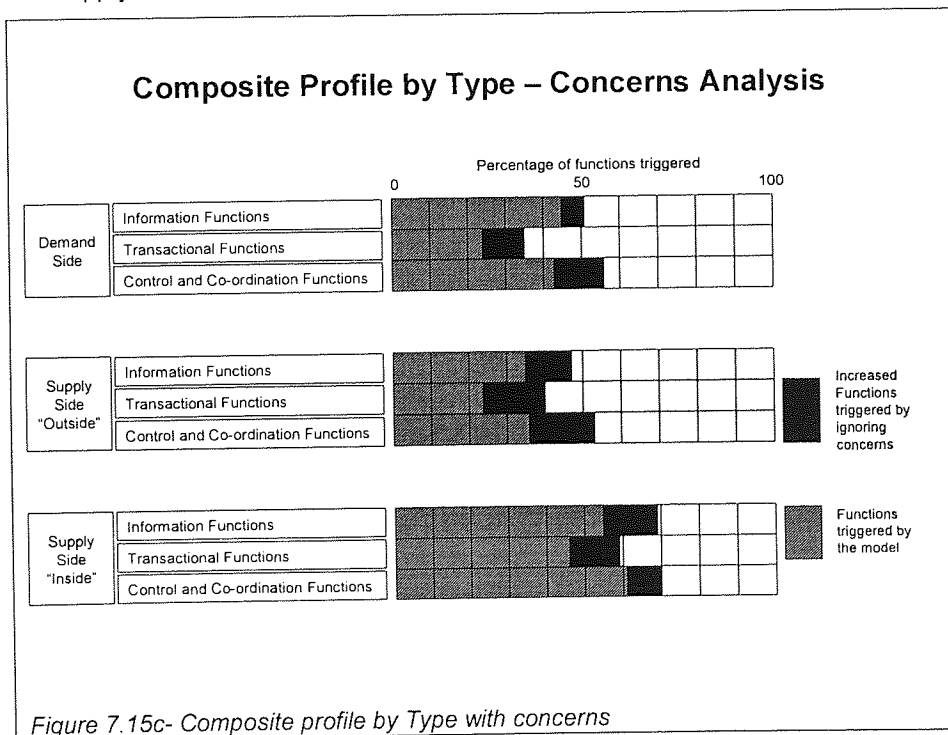


Figure 7.15c shows this alternative view. The analysis shows that concerns have an impact on every category. There is slightly more of an impact on the supply side functions, suggesting that concerns about suppliers tend to predominate in the sample of organisations studied.

On the supply side the biggest impact is on transaction functions and on the demand side on collaboration functions. On the inside, the impact is on the information functions. This is actually an elegant demonstration of the proposition that the problems with customers tend to be with attitudes and behaviour (hence collaboration); and with suppliers, their technical sophistication (hence transactions). Amongst the inside functions, those categorised as information functions tended to be most affected by concerns. This is not surprising because most issues collaboration type issues should not apply, and transaction functions should not present much of a problem internally.

## **7.5 Concerns by Case Study**

This section presents the results obtained by running the model both including and omitting the concerns. As in section 7.3, two profiles are presented:

- The standard profile representing the proportion of functions triggered in relation to the total possible by each functional domain;
- The alternative view of the profiles by level of function (Informational, transactional, and control and coordination). As in 7.3, these were summarised by:
  - Demand Side Functions;
  - Supply Side functions relating primarily to "outside" partners;
  - Supply Chain Functions relating primarily to "inside" the organisation.

### **7.5.1 Case Study A**

Figures 7.16a) and (b) show the profiles for case study A.

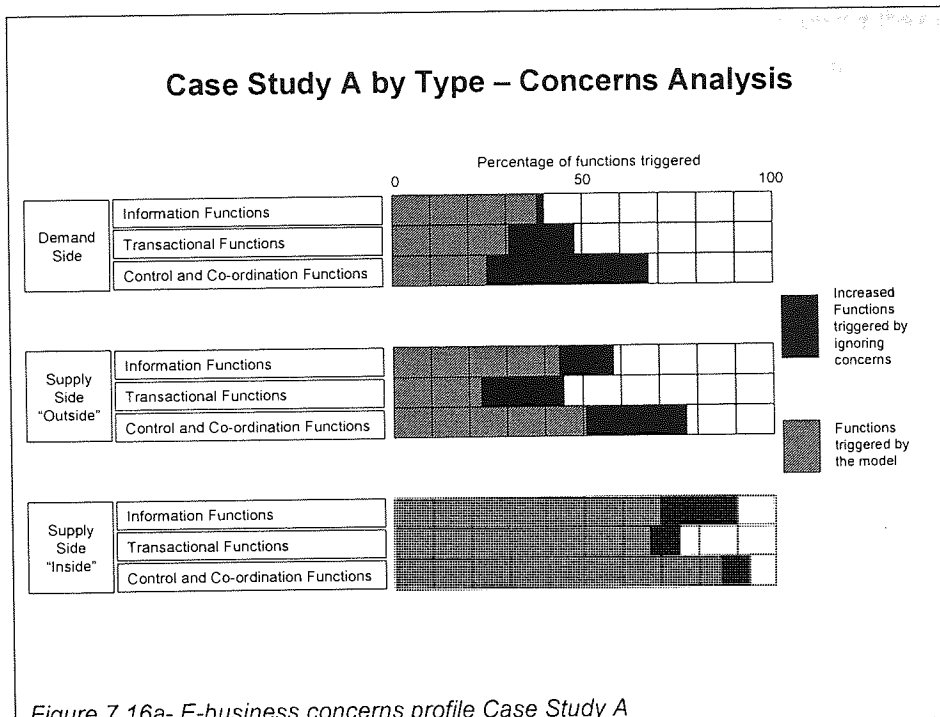


Figure 7.16a- E-business concerns profile Case Study A

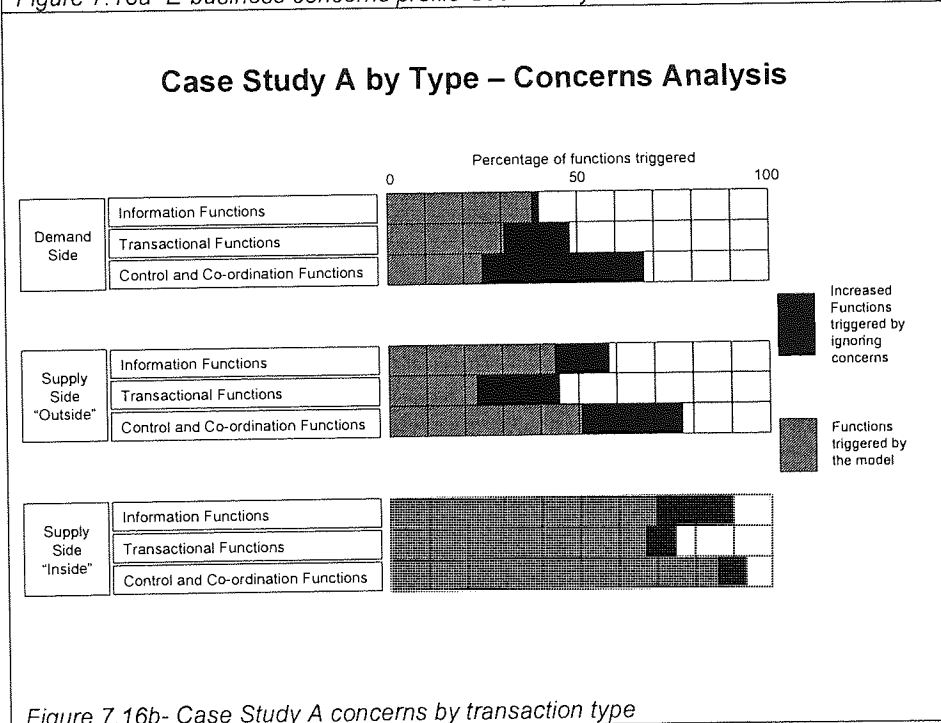


Figure 7.16b- Case Study A concerns by transaction type

An indication of one possible explanation for the observation (see above 7.3.1) that the relevance of demand side e-business functions seem surprisingly low, may come when one examines the model run while excluding the concerns. Strongly expressed concerns in this case study included:

- Our customers fail to respect industry standards;

- Our customers dictate requirements without concern for the problems they cause;
- Customers fail to communicate requirements clearly or respond effectively to queries;
- We incur expense because of our customer's non-adherence to industry standards.

It is easy to see how such concerns would tend to depress the relevance of some functionality. For example functions that are collaborative in nature are bound to be less relevant if customers show no inclination to be effectively collaborative! In these sorts of situations, the company would be advised to consider such functions only if forced to by the customer, and to invest as little as possible in them.

Figure 7.16b helps to understand more of how concerns may impact the relevance of e-business functions, by summarising the triggered functions according to level of function. For this particular organisation it is demonstrated that:

- On the demand side, the primary effect of the concerns was chiefly to depress the potential relevance of the control and co-ordination functions;
- On the supply side, the effect was more spread with both the transactional and control and coordination functions significantly impacted.

This was actually an elegant demonstration of the fact that:

- In respect of customers, concerns related to their attitudes and behaviour, whereas;
- In respect of their suppliers, the picture was more mixed with technical capabilities relevant to transactional functions and supplier size and sophistication impacting the control functions.

For the company that participated in this case study, this exercise was part of a continuing process of understanding where the e-business focus of the organisation should be directed. In addition to the detailed functional recommendations, two overall directions were clearly indicated. Firstly, the demand side collaboration functions were unlikely to be of much benefit in the context of the actual customer situations being faced. The recommended direction for the company is therefore to do the minimum necessary to conform to customer dictates as and when required. Secondly, whereas the relevance of the supply side e-business functions were clearly indicated, nothing much had actually been done in this domain. Action to develop both collaboration and transactional supply side e-business functionality was therefore of value, provided that the supplier technical capability issue could be addressed.

### 7.5.2 Case Study B

Figures 7.17(a) and (b) show the profiles for case study B.

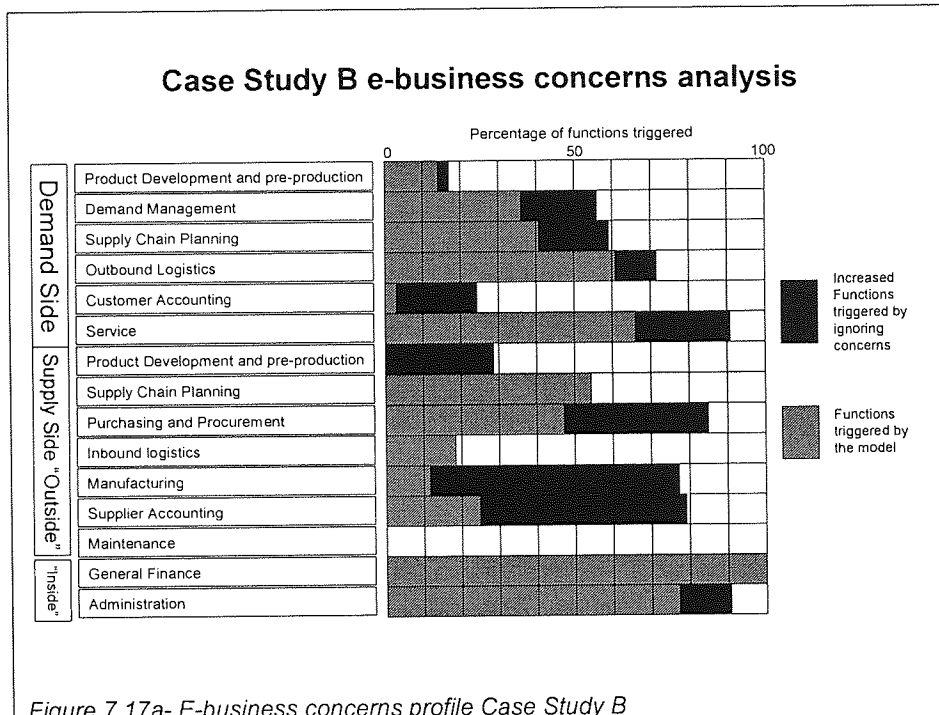


Figure 7.17a- E-business concerns profile Case Study B

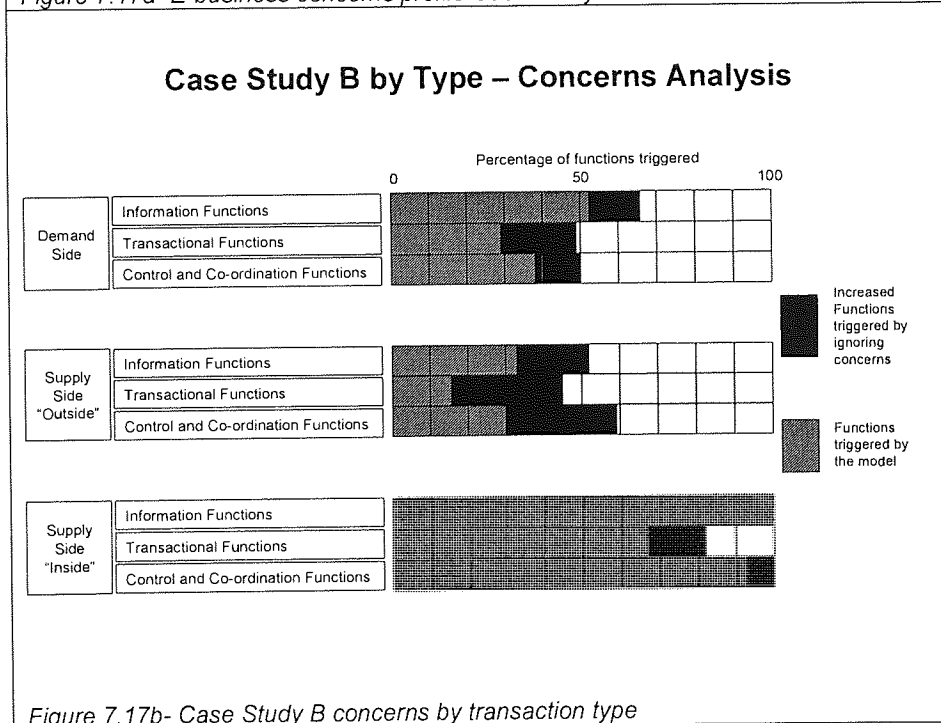


Figure 7.17b- Case Study B concerns by transaction type

In this case, the impacts of concerns were mostly in the supply side and related to supplier capabilities. In fact this explains quite elegantly the relative lack of "relevance" of supply-side e-business noted earlier (see above 7.3.2). The demand side concerns were primarily

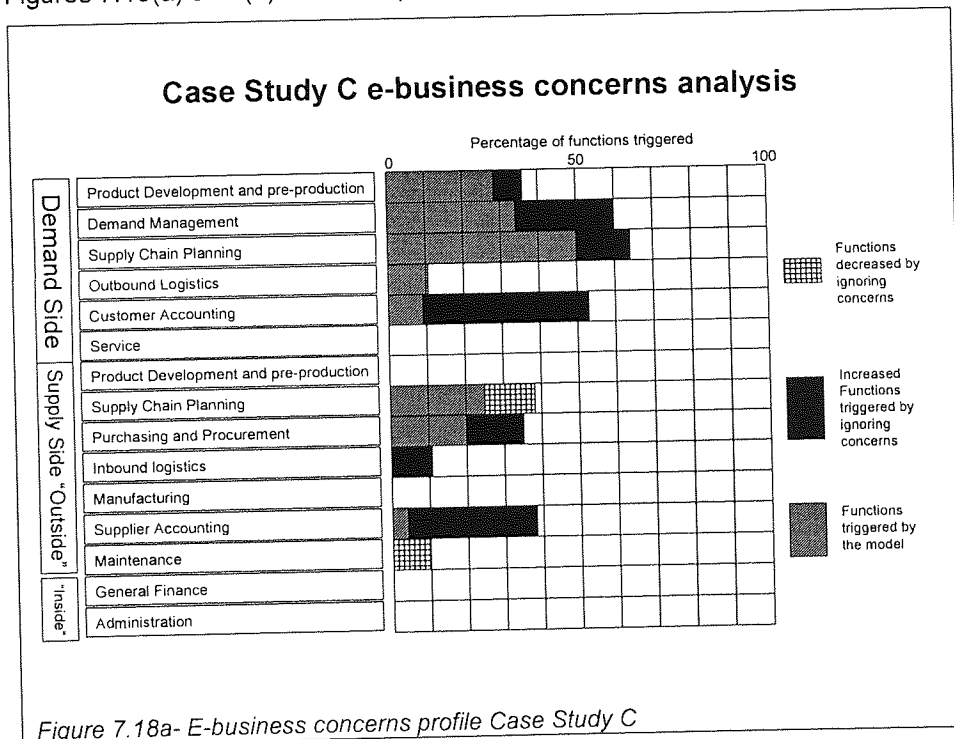
with the customer's lead-time expectations and the consequences in terms of the difficulty of meeting them.

Similar concerns related to supply reactivity and reliability, but there was a recognition that the demand side problems fed through into the stability of the demand placed on the suppliers.

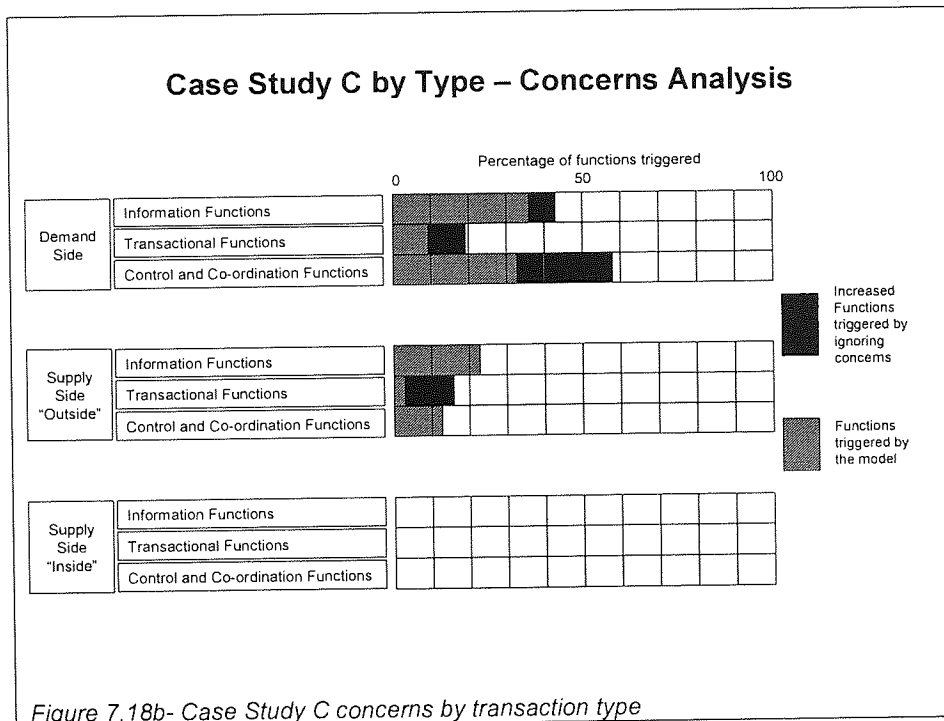
As a large company the use of e-business in internal administration was clearly indicated and not much influenced by management concerns. This reflects the fact that it is easier to overcome internal concerns.

### 7.5.3 Case Study C

Figures 7.18(a) and (b) show the profiles for case study C.







This analysis shows a small company with demanding and unsympathetic customers. This shows quite clearly in the impact of management concerns on the demand side collaboration functions.

There are also concerns about the capability of suppliers, and the lack of ability to influence them, and this shows itself in a depressive action of concerns on the relevance of supply side transactional functions.

It was interesting that on a few functions, in the maintenance and (supply side) supply chain planning domain, concerns were reasons for doing something instead of reasons for not. This is a corrective to the notion that management concerns are necessarily negative to e-business!

#### 7.5.4 Case Study D

Figures 7.19(a) and (b) show the profiles for case study D.

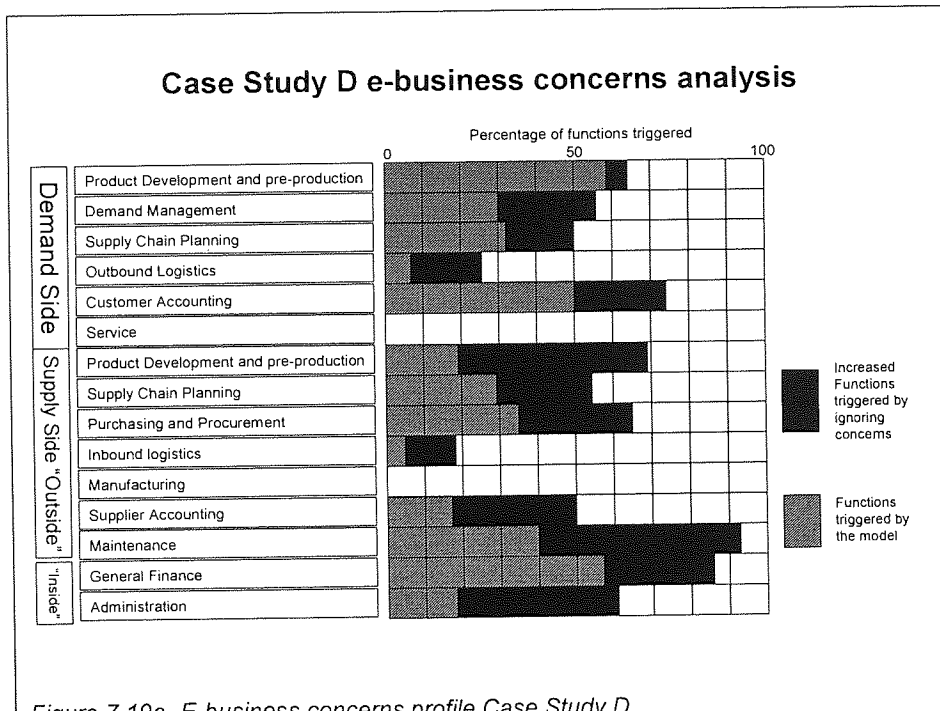


Figure 7.19a- E-business concerns profile Case Study D

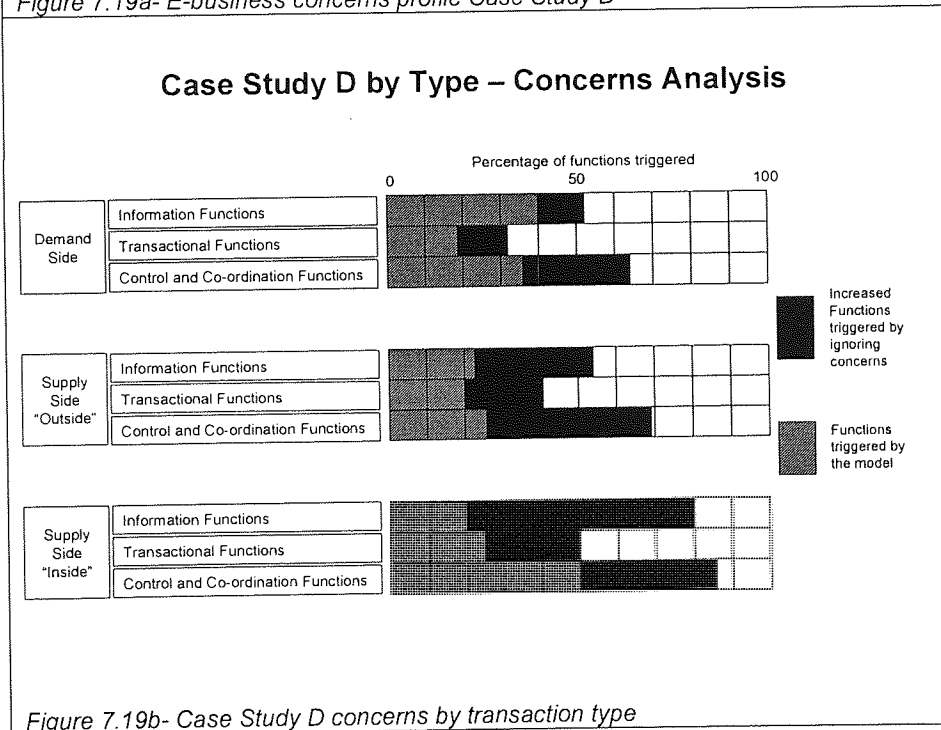


Figure 7.19b- Case Study D concerns by transaction type

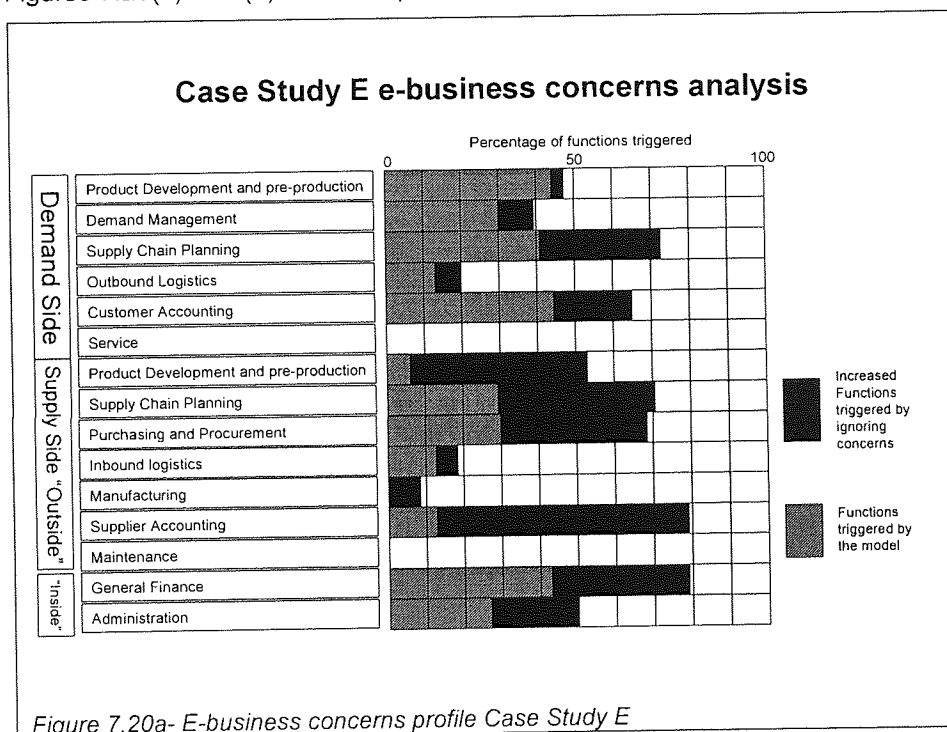
On the demand side, there were concerns relating to the efficiency of internal organisation and to the behaviour of customers, the latter quite reasonably affecting collaboration functions.

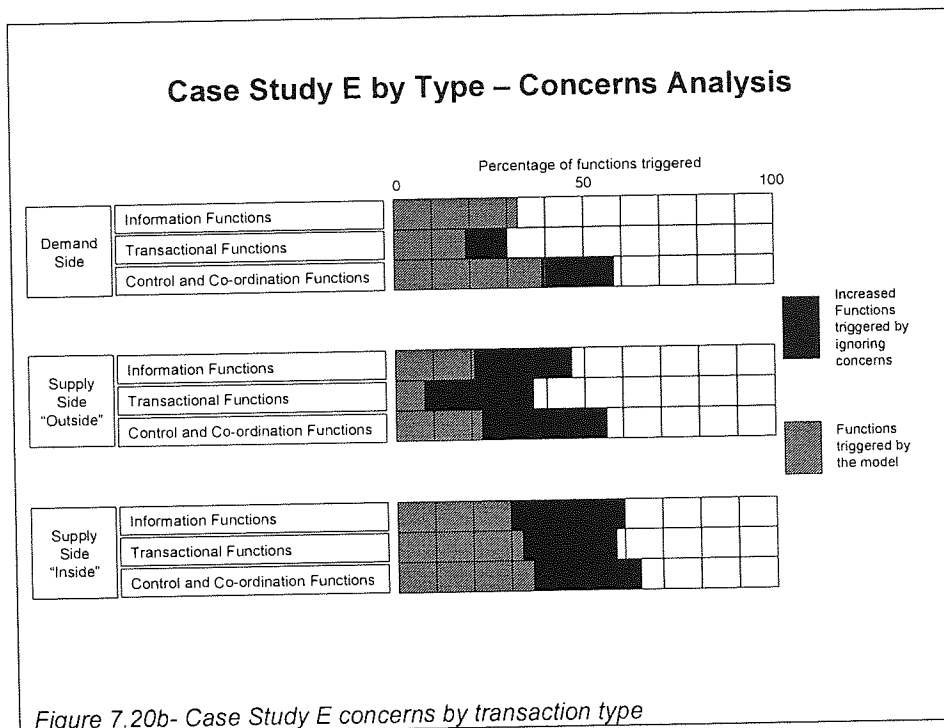
On the supply side, there were little real concerns with the suppliers, but the main issues suppressing functions were those of IT credibility (the integration of systems, how they are used, and the determination of management to implement them properly).

The effect of removing concerns helps explain the point noted earlier (7.3.4) that the profile seems exceptionally thin for a company of this size. In fact removing concerns makes this profile more similar to that of some of the other automotive case studies.

### 7.5.5 Case Study E

Figures 7.20(a) and (b) show the profiles for case study E.





This case study also demonstrates a fairly heavy impact of management concerns, again explaining why some functional domains, in this case the supply side, seem exceptionally light.

It was interesting that although there were many concerns on the customer side, these did not translate into a large impact on the e-business functions considered relevant on the demand side. The explanation of this is that most of the transaction and information functions are relevant or not as dictated by the marketplace, and concerns cannot affect this. Such impact as there was, was concentrated on the collaborative functions, and these are more sensitive to management concerns. The message for the company here might be not to expect any value from the collaboration functions and do as little as is sufficient to satisfy the mandates of the customers.

The low e-business profile of the supply side was commented on above (7.3.5). Additional insight here may be gained from the heavy impact of concerns on the supply side (both inside and outside), and if these were resolved then a "low" coverage picture would be transformed. Indeed most of these concerns are internal concerns rather than concerns with external partners.

#### 7.5.6 Case Study F

Figures 7.21(a) and (b) show the profiles for case study F.

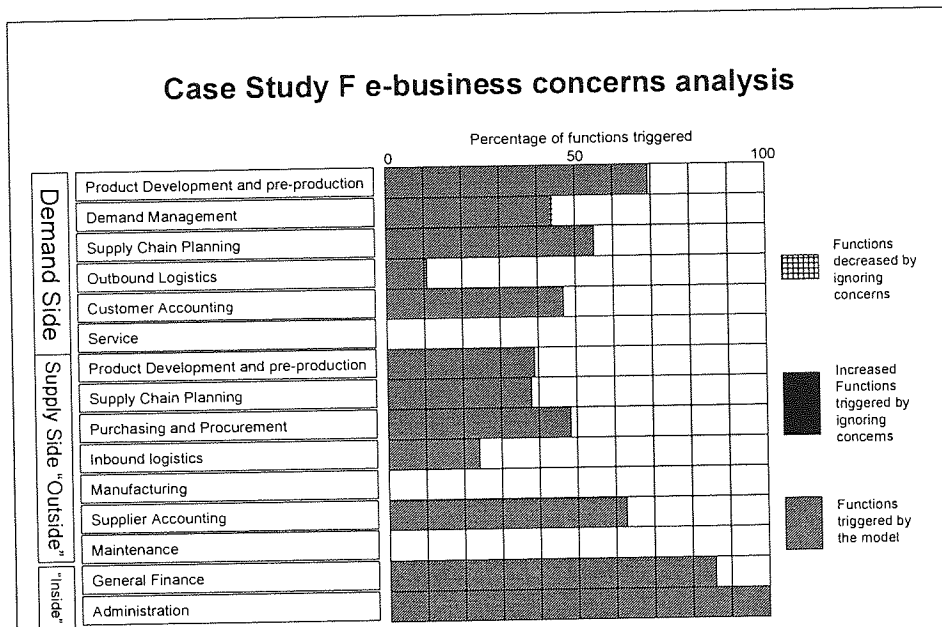


Figure 7.21a- E-business concerns profile Case Study F

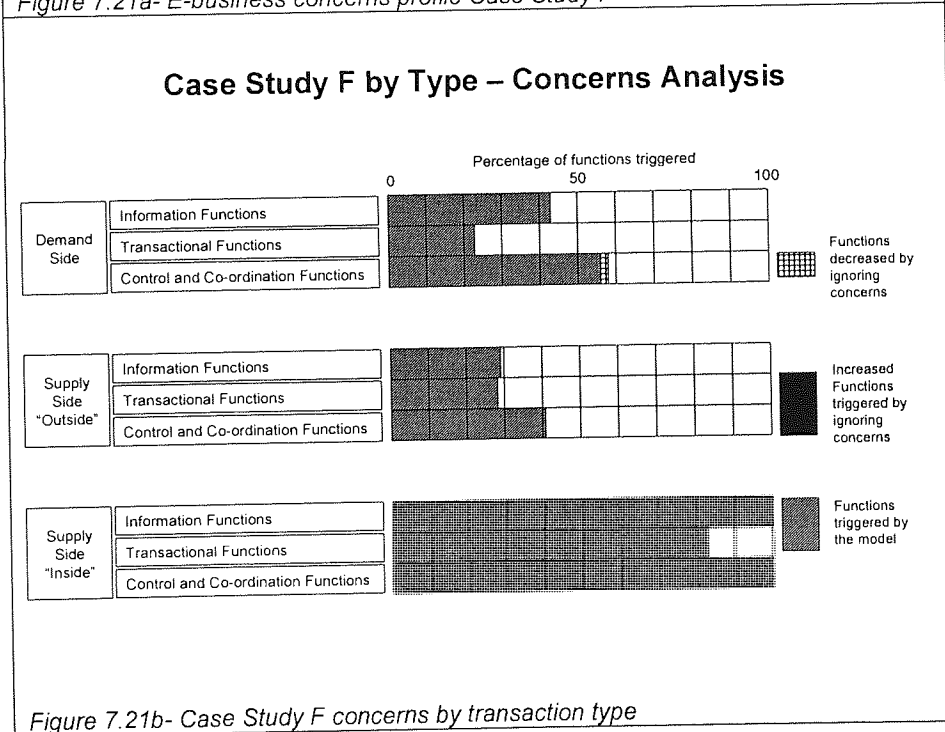


Figure 7.21b- Case Study F concerns by transaction type

This is a picture of an organisation with few concerns that they would admit to. Or to be more precise, there are no admissible concerns that the company would allow to inhibit the achievement of functions the performance of which it would consider relevant for the business.

### 7.5.7 Case Study G

Figures 7.22(a) and (b) show the profiles for case study G.

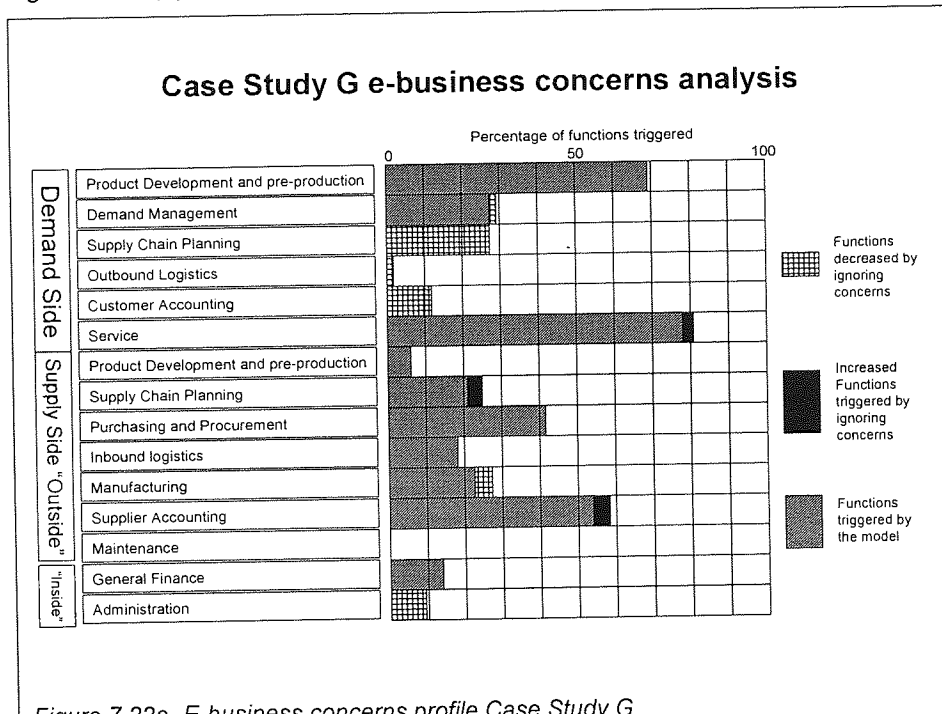


Figure 7.22a- E-business concerns profile Case Study G

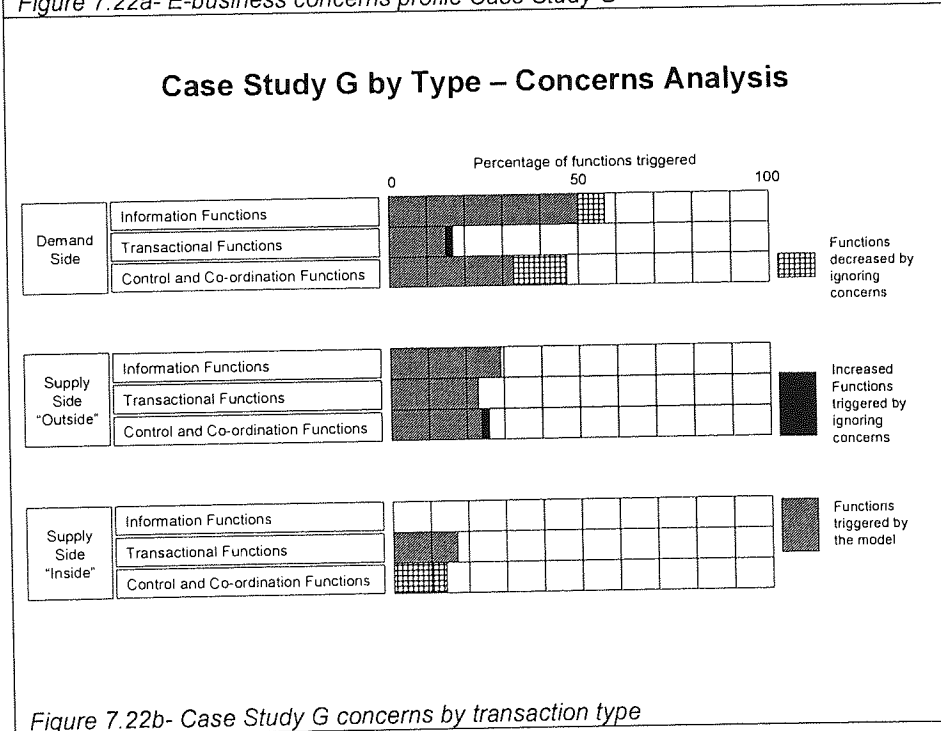


Figure 7.22b- Case Study G concerns by transaction type

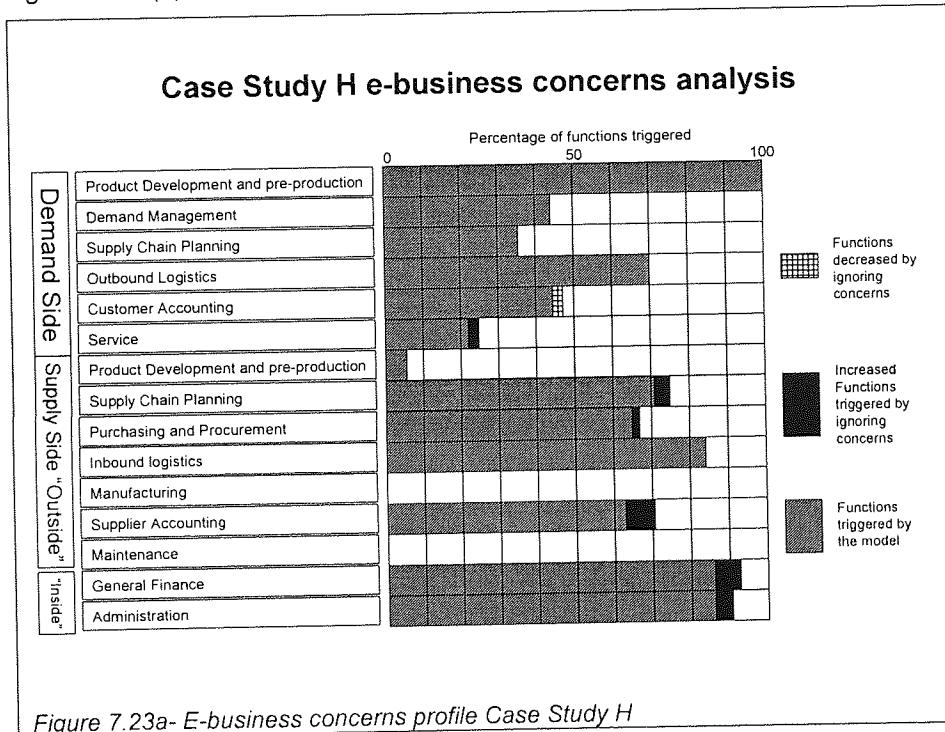
In this case study, the removal of management concerns caused an overall decrease in the e-business functions considered relevant. It was interesting here that concerns tended to be reasons for doing things rather than reasons not to do it.

For example removing the concerns reduced a significant number of demand side collaboration functions. Concerns involving exigent customers caused the model to suggest that the company could benefit from collaboration functions.

This is a relatively small company with few requirements for internal e-business functions. Here again concerns tended to be a reason for doing things rather than a reason not.

### 7.5.8 Case Study H

Figures 7.23(a) and (b) show the profiles for case study H.



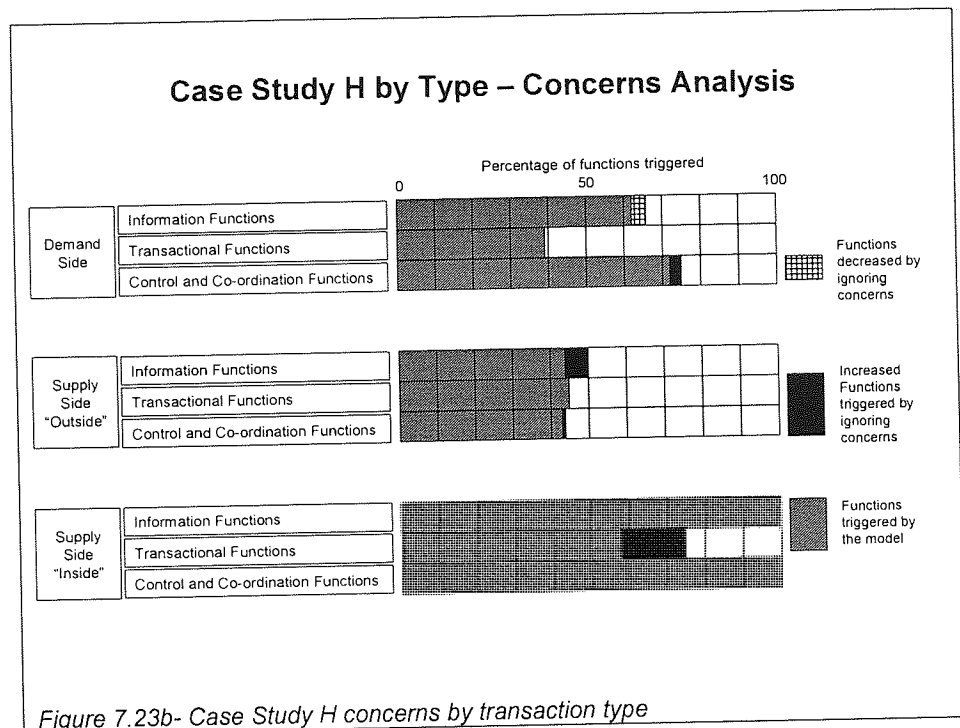


Figure 7.23b- Case Study H concerns by transaction type

In this case study there were no concerns significant enough to have a major impact on those functions considered relevant. For example, there were many concerns with demanding customers, but not enough to suppress those functions that are clearly indicated as necessary in the context of the characteristics of the organisation. This can be seen characteristic of a large organisation that has learned to live with concerns and does not see these as reasons for not doing things.

#### 7.5.9 Case Study I

Figures 7.24(a) and (b) show the profiles for case study I.



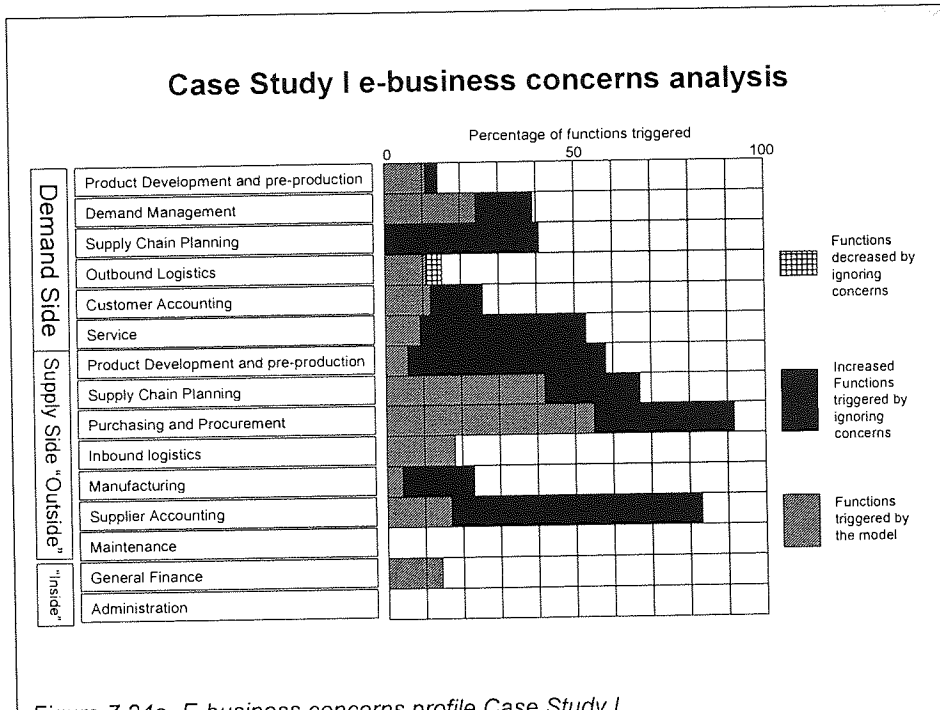


Figure 7.24a- E-business concerns profile Case Study I

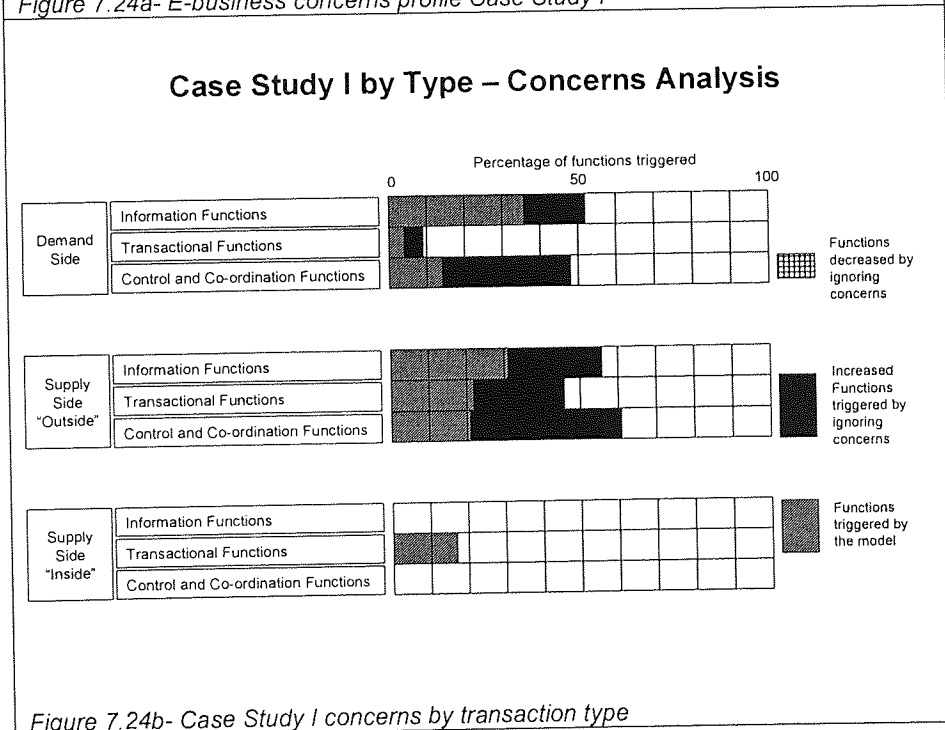


Figure 7.24b- Case Study I concerns by transaction type

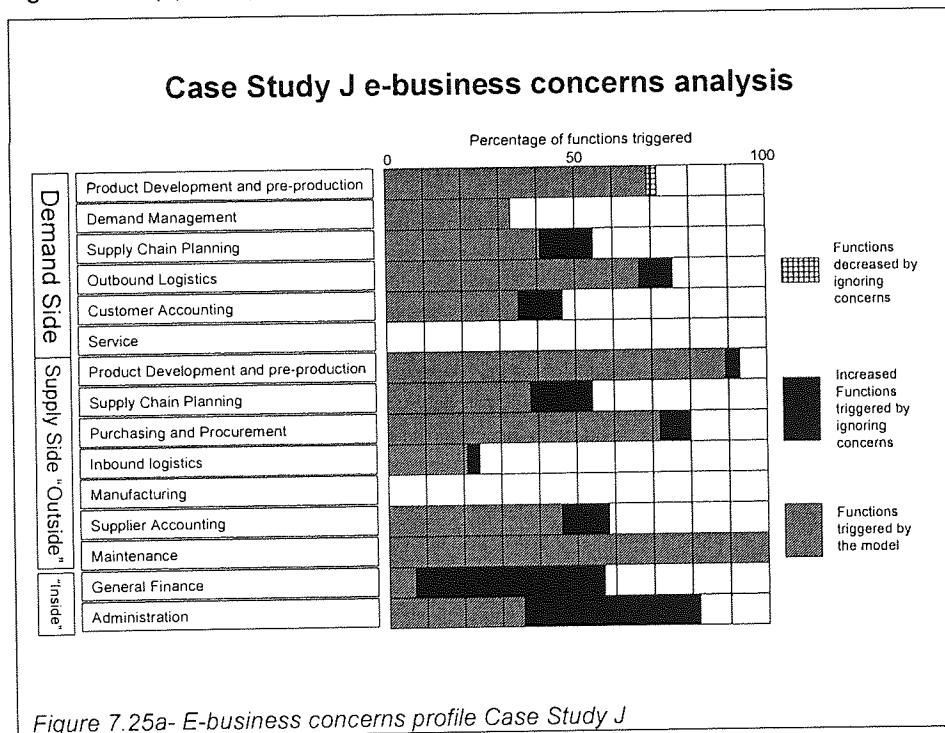
Here we see an organisation where the concerns have a significant impact. Most of these concerns related to "outside" concerns with external partners. This was a small company with little need e-business supporting the internal organisation, therefore equally not being inhibited by concerns in this area.

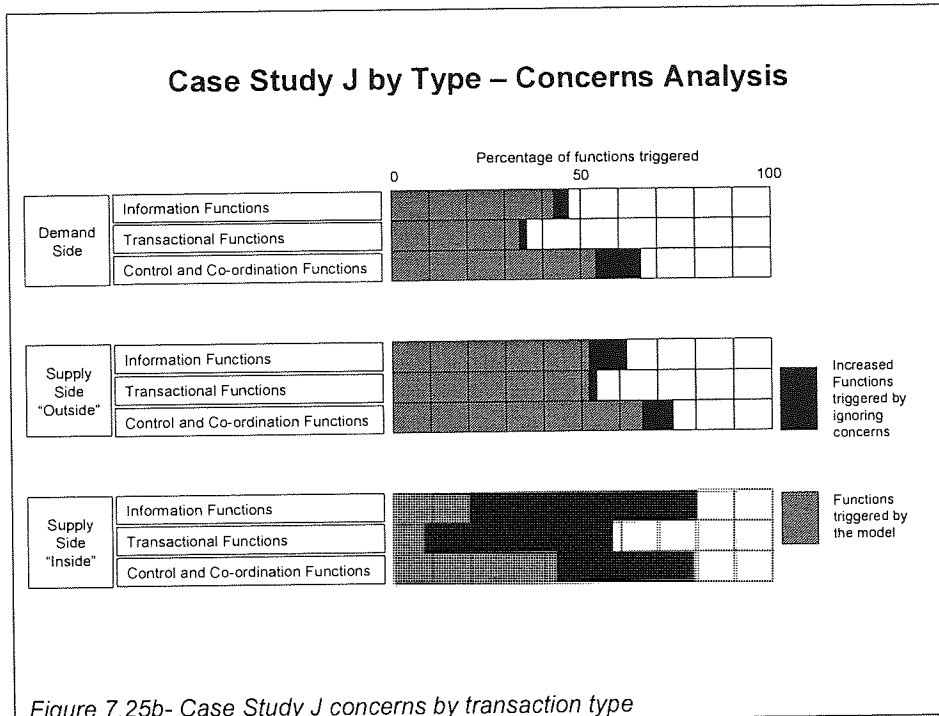
There seem to be more concerns on the demand side, the concerns having more of a flavour of "our fault" rather than the fault of the customers (e.g. concerns about ability to deliver on time, effectively manage finished goods stock and ability to satisfy quality expectations). Curiously, the impact of these concerns seems more to be on the supply side functions than those on the demand side. In effect this is saying that problems with satisfying customer demand have a knock-on effect on the effectiveness of the internal systems and this in turn has a knock on effect on reducing the potential effectiveness of the supply side functions.

There were also some concerns with the suppliers and general scepticism about the value of IT investments in general. One could perhaps suggest that this organisation seems unlikely to take much initiative in an e-business direction, and perhaps unlikely to make much of a success of initiatives that they do take.

#### 7.5.10 Case Study J

Figures 7.25(a) and (b) show the profiles for case study J.





The profiles for this case study excluding "concerns" explain a couple of otherwise unexplained points with the original profiles in section 7.3:

- The fact the major impact of concerns were in the internal administration functions helps explain the low profile in this area commented on above (7.3.10);
- The low number of concerns on the supply side "outside" helps explain the fairly high e-business profile in this domain in comparison with case study A (see 7.3.10, 7.3.1, 7.5.1).

Again, it is interesting to compare the profiles with those of case study F.

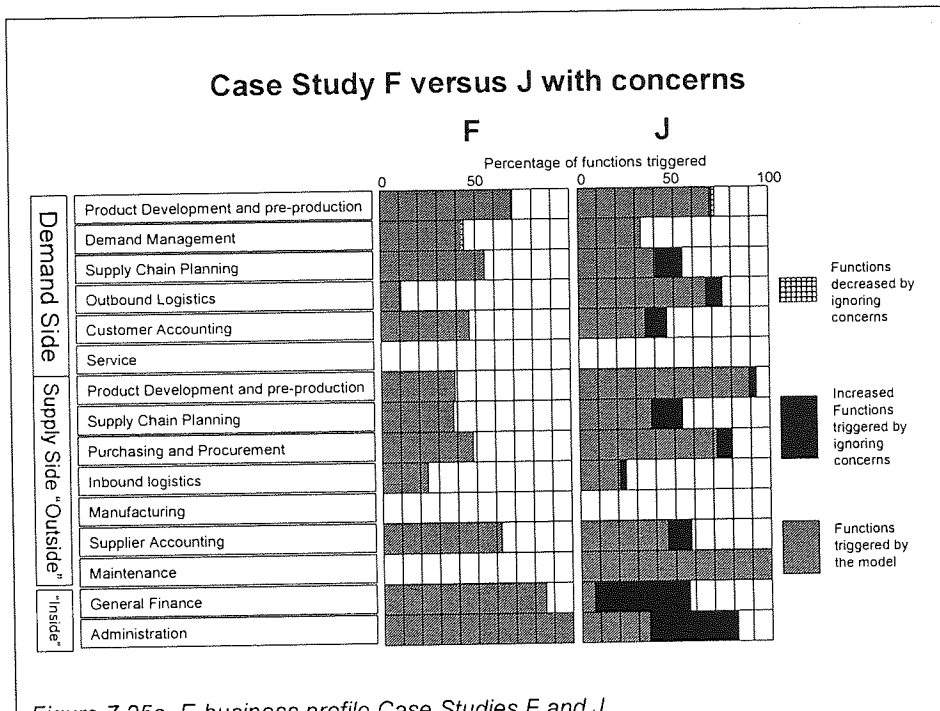


Figure 7.25c- E-business profile Case Studies F and J

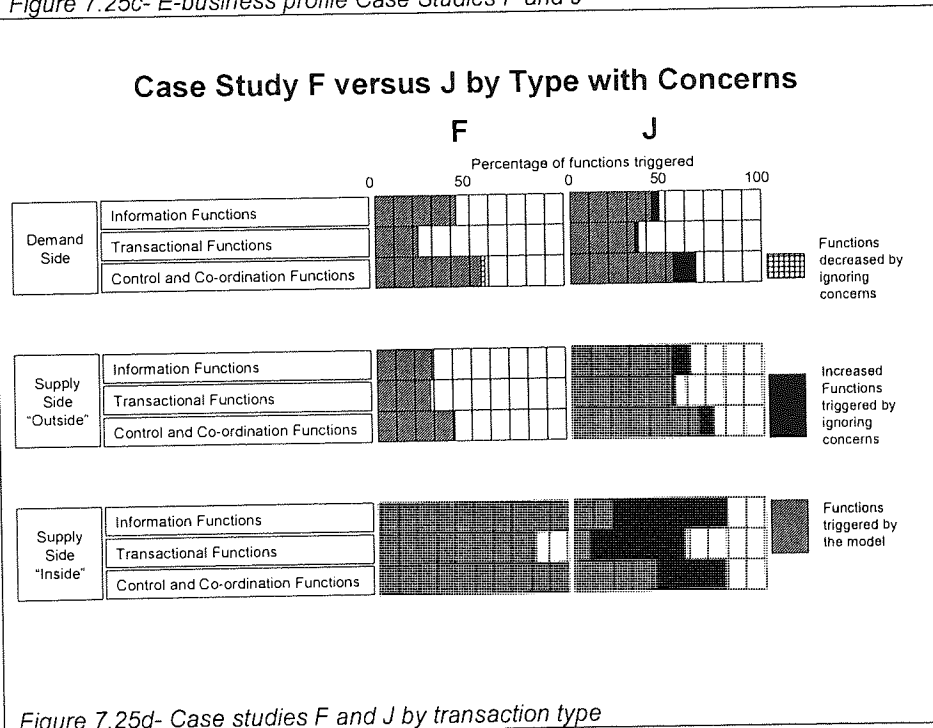


Figure 7.25d- Case studies F and J by transaction type

Figures 7.25c and 7.25d show the profiles of case studies F and J side by side.

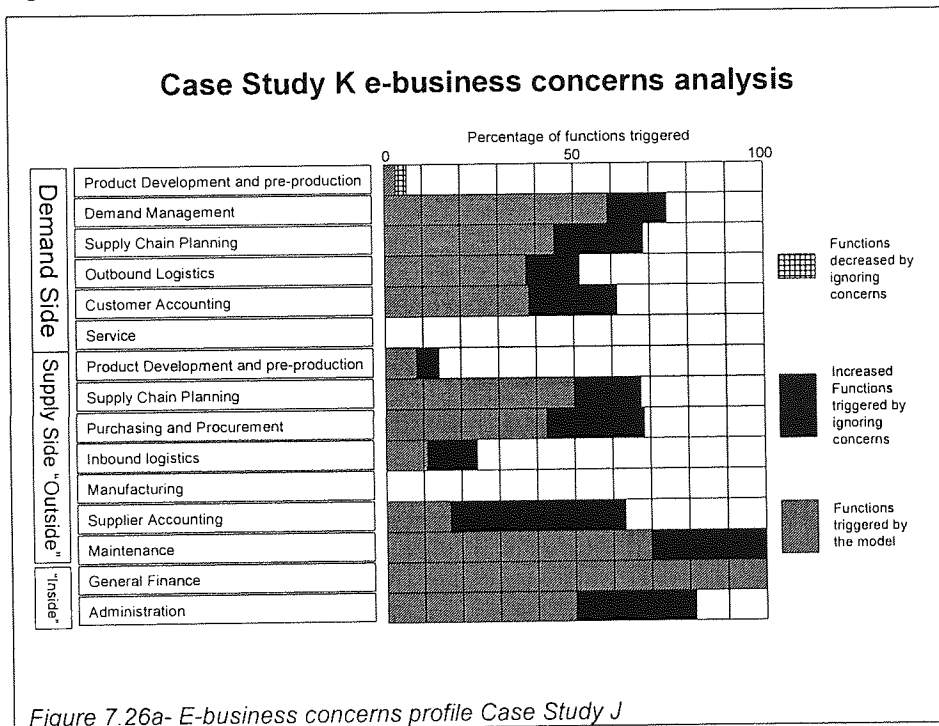
Most of the points of difference between these case studies have been commented on earlier (section 7.3.10). The interesting point about this "concerns" comparison was the discrepancy in the effect of management concerns on the "inside" functions. The difference

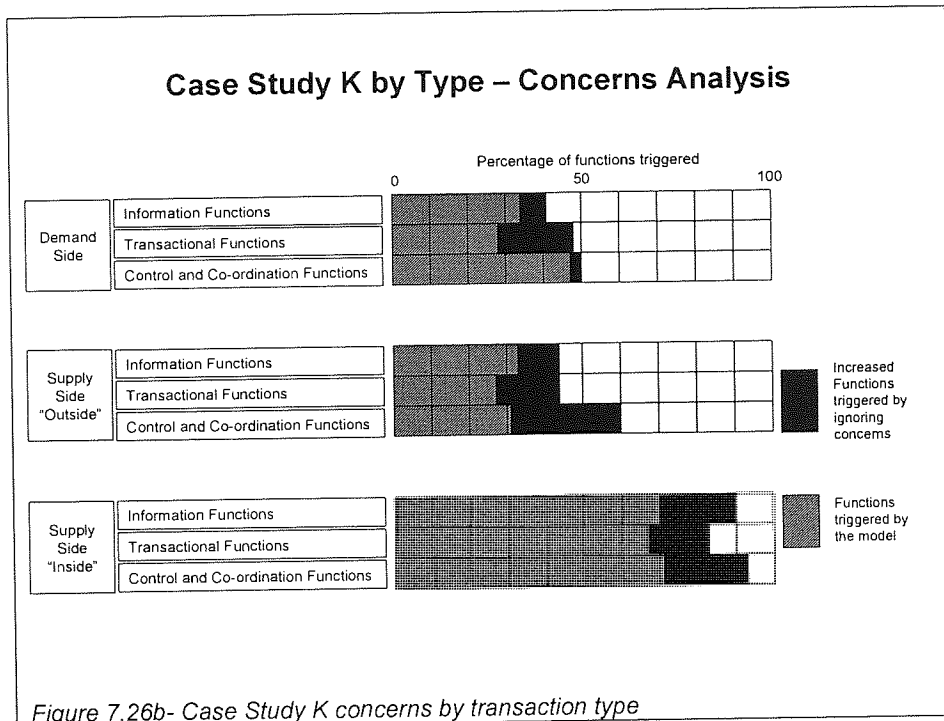
in e-business relevance was not caused by the objective characteristics (one could more readily have accepted this as caused by a difference of scale) but by a different view of the management concerns at the local level.

If we take the management concerns as some sort of surrogate for assessing the barriers to an e-business implementation, this is a useful illustration of how the barriers can look different from the local point of view as against the central point of view.

### 7.5.11 Case Study K

Figures 7.26(a) and (b) show the profiles for case study K.





We see here a case where management concerns again have a significant effect in suppressing concerns that would otherwise be relevant. Perhaps most interesting was the observation that concerns had little or no effect on the demand side collaboration functions. This is explained by the fact that the concerns seemed mostly to be "our fault rather than the customer's". In particular, issues such as poor data accuracy, incompatibility and poor integration of systems, an informal system mentality within the company and shortage of IT skills serve to depress the relevance of transactional functions. It is these concerns that tended to explain the effect of concerns on the "Inside" administration functions. Concerns with the supply side had most impact on the supplier accounting domain, with purchasing and procurement and supply chain planning also impacted. Of these, the collaboration functions were most impacted.

Figures 7.26c and 7.26d show the profiles of case studies A and K side by side.

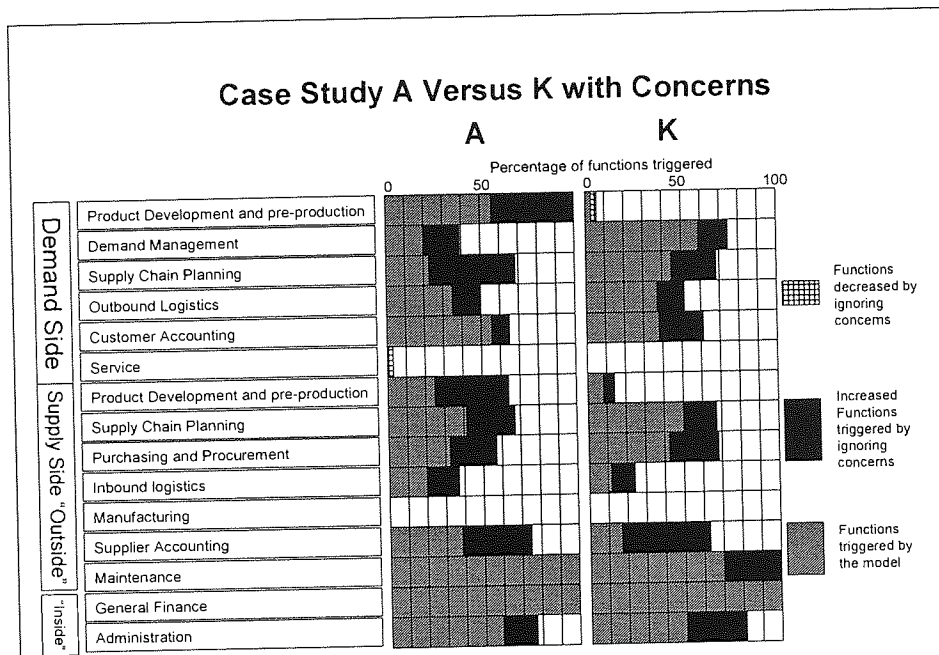


Figure 7.26c- E-business profile Case Studies A and K

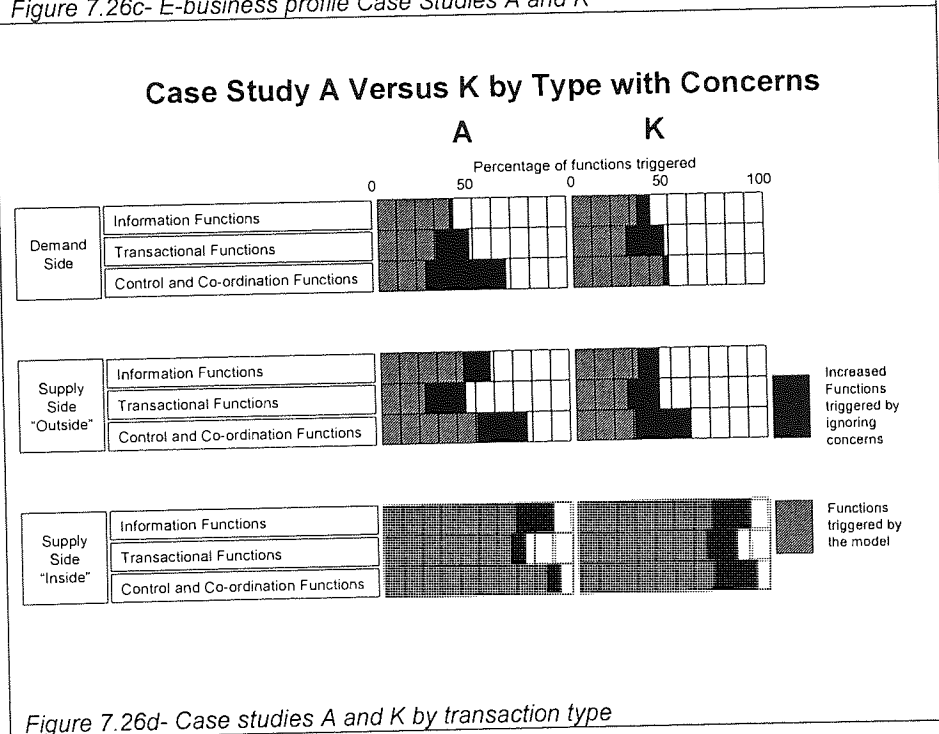


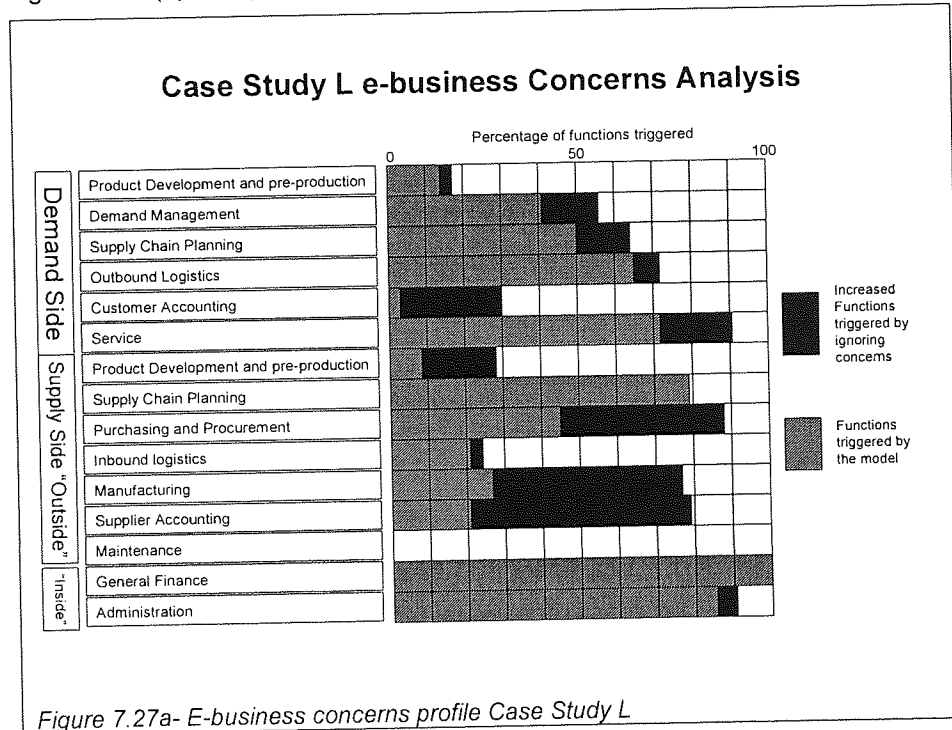
Figure 7.26d- Case studies A and K by transaction type

It can be seen that management concerns had a more depressing effect on the demand side collaboration functions in case study A as compared with case study K. The relevance of the demand side supply chain planning functional domain was particularly notable. Case study K did not manifest the same lack of confidence in the customer's willingness to work collaboratively.

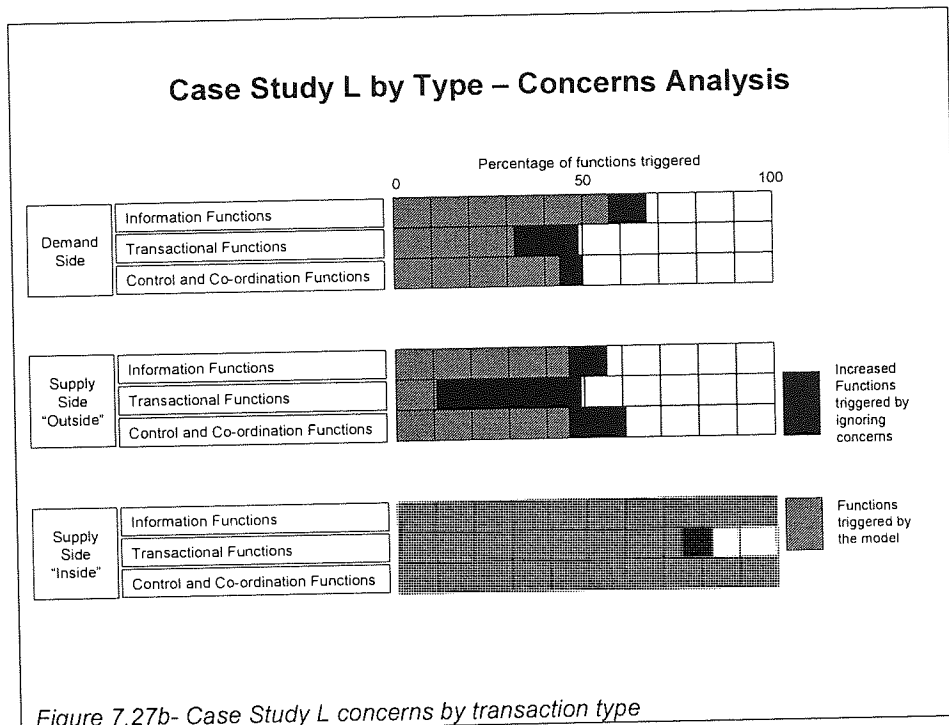
The analysis removing concerns tended to highlight even more the difference in the relevance of the Design functions (both with customers and suppliers). Apart from this the differences were not marked.

### 7.5.12 Case Study L

Figures 7.27(a) and (b) show the profiles for case study L.







Concerns seem to have more impact on the supply side, although the removal of concerns does serve to increase the relevance of the e-business demand side supply chain planning and demand management functions. The customer accounting domain seems the most inhibited by concerns. On the supply side, the major impact of concerns was in manufacturing and supplier accounting and purchasing and procurement.

Demand side concerns included problems with getting a good enough view of forward demand, and the ability to meet the customer's lead time and delivery expectations. These sorts of concerns, being associated with difficulty of planning effectively can also be expected to have a knock-on effect on the supply side.

In fact there are sufficient concerns with the supply base itself, both in getting the flexibility required to respond to demand and in getting the supply base to meet its commitments, once made. The inability of the supply base effectively to use either EDI or the Internet explains the dramatic effect of concerns on the supply side transactional functions. Concerns had little impact on the "inside" functions.

Figures 7.27c and 7.27d show the profiles of case studies B and L side by side.

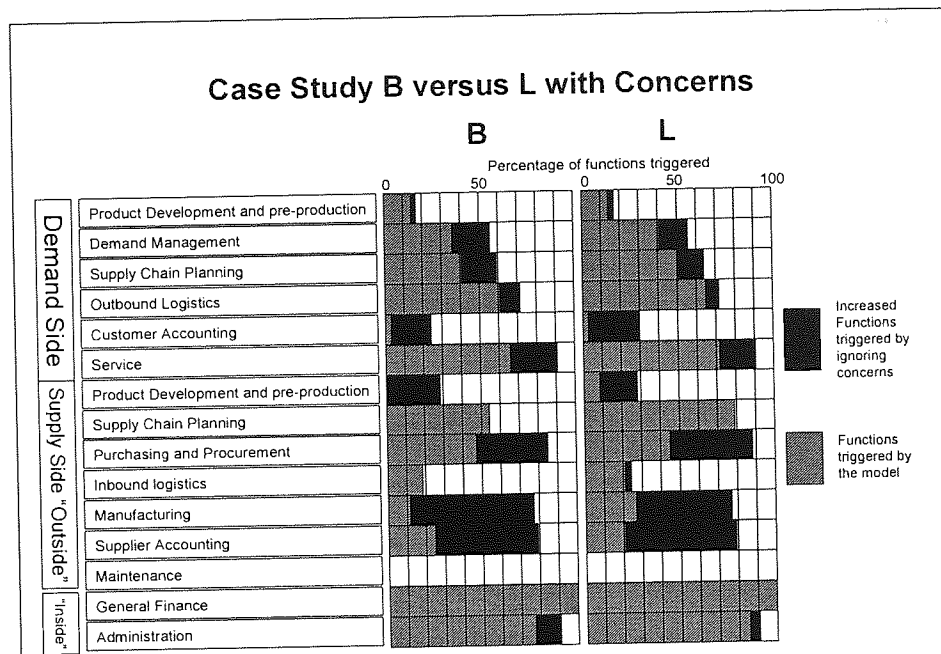


Figure 7.27c- E-business profile Case Studies B and L

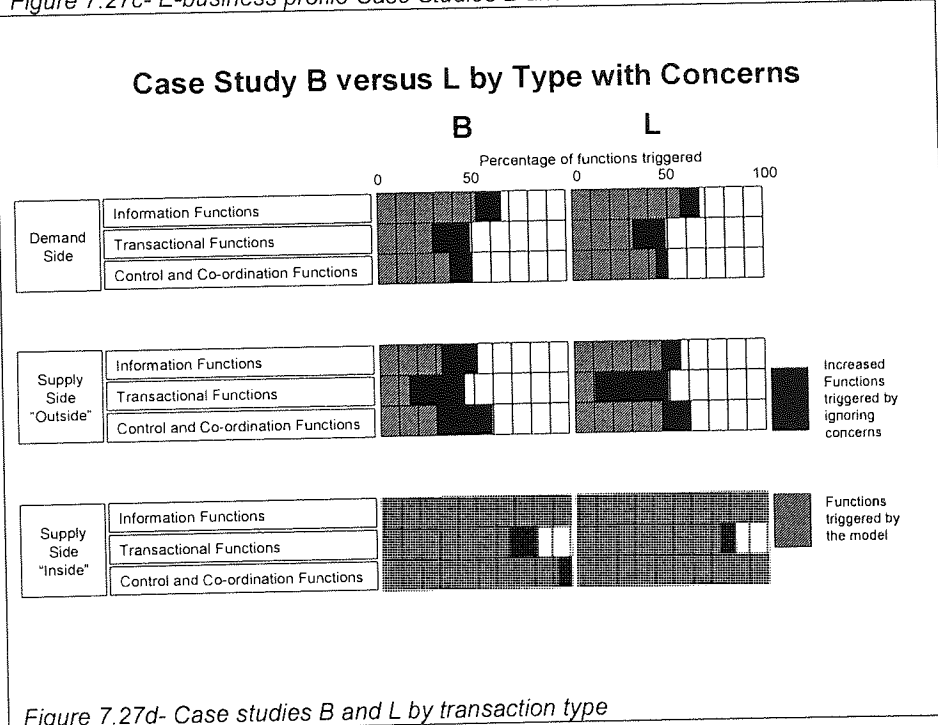


Figure 7.27d- Case studies B and L by transaction type

Most of the points of difference between these case studies resulted from an evolution of the company characteristics and have been commented on earlier (section 7.3.12).

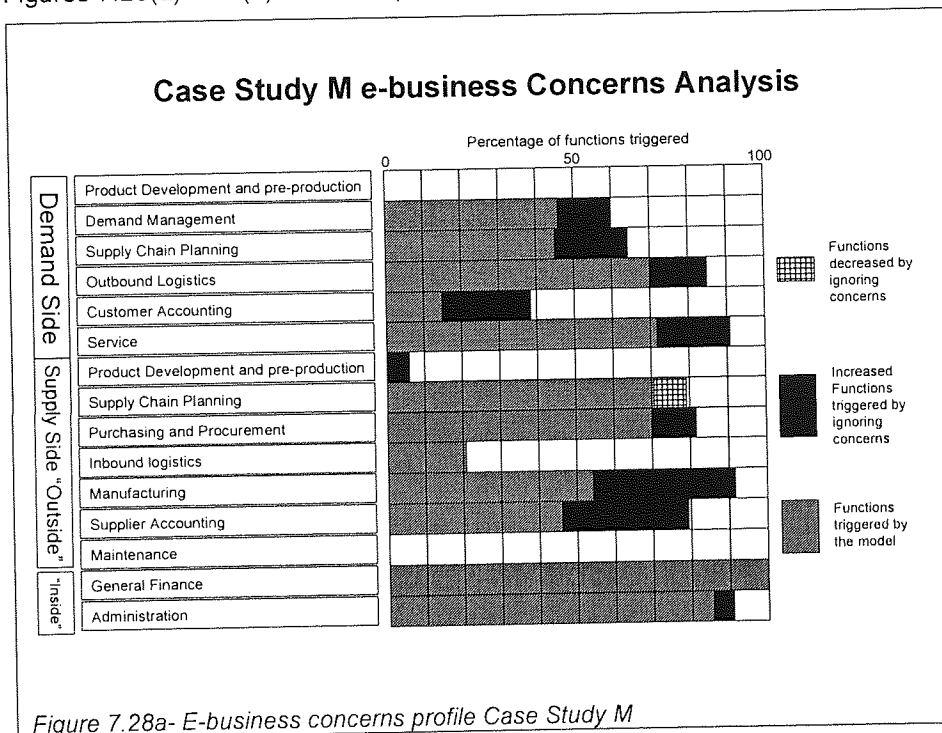
Concerns about the quality of the internal IT function had systems had reduced (e.g. inconsistency of information between departments, existence of informal system mentality

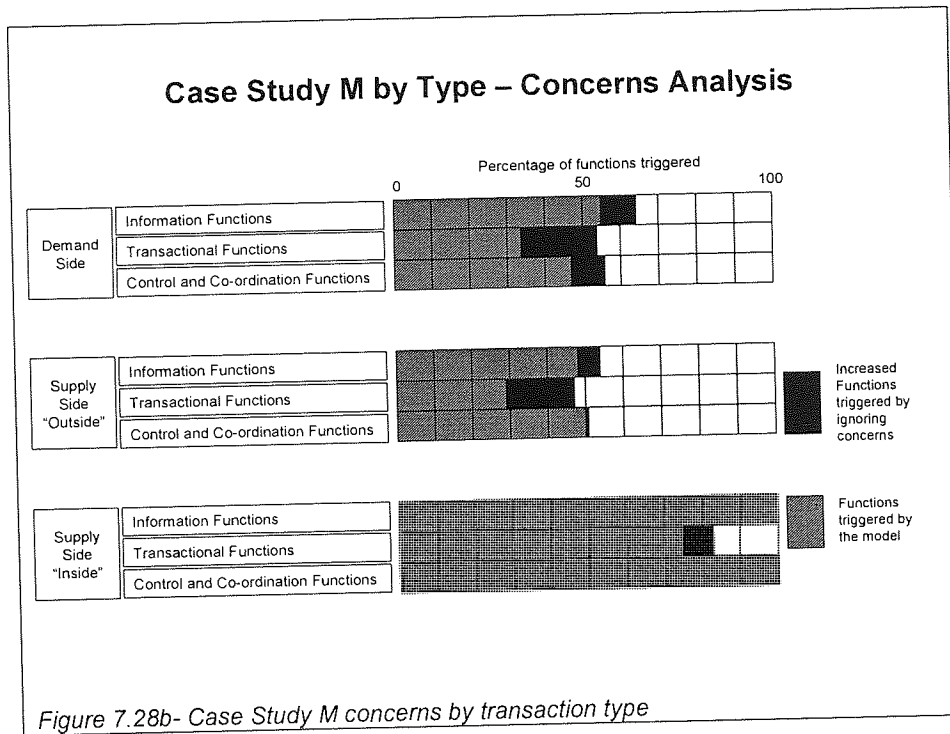
within the company, ability of the company effectively to exploit IT investments). This had manifested itself in slightly more "inside" functions being triggered.

Other concerns had arisen, including the EDI capability of suppliers noted above. This had particularly affected the supply side "outside" transactional functions. This manifested itself in less transactional functions being triggered by the model when including concerns, while more are considered relevant if concerns are ignored.

### 7.5.13 Case Study M

Figures 7.28(a) and (b) show the profiles for case study M.





The major demand side concerns for this case study included those to be expected in an organisation that must deliver a responsive parts service. The most significant of these are the difficulty of forecasting demand and the high level of stocks that are often incurred. These tended to impact the potential relevance of the demand management, supply chain planning, customer accounting and service functions. On the supply side, the concerns included supplier reliability and responsiveness, together with shortages of items coupled with high obsolete inventory. The major impact of these concerns was in the manufacturing and supplier accounting functions. Concerns had little impact on the supply side "inside" functions.

Figures 7.28c and 7.28d show the profiles of case studies L and M side by side.

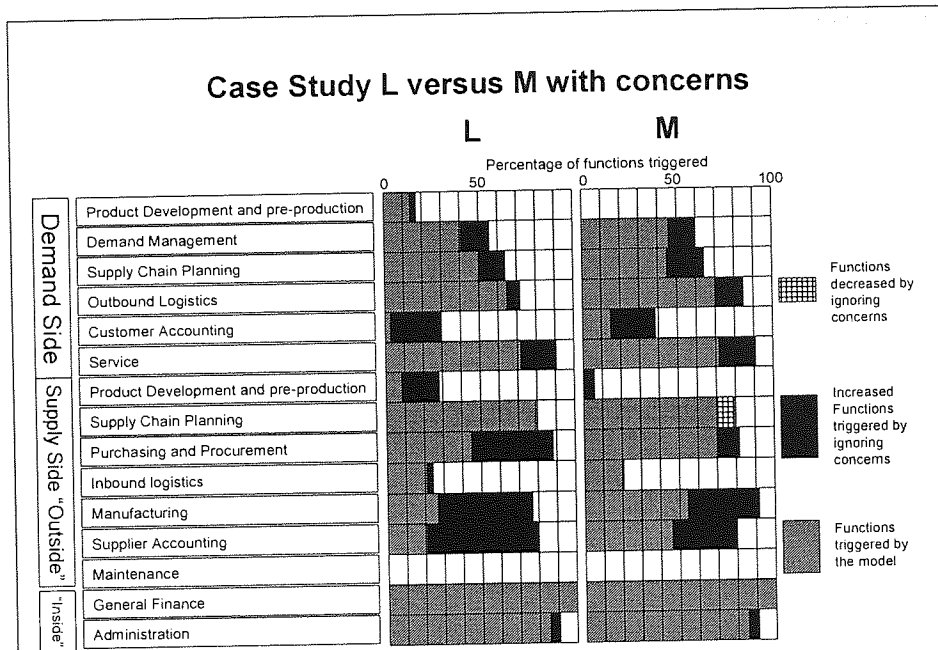


Figure 7.28c- E-business profile Case Studies L and M

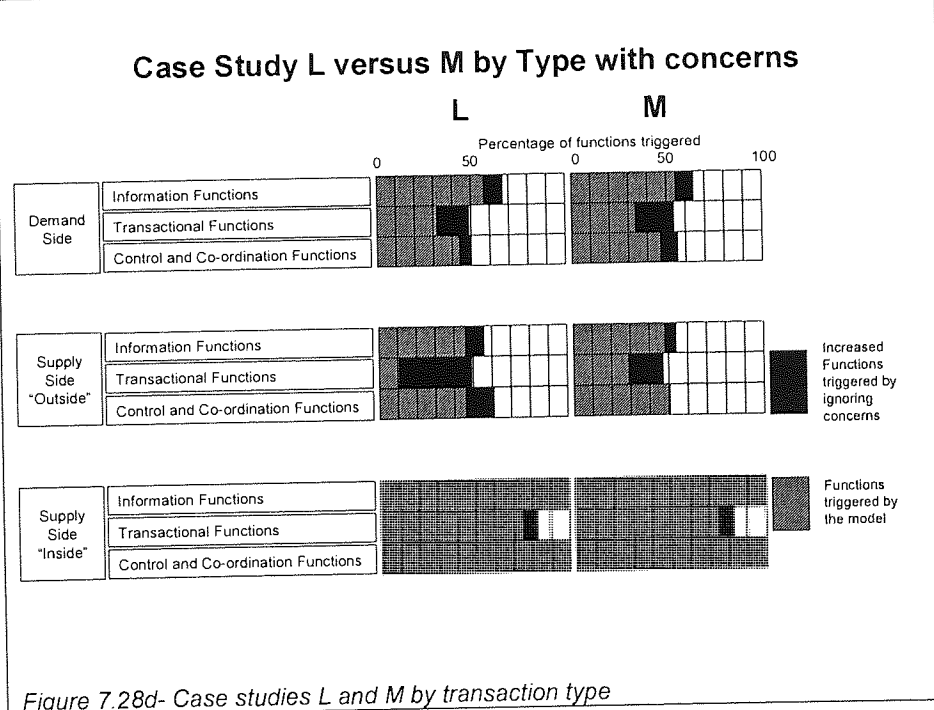


Figure 7.28d- Case studies L and M by transaction type

By and large, removing the effect of concerns, one continues to see the slightly heavier e-business profile in case study M versus L noted earlier (7.3.14), this to be expected as a consequence of the more complex type of supply situation that one might expect in a spares organisation.

On the demand side the removal of concerns has a similar effect in the two case studies. In fact this case study M had less customer concerns than case study L, suggesting that some of the concerns had little effect.

On the supply side "outside" functions, however, the removal of concerns tends to even up the comparative relevance of the purchasing and procurement, manufacturing (sub-contract) and supplier accounting functions. Concerns had a less inhibiting effect on case study M than in case study L. This would suggest that the supply base is more amenable in the case of the part business (Case Study M), or perhaps it is less under stress. On the supply side "inside" functions, one would not expect to see any differences and indeed one does not.

## **7.6 Conclusions**

### **7.6.1 Validity of e-business profiles**

- (a) This chapter has used the e-business profiles as a mechanism for summarising the case studies that were used to validate the model. It must be emphasised once more that the primary purpose of this research was to develop a model that was capable of giving useful advice at the detailed level rather than simply to produce superficial diagrams. To that extent these e-business profiles were an unexpected product of the research.

The concept of the e-business profile evolved to meet the requirement to be able to discuss the results of a model at an intelligible level of detail. The model enabled an "e-business requirements" study to be conducted quickly for an organisation and produced a 100-page functional specification report containing of the e-business functionality required by the company. In response to requests for a summary of recommendations for presentation to management, a management summary section in the report was produced using the profiles as an overall summary of the recommendations contained.

The e-business profile therefore became a tool for meeting the need for summarisation. It seems natural therefore to propose them as a potential method of discussing the results of investigations using the model, thus enabling more general issues to be exposed. It is also possible to use these profiles to discuss in general terms the potential impact of management concerns in the achievement of e-business possibilities.

- (b) The question arises as to whether e-business profiles are acceptable, and more important, a useful way of representing information. The starting point in answering this question is to recognise that there has to be some way to provide management with an overall summary

of the recommendations provided as a result of running the model. The notion of presenting the proportion of functions triggered in each of the major functional domains seems a reasonable way of presenting the "weight" of e-business interest in that functional area.

The e-business profile is not a complete picture and has some limitations. The most significant of these limitations is that the concept does not take into account the proportion of the e-business functions triggered in relation to the total that could conceivably be relevant to the type of organisation involved. Some functions may be intrinsically irrelevant for some companies operating in some business contexts (for example order taking functionality in an environment where discrete orders do not exist). In these cases the profile in that domain might look light even though it was heavy in relation to what was possible. These limitations, however exemplify the limitations of any summarisation process: summarisation implies simplification and simplification may mean loss of accurate distinction. The profiles are only a summary and do not replace the detailed results of the model. In fact they can be used as a way of entering the detail to explore further issues exposed. Our conclusion therefore was that e-business profiles present useful summary information.

- (c) To summarise, therefore, the e-business profile seems to be a valuable tool for meeting the needs to provide a summarised picture of the e-business requirements of an enterprise. They are useful as a method of discussing the results broadly enabling more general issues to be exposed. It is also possible to use these profiles to discuss in general terms the potential impact of management concerns in the achievement of e-business possibilities. The key "selling point" is that they are not only just "pretty pictures", but also a synthesis of the true detail of the model, detail that is available in order to study the detail behind the overview picture.

#### **7.6.2 Analysis by transaction type**

The next question that arises is whether, given that e-business profiles are acceptable, the process of analysis by transaction types is helpful. The limitations of the function count by domain approach have been commented on above in 7.6.1. The analysis by type provides a different summary view of the e-business potential for the company that can give the slightly different perspective, especially with regard to concerns.

Information functions represent the ability to access information and to provide information. There is little difficulty in organisations performing these basic functions and therefore one

would not expect to see them inhibited by technological factors or issues with IT sophistication or lack of it.

Transactional functions represent the opportunity for computer-to-computer communication. An electronic communication representing a business transaction (e.g. a new order) moves from one computer to another or is done interactively with a user. The validity of these processes depends on the efficiency of the back office capabilities of the organisation at the receiving end. Concerns about technological capability both internally and those of partners can be expected to be particularly significant here.

Control functions represent opportunities to work collaboratively and in co-ordination with a business partner, sharing information and in some cases working using a common system. Concerns about attitudes of partners and the relative power and influence of the members of the supply chain could perhaps be expected to be most influential here.

In the analysis above, the profile by transaction type enabled insights to be gained in some of the case studies. The conclusion is that the perspective to be gained by this analysis is useful.

### **7.6.3 The Impact of concerns**

- (a) One of the major developments over the previous work in this area (Howard et al, 1998) lay in the significance of concerns and the analysis of the results both with and without concerns. It is relevant to consider what this analysis has led to. Two questions then seem to arise from this analysis. Firstly, are concerns a good idea; in other words do the concerns improve the model? Should they be used when the model is used? Secondly, if concerns are a good idea, is there a value in effect in running two models for every case, both including and excluding concerns, and presenting conclusions representing results from both situations to management?
  
- (b) It is suggested that the incorporation of concerns tend to improve the model, because they expose issues that are of relevance to a decision-making process relating to e-business. This can best be explained by considering an example of an e-business initiative. Let us suppose that the example involved a supply chain visibility initiative that requires the involvement of suppliers. Such an initiative may fit the characteristics of the company in question in a perfect world. However with concerns such as lack of support from management or lack of an adequate capability amongst the supplier community, it may be a waste of time and effort. A model that exposes this must be of value; a model that is not



capable of dealing with this must be of less value. Therefore it can be argued that the model is clearly more right (i.e. more useful) by including concerns.

The contrary argument is that characteristics represent the objective properties of the business and are relatively static, at least in the short/medium term. Concerns on the other hand are more subjective and therefore one might expect them to be capable of being challenged, should they be preventing otherwise feasible initiatives. Also concerns could represent constraints that could be capable of being changed (providing that the motivation was there). The argument then would be that the concept of management concerns is anomalous in a model purporting to be objective.

- (c) In the various case studies the concerns, as expected, tended to have one of two effects:
- They represented problems that were positive reasons for triggering the relevance of an e-business function (particularly noticeable in case study C);
  - They represented issues that would seriously inhibit the potential for success of a given e-business function from being useful (an effect visible in most case studies).

For example in case study A, it was easy to appreciate how concerns such as the dictatorial attitude of customers and their failure to communicate effectively or respect standards would tend to make functions that are collaborative in nature of less interest. It might be argued that the organisation being modelled would be forced into such functions anyway (by the dictatorial attitude of customers!), but it is still relevant for the model to suppress their relevance and to discourage adoption. The organisation would at least be pre-warned, and able to do and spend the minimum necessary to achieve whatever conformity was forced upon it.

It is concluded therefore that the arguments in favour of concerns (the fact that the model is more realistic and useful) prevail against the counter-argument of subjectivity. The key point is that the effect of these concerns in individual detailed cases can be studied at a detailed level, and therefore overridden if the effect of the concerns is unreasonable in an individual case.

- (d) The model in its current form does not differentiate between concerns that were endemic to the business environment that the organisation was operating in and those that represent problems that the management of the organisation should be capable of resolving if there was sufficient motivation and justification. It could be argued therefore that including

concerns would tend to result in an unduly pessimistic assessment of the relevance of the e-business functions.

The possibility that concerns would create an unduly pessimistic assessment is something to be borne in mind, but it does not invalidate the concept. The purpose of the model is to predict from the inputs (characteristics and concerns), what is likely to be significant and what is not. It is accepted that this will not represent a perfect functional specification of requirements; but the expectation is that that it will provide a constructive input into a requirements definition process. It is to be expected that the results will be subject to critical review based on local circumstances. The fact that the model cannot currently automatically reflect all the possible subtleties of the concept of management concerns is therefore not a reason for not considering such concerns.

- (e) It was observed earlier (Section 3.2.1) that the e-business domain involves functions that are not under the control of external partner organisations (for example customers and suppliers) but also have no purpose unless such organisations are working collaboratively. Concerns about the behaviour of such external organisations must therefore be relevant in order for the results of the model to be in any way realistic. With the inclusion of concerns in the model, there is a tool that can go some way to address the issue of how partner behaviour can make or break the relevance of certain functionalities irrespective of the objective relevance or otherwise of these said functions. In addition since the e-business domain is still (see chapter 2) immature both technologically and in the application of sound business common sense, it seems reasonable to suggest that management concerns could be of importance. Finally it is reasonable to expect that management may also appreciate judgments on the barriers potentially influencing implementation success.

The results of the case studies demonstrate that insights have been gained by studying the impact of concerns. Therefore, despite the fact that we do not currently easily differentiate between concerns that can be addressed and those that cannot, the fact that the issues have been exposed has been constructive. It is concluded therefore that concerns are a useful ingredient in the model.

- (f) Having established that concerns are useful, then the question arises as to whether there a value is producing results both taking concerns into account and ignoring them. As already observed above (c), concerns could represent positive reasons or negative inhibitors.

Most concerns proved to be inhibitor concerns, the inclusion of which in the model tended to suppress the potential relevance of e-business functions. Excluding them would suggest that a function was relevant; including them would suggest that a concern was not relevant. For example the e-business supply chain initiative quoted above (b) is considered relevant in the absence of concerns, but concerns involving lack of support from management or lack of adequate capability of suppliers render it irrelevant. Which of these judgements is the most useful? The answer is either – depending on circumstance. The judgement including concerns could be a correct reflection of the likelihood of an organisation making a success of a particular function. However the version without concerns could be an inspirational reflection of the potential for e-business in an organisation providing that there was determination to address the said concerns.

It has already been observed above (d) that in the current development of the model it is not possible to differentiate between the concerns that can be alleviated and those that cannot. The use of the model without taking concerns into account could help guard against an overly pessimistic assessment of the e-business potential. Running the model both with and without concerns, and examining the reasons for major variances, can expose the issues and enable them to be studied in detail at the individual function/reason level.

- (g) It can therefore be concluded from the case studies that running the model with and without using the concerns can generate insight. The model run without concerns is a useful indication of the objective relevance of the e-business functions to the organisation in a reasonably concern-free world, whereas the version with concerns represents the relevance of the functions in a practical world where theory cannot always be perfectly applied! The original idea was that by exploring the difference between the two, an indication could be obtained of the significance of the difficulties of implementation of e-business functions that otherwise might have a theoretical application. Although not perfect or fully developed, it was concluded that the concept was useful in most cases in exposing some of the barriers that could inhibit an e-business implementation. It could therefore be regarded as a useful indicator of the consequent ease of implementation and probability of success.

In conclusion therefore it is to be recommended that the model be run in two versions for each case study. It is recommended that the detailed report for the client should represent the version that takes full account of the management concerns expressed (because this represents the best overall advice on balance that the model can give). The e-business profiles however should be calculated for both versions and the management summary of

the report and any accompanying presentation should include the version both including and excluding concerns. In addition overall insights from any differences should be highlighted. The impact of concerns at the individual function level can then be studied further in detail should this be required.

## 8 Discussion and Conclusions

### 8.1 Principal Conclusion

- (a) Although the following quotation (Feng-Li, 2007, p xiii) is with the advantage of hindsight not available at the start of this research, it is nonetheless indicative of the issues that this research attempted to address. "Today, memories of the dot.com boom and bust are fading, and the euphoria and pessimism have been replaced by more cool-headed rational thinking and co-ordinated actions, underpinned by *various* (authors italics) theories and conceptual frameworks. The dot.com bust did not mark the end of the Internet and e-business, because the underlying rapid growth of the network society and economy, in terms of the number of people and organisations getting online and the business volume of e-Commerce, has continued even during the economic downturn."

In other words, the relevance of e-business is still here, but the need for rational thinking is recognised as just as important. The catchphrase "The internet changed everything" (see section 1.1) illustrated the point because at one level this is clearly excessive. The fundamental business drivers of managing a business (generating revenue, controlling costs) have clearly not changed, as those who continue to lose money in failed enterprises can testify. However at a less pedantic level it is clear that the Internet has changed many aspects of the way that one thinks about systems. The question then arises of how can people be helped to focus on what is useful rather than be submerged in the hyperbole? How can decision makers be assisted to achieve this focus based on objective criteria?

- (b) The research hypothesis that acted as a starting point to this research was that it should be possible to produce a systematic process that defines usefully the probable e-business requirements of an organisation based on objective criteria. Initially, therefore, the research issues were twofold:
- Is it possible to produce a generic model based on characteristics and concerns, which can generate a functional specification to a useful level of detail, at a useful level of accuracy?
  - How can the accuracy and usefulness of the model be judged?

The main objective of this research was therefore to provide a method whereby organisations interested in the e-business concept can understand their requirements with relatively little time and effort. Although there are "softer" inputs to a requirements definition process (e.g. special circumstances, politics), the objective was to create a model good enough to be a useful animator and guide for such a process.

- (c) Despite the terminological problems around the meaning of e-business, a pragmatic view of the concept (Lesjak and Vehovar, 2005, is typical) was adopted. This view was tested using a survey on e-business activity. A model was constructed containing all the functions relating to the process of buying, selling, or exchanging products, services, and information via computer networks. It also included some not-strictly-commercial applications including communication, administration and conducting electronic transactions within an organisation. This model was tested on a variety of case studies and was demonstrated as improving in reliability as case studies progressed. Methods were developed whereby conclusions from the model could be presented at a "management" level of detail, and whereby useful insights could be provided.
- (d) The location of the survey and case studies (most, but not all, being in the UK West Midlands) raises the issue of the extent to which the research is representative of manufacturing industry in general and the use of e-business within manufacturing industry in particular.

The purpose of this research is not to arrive at conclusions concerning the state of manufacturing industry, but to create and test a model purporting to be of use to manufacturing industry. The extent to which it matters how "representative" are the involved organisations is relevant only if:

- Functions, characteristics and concerns are missed because of the unrepresentative nature of the organisations surveyed or involved in the case studies;
- The degree to which the testing of the model performed using the case studies was significantly impaired by the unrepresentative nature of the cases studies.

The e-business survey was confined to organisations in the UK West Midlands. Although clearly missing some sectors (e.g. shipbuilding), it is felt that there is a wide range of general engineering and manufacturing activity in the Midlands, sufficient at least to give a reasonable picture of e-business activity in the manufacturing sector.

- (e) In the case studies, there was some bias towards automotive related organisations (7 out of 13). This was unintentional but easily explained by two factors:
- The location of most of the activity in the UK West Midlands, an area where even today there is an emphasis in manufacturing industry towards the automotive sector;
  - The automotive industry has given a lead in many aspects of the e-business domain. In fact both the case studies and the e-business survey were to some extent self selecting in the sense that they were organisations that had a genuine interest in the topic.

The automotive component industry has some specialised characteristics (for example in focussing on regular scheduled demand, and not dealing directly with consumers) and these mean that some aspects of the model could not be tested by such organisations. Nevertheless, it was verified (see section 6.4) that (almost) the entire model was tested by some case studies.

It is felt therefore that the range of organisations covered by the survey and case studies is sufficient for the purposes of the work. The possibility of extending the use of the model (into a wider range of organisations is noted in section 8.10)

- (f) It has therefore been demonstrated that it is feasible to generate a functional model capable of objectively contributing to an e-business requirements specification creation process.

The objectivity aimed at by this model lies in the objectivity of the advice to be given as a result of facts (or perceptions of fact). In other words the aim is to give advice based on perceived characteristics, unbiased by prejudice on the part of the person using the model.

It was demonstrated that such a model could be achieved by the methodology of creating a model initially based on theoretical considerations, with subsequent refinement using a multiple case study approach. The basic research method that was adopted was therefore validated.

- (g) In order to present coherently the detailed conclusions of this thesis, a synthesis of the summaries of, and conclusions from, the various stages of the research process is presented below. These represent a consolidation and summarisation of comments made in the earlier chapters.

## **8.2 Literature Review Summary**

- (a) E-business needs to be considered in relation to the related concepts of Electronic Data Interchange (EDI), Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) and Supply Chain Management (SCM).
- (b) It is a waste of time attempting to differentiate between the concepts of e-business and e-commerce. The terms are used interchangeably and inconsistently and there is no legitimate reason for distinguishing between them (any more than distinguishing between

the terms "business" and "commerce"). The common-sense standpoint (Turban et al, 2004 and Croom, 2005 are helpful in this regard), in regarding e-business and e-commerce as equivalent and interchangeable concepts, should be adopted.

- (c) There is a relatively coherent picture in the literature of what "e-business" = "e-commerce" amounts to. The essential theme (for example Damanpour, 2001, Rodgers et al, 2002, Pant and Ravichandran, 2001) is the integration of systems inside and with those of customers and suppliers using the Internet.
- (d) It is clear that the concept of EDI was invented to address the same basic requirements that e-business now purports to cover. In that respect it can truly be regarded as an early (now considered old-fashioned by some) form of e-business (for example Murillo, 2001). E-business can be regarded as extending the breadth of functions covered, transactions supported, and types of interaction made possible, and as providing more economic access to such interactions by the use of Internet based facilities. There is a danger that the valuable standardisation enforced by EDI might be compromised by the more informal and potentially anarchic possibilities of the Internet. This itself could perhaps explain the persistence (for example, Auramo et al, 2005) of the "old fashioned" EDI concept in the new world of Internet opportunities.
- (e) In manufacturing and similar industries, the ERP concept is central to that of e-business, which is clearly aiming to extend similar ideas to interactions with an organisation's business partners. However, despite such centrality, a relatively incoherent picture of ERP emerges where much depends on what one is trying to sell (and to whom!). Wieder et al (2006), exposes one common theme: that of enterprise-wide integration of data/information and business processes, but these are words that are capable of a variety of interpretations. It is possible to adopt fairly narrow definitions (for example Manetti, 2001 quoting APICS; Payne, 2002) whereby the notion of a central database and support for basic business processes are the key points. Alternatively more wide definitions are possible (Pant and Ravichandran, 2001; Nah et al, 2001 and Reyes et al, 2002 seem typical) where almost everything is a component of the overall enterprise "ERP" system. The concept of ERP II (Møller, 2005) represents one of the more extreme manifestations of the "wide" ERP concept, and is to be distrusted as essentially self-serving.
- (f) It is concluded that the narrow view is the one to be preferred (typified by Soliman and Youssef, 2001). In this view the Enterprise Requirements Planning (ERP) concept describes the business systems within the enterprise, the systems to which the employees



of the enterprise are normally connected. By contrast, Internet-based e-business should be thought of dealing with all matters relating to interactions between business partners, external resources, or transactions between an organisation's employees who may not have direct connection to the ERP system. The e-business model should not therefore concern itself with the internal business systems of the enterprise.

- (g) It is perhaps understandable that with the general incoherence of the ERP concept, expectations are often oversold and hence disappointment is the norm (for example Willis and Willis-Brown, 2002), and there is a clear parallel between the past overselling of the ERP concept and the similar oversold expectations around the e-business area.
- (h) CRM seems a somewhat arbitrary collection of functions under an attractive marketing label (for example Light 2003). The concept of CRM has clear similarities with that of e-business, including the role of the Internet (for example Kotorov, 2003). However whereas the Internet seems central to the concept of e-business (or at least to making the concept of e-business accessible to other than the largest organisations), it seems more marginal to the CRM concept, a concept that in its fullest sense seems more relevant to large organisations (for example Zeng et al, 2003; Bose, 2002).
- (i) The theme of Supply Chain Management (for example Lin et al, 2002) is that of extending the reach of a company's systems beyond the management of internals to the management of one's suppliers and customers (both immediate and ultimately throughout the supply/demand chain. In this it can be regarded as ERP applied to the multi-organisation environment. There is also the notion (for example Reyes et al, 2002; Kehoe and Boughton, 2002) of co-ordination, collaboration and control across organisations so that everyone will behave for the greater good. When one accepts that it is the Internet that makes this possible for a wide range of organisations, it is clear that the SCM concept is very closely aligned to that of e-business.
- (j) Furthermore, many aspects of the concept of e-business depend for their credibility on their close alignment with modern supply chain management concepts and one is forced regrettably to conclude that many of these concepts are unproven (for example Cox, 1999). The Internet may create (or enhance) the ability to network, but this may be of little value if the fundamentals of doing business have not changed. More recent evidence (for example Smart, 2008) would indicate that little real progress is yet being made in achieving this alignment.

- (k) The "Exchange" concept (also known by several different names such as buying networks, exchanges, or hubs.) represents a type of "business-to-business" organisation that serves as an intermediary between the buyer and the seller (for example Mullane et al, 2001). As such it does address the provision of functions that are relevant to the world anticipated by the promoters of e-business. Specifically Exchanges support the notions of advanced supply chain management typified by such concepts as global optimisation.
- (l) The "Exchange" concept represents e-business in action and provides support for a number of the e-business functions identified by this work. The ultimate significance of the concept is however still unclear. The evidence (Sherer, 2005; Murtaza et al., 2004; supported by the personal experience of the researcher) would suggest, if anything, that the impact of exchanges could be limited. Among the issues encountered seem to be lack of trust, and the failure to attract the numbers of buyers and sellers that the business models require. It is reasonable to conclude that Exchanges have their place for the performance of some useful functions in some specific situations (a conclusion that could be considered to mirror the relevance of the entire e-business concept).
- (m) The impact of e-business on the smaller organisation is still open to uncertainty. There is an argument (For example Ritchie and Brindley, 2000 and 2002) that the potential impact of Internet based Supply Chain Management on the smaller business (the SME's) is likely if anything to be even more significant than the impact on larger organisations. The idea is that the smaller organisation will increasingly be favoured by such developments given the lower fixed overheads and the ability to be more flexible and rapid in response to changes in both supplier and consumer needs. A contrary view (for example Keindl, 2000) is that the so called "virtual marketplace" gives a competitive advantage to the larger organisation that can master the technology better, and this may be a problem for the smaller company.
- (n) On the one hand therefore it might be thought that e-business concepts represent "big" information technology, relevant primarily for the bigger organisation. Paradoxically, it is argued that e-business not only encourages a trend towards smaller organisations, but also needs to be made to work in smaller organisations in order to be a viable concept. The results in practice, however, do not yet seem to support this notion. Research (for example Wagner et al, 2003; Quayle, 2002; Pavic et al, 2007, Fillis et al, 2004) has failed to support the notion that adoption of e-business strategies will have a dramatic and positive effect on the smaller business. The only thing that seems safe to say at the present time is that the theory of the relevance of e-business for the smaller organisation seems reasonable. One

must continue to monitor further the current achievements of e-business in the smaller company.

- (o) E-business is best regarded as a set of incremental improvements (supporting for example, Coltman et al, 2001), using new technological opportunities. It follows therefore that "labels", either the "e-business" label or the "e-commerce" label, are not actually helpful and that organisations would be better employed searching for these incremental improvements individually.
- (p) It follows furthermore that organisations need help on issues of specific functionality and practicality at the detail level. It is therefore concluded that this supports the initial hypothesis that there is a value in providing detailed guidance to organisations in respect of the functions that are relevant to them in the e-business domain. An e-business model to do this is therefore of potential value.

### **8.3 Research Methodology Summary**

- (a) The objectives of this research clearly indicate a qualitative approach, the most relevant method being that of the case study. In case study research that involves creating models that help describe and predict behaviour, the testing and refinement of the model is the crucial stage (Stirling et al). It was also reasonable to agree with Jennings (1997) that an initial reference model should be attempted at the earliest possible stage in the research process.
- (b) It was concluded that the approach that best fits the objectives of this research is the work of Howard et al (1998), although this itself required some improvement to reflect the fact that the functional requirements of the e-business domain are less well defined and have not as yet been long established. In particular, the need for more sources of evidence and data (supporting for example Amaratunga et al, 2001) was an inducement to add an e-business survey to the research methodology.
- (c) It was concluded that an attempt should be made to reduce the risk of bias (following for example Van der Vorst et al, 2002) by ensuring that all changes to the model were recorded together with the reasons for the change – it was possible therefore to analyse the stability of the model during the case study process. It was also concluded that a chain of evidence should be maintained by storing the status of the model versions before and after the case studies thus allowing the evolution of the model to be demonstrated.

- (d) As the research attempted could be classed as qualitative research aimed at understanding a process, it was considered important that in the design of the e-business survey, the use of open questions was indicated together with *post hoc* analysis and categorisation by grouping together similarities in the freeform responses of the participant responses.
- (e) The question of whether the research qualified as action research arose during consideration of a paper produced as a by-product of this research. It was felt that the boundary between a case study approach and an action research approach was somewhat arbitrary and perhaps irrelevant for the purpose of this research. However it was concluded that the weight of literature (for example Altricher et al, 2002; Gilmore et al, 1996; Gummesson, 2003; Näslund, 2002; O'Leary et al, 2004; Westbrook, 1995) adopted a more narrow definition of "action research" that did not apply to this research.
- (f) In terms of the four different types of research defined by Cooper and Schindler (2003), it was concluded that there were elements of all four in the research:
- Reporting - data has been collected;
  - Descriptive - the data collected has been related to the characteristics of the organisation;
  - Explanatory - it was explained how the characteristics related to the requirements experienced by an organisation;
  - Predictive - the outcome from the research is a model that can be used to predict the e-business requirements of an organisation based on its characteristics.
- It was concluded that the case study methodology so described was an acceptable way to go forward as a way of achieving the research objectives.

#### **8.4 The Development of the Functional Model**

- (a) As mentioned above (8.3), it was deemed appropriate to adopt, for the e-business model in this research, a structure with similarities to the work of Howard et al (1998). However, because the e-business domain deals with functions that not only are under the control of external organisations (for example customers and suppliers) but also require organisations to work collaboratively, this was extended to allow management concerns to take a larger role than was previously the case. One of the innovations of this research was to produce model outputs both with and without concerns.
- (b) The attempt was made to establish whether one could discern the detail behind the "e-business" concept by studying the e-business products in the market place, products that

are designed to deploy functionality of significant benefit to manufacturing and distribution organisations.

- (c) The ODETTE organisation provides a list of those potential electronically supported processes that have been proposed theoretically by an objective organisation. Accordingly this was a useful checklist for the development of the functions of the model, especially those relating to formal business transactions.
- (d) The SAP organisation has invested effort into presenting an e-business vision at a useful level of detail, and this represents a significant attempt to translate e-business into meaningful detailed functionality. This vision was useful as a checklist of e-business functions in the development of the model and was helpful in the development of the reasoning underlying the possible selection of such functions.
- (e) In contrast to the SAP organisation, the Oracle Corporation has little to say on functional detail, but emphasises the Internet, information and database issues. In effect the Oracle "e-business" view would equate the concept with that of a modern ERP system. Whatever the merits of this as a notion, since it had been established that the e-business model should not concentrate on the internal systems of the enterprise, for the purpose of this research there was little of useful detail in the material examined.
- (f) The Web-EDI product was particularly useful, not in terms of adding functions to the e-business model, but in that it showed how EDI functions could be made affordable for the smaller organisation. It was possible therefore to allow the model to suggest that EDI functions could be relevant for the smaller organisations that otherwise might have had them ruled out on cost grounds.
- (g) Although there is considerable uncertainty around the functions and scope of the "Exchange" product examined, there are functions provided that represented a useful addition to the possibilities of the e-business concept.
- (h) It is therefore concluded that one can indeed discern an adequate amount of the detail underlying the "e-business" concept from the study of a selection of the e-business products in the market place. It was therefore possible to develop an initial e-business functional model, using as a source and partial starting point, the functions that the market place is trying to sell or otherwise define under the e-business label.

- (i) It was possible to construct and structure a comprehensive identification of detailed e-business possible functions. A preliminary rationale (i.e. a set of reasons) was produced in order to link these e-business functions to possible factual characteristics and subjective management concerns. It was also demonstrated that it is possible to develop a reasoning structure that links the characteristics and concerns of the company through detailed reasoning to an overall verdict as to the overall relevance of a given function.
- (j) The model outcomes (that is, the possible functions) were created initially based on a number of sources, including academic literature and solutions available in the market place. The reasoning in the model was developed from a starting point of common sense and judgement. This was then a model based initially on theoretical considerations. Testing and feedback from case studies were necessary both to refine the model rules and ultimately to demonstrate their validity.

#### **8.5 E-business Survey Conclusions**

- (a) Organisations were more concerned with the use of e-business functions in the management of customer demand than with anything else, thus suggesting that e-business is something that one does primarily because one's customers demand it.
- (b) Most organisations expect to be making some moves in some aspect of e-business in the next two years. For companies of all sizes, most of this progress is expected to be by using Internet based facilities. In this sense it seems that the concept of e-business can for most practical purposes be equated with the use of the Internet (Pant et al, 2001; Van Hooft et al, 2001).
- (c) Overall it seems that large companies are slightly more satisfied with what they have achieved using e-business technology than smaller organisations.
- (d) The most "active" areas of e-business were those that are the simplest (e-mails and web pages). For small/medium organisations particularly, it can be said that the simpler the use, the greater is the likely satisfaction.
- (e) Notwithstanding the increased use of Internet facilities, the use of the more traditional EDI technology is also likely to expand and continue to be relevant for the foreseeable future. This can be seen among all sizes of organisation but especially for the larger organisation. The conclusion that EDI was alive and well is similar to those reported by Auramo et al (2005).

- (f) Supplier EDI will remain the domain of larger organisations that can dominate, and can enforce practices on, their supply chain. Such organisations remain interested in broadening the use of classical EDI with their suppliers (for example to logistics and product development).
- (g) Smaller organisations will in future rely on the use of Internet-based facilities, rather than the use of EDI, for future initiatives involving links with suppliers.
- (h) Activity in collaboration functions (for example collaborative exchanges) is limited and what there is comes mostly from the larger companies. However large organisations tended to be less satisfied with participation in collaborative industry exchanges than smaller companies. There seemed little evidence of the amorphous supply chain (Ritchie and Brindley, 2001), and it is concluded that collaboration functions will not grow that much and therefore the penetration of exchanges will be limited.
- (i) There was evidence of the achievement of benefits from the adoption of e-business techniques. Improved access to new customers and markets was a benefit experienced especially for small companies (supporting for example Ritchie et al, 2000 and 2002; Wagner et al, 2003).
- (j) The value of the diffusion of timely information throughout the supply chain (see Kehoe and Boughton, 2001a and 2001b) was recognised especially for larger companies, more reliant as they are on systems and information. Similarly larger companies were likely to find that e-business technology help them regain their flexibility and reaction time.
- (k) It was demonstrated that, although there was recognition of some benefits, there was, throughout all sizes of organisation, scepticism about the scope and value of many of the functionalities that come under the heading of the "e-business" concept. It was surprising that large companies were just as likely as smaller companies to be cynical about the benefits of e-business. Large companies seem not surprisingly to have done more and achieved more benefits, but also to have more negative experiences.
- (l) More positively, it is concluded that organisations are able effectively to adopt the *caveat emptor* principle and choose the most likely areas that will benefit them. The simpler functionalities were generally seen as the most satisfactory. The survey results supported

the view that, in practical terms, e-business represents incremental improvements rather than a revolution in the conducting of business (see Coltman et al, 2001).

- (m) It was possible to show that organisations selling information technology tools under the banner of "e-business" should not assume that they can easily persuade their prospective customers into spending money chasing technological fashions. The organisation doing the "selling" could therefore potentially benefit from a tool that provides an objective way of assessing what potential "e-business" opportunities could be of value. This could be a valuable sales aid, because it would give the confidence to the prospective customer that the e-business initiative was being associated with explicit reasoning, that itself could support the business justification process.
- (n) The survey confirmed the conclusion of the literature review that the "e-business" label is vague and terminologically muddled from a variety of causes, and is therefore more useful when considering functionalities at a more detailed level. However it was concluded that e-business projects can be justified in the same way as any other project, and sensible organisations can and do "cherry pick" the most likely areas of benefit.
- (o) Finally (and most important from the standpoint of this research) there was also support for the initial proposition that there is a need for more unbiased advice and support to organisations contemplating or embarking on e-business initiatives. There was also support for the proposition that advice at the detail level is what is required rather than vague "strategic" messages and general exhortation.

#### **8.6 Conclusions from the testing of the model**

- (a) It was demonstrated that a reasonably well representative range of case studies was undertaken, with a reasonable range of characteristics. It was demonstrated that almost all the functions in the model were tested by at least some of the case studies. It was demonstrated that both the refining and re-testing sets of case studies each provided a reasonably wide range of functional coverage and therefore, as individual phases, represented a reasonable variety of cases.
- (b) The result of these case studies was not significantly to expand the potential outcomes from the model. The original functional specification as to what was meant by "e-business" was therefore little changed at the end from what it had been at the beginning. Similarly the case studies did not result in a significant expansion of the characteristics and concerns, the potential inputs to the model. However both the earlier "refining" and later "re-testing"



phases resulted in the expansion of the model rules that lead from characteristics to functions. At the end of the model re-testing process the model rules, and hence the complexity of the model reasoning had expanded by 40% from where the model was at the beginning of these phases. The case study methodology adopted was therefore successful in enhancing the rules as a result of studying the operation of the model in practice.

- (c) It is concluded that the e-business concept contains functional "hot spots" where what is provided is likely to have a wide relevance to a reasonably wide range of organisations. It can also be concluded that there are many functions (the majority in our sample) that are likely to be more rarely invoked. Therefore although all the e-business functions are likely to have some relevance in some situations, only a minority will have general relevance to the majority of situations.
- (d) The analysis of model evolution demonstrated that:
- The model was good enough after the refining case studies to give good results subsequently;
  - The model was moving towards stability as the case studies progressed, generating decreasing amount of change.
- (e) Most of the case studies continued to make a significant contribution to improving the model. In the later case studies there was evidence of a model accuracy of 89% as measured by the Delta analysis (see above 6.5). It was demonstrated therefore that the model was approaching convergence. It was also demonstrated that the strategy of only making "thought through" changes was effective in preserving the validity of prior case studies. It was therefore concluded that the model refinement method was sound.
- (f) The aim of the model was to generate an 85-90% accurate specification that can be refined according to local conditions. It was intended to stimulate awareness of potential functions as a contribution to a planning process. A certain amount of inaccuracy could therefore be tolerated especially if the faults tend to the excessive proposal of functions. The model can now be considered accurate enough to be useful because:
- It has demonstrated an accuracy of 89%; and
  - The inaccuracies have tended to over-specification (corrections having the result of reducing the number of functions identified).
- The model is capable of continuous improvement as it is used in an increasing number of new situations and the feedback from the companies is evaluated.

- (g) Because there are a significant number of characteristics and reasons, the model was fault tolerant. In other words correct answers were frequently given despite mistakes in the reasoning (because of the impact of other reasons). In fact this resulted in an extra challenge because it was possible for errors in the model to be masked and therefore to take longer to be exposed. Similarly, because the methodology relied on subjective judgements and the noticing of inconsistencies, errors could lie uncorrected. Despite these imperfections the analysis demonstrated that the broad picture is one of a model that gave sound results.
- (h) It was demonstrated that the case study process adopted produced a model that gives stable results and tended to improve with usage. Specifically the impact of change on the second group of five case studies was approximately 50% of that of the first group. An alternative way of expressing this is to say that the first group of case studies produced results that were 78% accurate, while the second group produced results that were 89% accurate. It is therefore fair to say that the case studies represented a process of on-going validation and model improvement.

#### **8.7 Conclusions from applying the model**

- (a) The primary purpose of the research described in this paper is to produce a model capable of giving useful advice at the detailed level rather than merely producing superficial diagrams. However, as a by-product of the case studies, it was discovered that it is possible to create overall e-business profiles of each organisation, profiles that are invaluable for management level communication.
- (b) E-business profiles proved to be a useful addition to the core purpose of the model in that one could use them as a method of discussing the results of the case studies, thus enabling more general issues to be exposed. It was also possible to use these profiles to discuss in general terms the potential impact of management concerns in the achievement of e-business possibilities. The key "selling point" of e-business profiles is they are a synthesis of the true detail of the model, detail that is available in order to study what lies behind the overview picture.
- (c) It was concluded that e-business profiles present useful summary information despite two limitations. The first limitation is that a profile is based on a function count that does not differentiate between important functions and unimportant. The second is that the profile does not take into account the fact that not all model functions are necessarily conceivably

relevant for an organisation being studied, and therefore profiles can look too "light" in some situations.

- (d) It was concluded that there were useful insights to be gained by analysing the profiles by the concept of level of function, the structure following the general consensus exemplified by McCormack and Kasper (2002). Information functions represent the ability to access information and to provide information. Transactional functions represent the opportunity for computer-to-computer communication. Control functions represent opportunities to work collaboratively and in co-ordination with a business partner.
- (e) One of the major developments over the previous work in this area (Howard et al, 1998) lay in the significance of concerns and the analysis of the results both with and without concerns. At the outset, it was considered probable that a model that deals with the impact of management concerns will generally (by being more realistic) be of more value than one that does not. The case studies have however demonstrated that insights have been gained by studying the impact of concerns.
- (f) In the case studies, the concerns either represented problems that were positive reasons for triggering the relevance of an e-business function, or represented issues that would seriously inhibit the potential for success of a given e-business function from being useful. In both types of situation, by studying the detailed reasoning, useful insights were often gained into the factors affecting the e-business potential.
- (g) It is concluded that management concerns, especially when they relate to the behaviour of external business partners, are relevant in order for the results of an e-business model to be realistic. It is therefore concluded that concerns are a useful ingredient in the model. Most concerns proved to be inhibitor concerns, the inclusion of which in the model tended to suppress the potential relevance of e-business functions.
- (h) The current version of the model does not differentiate between the concerns that can be alleviated and those that cannot, and this could cause an unduly pessimistic bias in the results. It is concluded however that this does not present a significant defect in the model results because of the potential for running the model both with and without concerns, and examining the reasons for major variances. Whatever may be the practicality of addressing the concerns, the fact that such issues can be exposed is a constructive contribution to an e-business requirements definition process.

- (i) It is concluded therefore that the arguments in favour of concerns (the fact that the model is more realistic and useful) prevail against the counter-argument of lack of alleviation sensitivity. The key point is that the effect of these concerns in individual detailed cases can be studied at a detailed level, and therefore overridden if the effect of the concerns is unreasonable in an individual case.
- (j) Although not perfect or fully developed, it was concluded that management concerns were useful in exposing barriers that could inhibit an e-business implementation. They could therefore be regarded as indicators of ease of implementation and probability of success, and it is reasonable to expect that management should appreciate such indicators.
- (k) It is recommended that the model be run in two versions for each case study. The version that takes full account of the management concerns expressed should be regarded as the definitive "best advice" version presented in detail to the client. The version that excludes concerns should be presented at an overview e-business profile level, and significant differences should be commented on.
- (l) The e-business profiles should therefore be calculated for both versions and the management summary of the report and any accompanying presentation should include the version both including and excluding concerns. In addition overall insights from any differences should be highlighted. This will serve to focus attention on the broad impact of management concerns, the detail effect of which can be studied further if required.

#### **8.8 Benefits of the model**

- (a) A detailed collection of functions that could be described as "e-business" functions has been developed by synthesis of a variety of sources. This itself is valuable as a detailed definition of the concept.
- (b) The model created provides ways in which organisations can be supported in investigating their own specific requirements at a detail level, rather than being put in the position of having to accept the concepts at a "marketing" level of detail.
- (c) This research has therefore satisfied a need for a systematic process that can propose at a useful level of detail the probable e-business requirements of an organisation based on objective criteria. Equally importantly the model provides a process where the probable requirements specification can be produced very quickly, with the expenditure of a few

hours work. The provisional specification thus provided can be used to animate the start of a requirements definition exercise, and for support during the process.

- (d) The model can provide a detailed functional specification identifying the e-business functions relevant to a given organisation. This is a great advance on the "you must do something" level of advice and may act as a preventative against worthless investments undertaken for ill thought out reasons.
- (e) In the e-business profiles, the e-business model allows the synthesis from the detail of a summary picture of where the weight of the e-business requirement lies. This enables the results of the operation of the model to be reported and exposed at a level of detail accessible to management. The provision of the summary picture is not inconsistent with the principle that what is needed is practical advice at the detailed level because the one does not preclude the other. It can be an alternative way of using the model. In effect the management summary is justified by being synthesised from the detail level.
- (f) An analysis of the impact of concerns on the otherwise "ideal" requirements can be regarded as a measure of the extent to which organisational and/or business environment may inhibit the implementation of functions that are relevant based on strictly objective considerations.
- (g) The specific value points therefore can be summarised as firstly, the provision of useful detail, secondly the provision of an objective viewpoint, and finally the ability to produce results quickly. Whatever revisions are subsequently thought appropriate, the outputs of the model cannot help but be a useful input to a requirements definition process.

### **8.9 Limitations**

- (a) The approach depended on predefinition of functions, namely from academic literature, expert knowledge, an activity survey, and a survey of the marketplace. It therefore relies on being able, from such literature and selection of products on the marketplace; to start with a reasonable assessment of what is possible. The case study approach did not lend itself to the discovery of previously undiscovered opportunities, unless these happened to be known to the case study participants. No such functions were added during the case study process.
- (b) Similarly the case study approach that was taken required participants (and the researcher) to notice errors and make value judgements. This meant that the convergence of the model

towards an acceptable version could be and was delayed simply by errors not being noticed.

- (c) The case studies were to some extent self selecting in the sense that they were organisations that had a genuine interest in the topic. This was not in itself unreasonable because it is self-evident that the model will only ever be needed and used by organisations with a genuine interest in the subject.
- (d) The location of the case studies (UK West Midlands) explains some bias to automotive related organisations, although this was deemed to be acceptable given the lead provided by the automotive industry in many areas of inter-organisation communication.
- (e) The e-business model can only deal with the "headlines" of a particular function rather than the subtleties of the detail. The objective is to stimulate awareness of a potential need, not to provide a full definition of the detailed functionality required.
- (f) In the current version of the model we do not differentiate for concerns that are capable of being resolved and those that are not (although the participants can adjust for this themselves).
- (g) The issue also raised here is the degree of objectivity that can be expected from the model, when the results in some of the domains have clearly been affected by the different perceptions (of what the facts are) on the part of the persons answering the question.

It has to be admitted that when the model claims to be based on facts, it is in reality based on perceptions of fact by people answering questions. If these perceptions are wrong, then the results will be correspondingly wrong. However, the purpose of the model is to create a requirements document that can be refined by discussion. It would be expected that the discrepancies caused by the different perceptions of different persons would be exposed and resolved by discussions of the proposals generated by the model.

- (h) This research addresses the issue of which detailed functions are potentially relevant to an organisation. It does not address the issue of the relative cost/benefits of these functions and hence the prioritising of the investments required to achieve them. The work of Tan et al (2004), Clegg and Tan (2007), and Tan and Bennett (2007) seems constructive in dealing with the determination of the e-business processes that are of critical importance to

the organisation (see above 2.2.4(i)). The tool described could usefully be used in conjunction with this research, as a complementary input to the decision making process.

- (i) Finally, the point needs to be emphasised that no model can ever be a perfect representation of requirements. It is considered good enough if the model can produce a functional specification that is 85-90% correct, with the balance being left to an intelligent assessment of local conditions
- (j) The model is currently implemented using Microsoft Excel spreadsheets supported by Microsoft Word macros. As it stands today the model can be amended and/or used today by anyone with an understanding of Word and Excel, but involves a certain amount of manual effort (perhaps two hours) in order to assemble and present the results. The model itself is not at the present time intended to be part of a marketable software product, but potential improvements to the technical implementation could be considered in the future, should the demand arise.

#### **8.10 Opportunities for further Research**

- (a) Further research could address the issue as to whether further e-business functions can be identified as time moves on (or indeed whether some of the functions should be abandoned as non-starters). The model is capable of expansion to include new functions, new model rules, new characteristics and concerns as these are identified.
- (b) The location of the case studies (UK West Midlands) and the heavy bias to automotive related organisations, although acceptable, is something that could be addressed by exposing the model to a greater variety of businesses.
- (c) The simplest possible scoring system was adopted for simplicity at the outset, and was not improved upon during the research (because it seemed to be performing adequately. There is potential to develop the scoring systems further and fine-tune the reasoning of the model.
- (d) Although this research has developed the concept of management concerns, it is clear that there is potential to do much more to develop further the concept. Firstly it could be relevant to differentiate better the concerns that are positive from those that are negative, Positive concerns represent problems that could potentially be alleviated by the use of e-business functions. Negative concerns are those that would inhibit the effectiveness of the e-business functions. These are conceptually different types of concern and it could be interesting to study their respective effects more.

- (e) Of even more relevance for further research would be to address better the issue of the resolvability of concerns, and find a way of differentiating this in the model. It became clear that there are two types of concern:
- Concerns that were endemic to the business environment that the organisation was operating in, and could not be realistically changed at least in the short/medium term;
  - Concerns that represented the current organisation and management performance of the company, and should therefore be capable of amelioration should sufficient e-business project justification arise.

If ways could be found of differentiating effectively between these two types, then the value of the concerns as a method of estimating the difficulty of implementing otherwise relevant e-business functions would be enhanced.

- (f) The concept of e-business profiles was introduced as a by-product of the research and was considered potentially useful as a method of communicating the results of a case study to a management level audience. The e-business profile did however represent a side issue as far as the purpose of this research was concerned, and it is felt that the concept could be explored further by research more concentrated in the production of such higher-level models.

#### **8.11 Reflections on the e-business concept**

- (a) It was concluded in the earlier literature review (2.9.2) that the picture of e-business, in so far as the concept affects manufacturing industry, involves the integration, using the Internet, of systems both inside and with those of customers and suppliers. This essentially equates to Supply Chain Management using the Internet. The question was raised then (and to some extent explored) as to how valid is the concept. Having concluded the research process stimulated by the issues raised by the literature review, it is relevant here to reflect further on the validity of the e-business concept.
- (b) Cox (1999) makes some very useful observations relating to the fundamental flaws in modern supply chain thinking which seem particularly to apply to (almost "politically correct") notions of collaboration. Any approach to supply chain must be based on an understanding of what business is actually about in theory. Essentially business is about appropriating value for oneself; it is not about passing value. He observes that the concept of power is rarely discussed in supply chain writing, except to deny it as important, or to argue that power should not be used because lean approaches should be based on equity, trust and openness.



Companies are only successful if they possess power over something or someone. In understanding how to manage supply chains strategically and operationally it is essential that practitioners properly understand the power structures that exist in their supply chains. If they do not, then both practitioners and academics may well be guilty of recommending strategies and operational practices that are inappropriate for the supply chains in which they operate.

- (c) There seems to be a recurring theme that the key to supply chain operations is to enable coordination and cooperation by providing timely information and making this available throughout the chain. It is certainly true that this is currently a fashionable idea. Indeed it is undeniable that the Internet is making possible systems that permit the entire supply chain to have visibility of the requirements of the final tier player. The presumptions here are that:
- Everybody can be enabled to know everything;
  - If everybody knows everything they will "optimise"; i.e. behave for the greater good of the greater number.
- (d) However these presumptions seem open to challenge. In practice it must be doubtful that one could ever have access to sufficient data of the right degree of currency to be able to completely duplicate the planning of everyone else in the supply chain. And unless it can be done exactly, what is the point of doing it at all? And even if it were possible how would one allow for the tendency of people to make their own informal judgements?

In short, it seems unreasonable to assume that everyone in the supply chain tells the pure unvarnished truth to his or her business partners. The risk is that people adjust data to compensate for how they imagine other people are going to use that data. The inevitable conclusion is that this concept is a counsel of perfection for an ideal world! To pretend that this is a sensible and possible way of working is to fly in the face of the practicalities of the real world.

- (e) Scherer (2005) encapsulates the position. He accepts that Information technology is not the constraint to the effective flow of information throughout a supply chain. He recognises that most companies deploying supply chain technology are only getting a small fraction of the benefits that are promised not because of a lack of trust in the systems and technology, but because of lack of trust in each other (see also Ghosh and Fedorowicz, 2008).

The e-business concept therefore is one of technological capabilities made possible by the availability of computing power and the Internet. However it is also one of business attitudes and psychology.

#### **8.12 Implications for industrial practice**

- (a) At the time of starting the research project of which this thesis is a product, it seemed that there were clearly opportunities for manufacturing industry in the sense of potentially useful initiatives that could be undertaken. In fact it seemed at the time that the main danger was that time and money can be wasted on systems that had not been conceived or justified on a rational basis. In fact with the passage of time and the relatively limited achievements in relation to the original big ideas (for example, in relation to Covisint, see above 2.7.3), the task may have evolved into one of stimulating interest rather than protecting vulnerable potential consumers.
- (b) In assessing the implications for industrial practice of the research described in this thesis, there are two fundamental issues:
- Is the concept of e-business something that has stood, and will continue to stand, the test of time, and be something that organisations need help in assessing?
  - If e-business is such a concept, how much do organisations really want an objective view of their requirements? If e-business activity is customer forced and/or motivated by management following fashion for reasons of politics or self-importance, then there is no particular need for objective advice.
- (c) The conclusion of this research is that the potential for e-business in some form is real, even if some aspects of the concept are of dubious value. It can therefore be legitimately concluded that there is a need for organisations to be guided as to what aspects are of genuine benefit. Furthermore as the fashionable "buzz" recedes, then the propensity for fashionable investments also recedes, and the need for objective justification therefore becomes greater. Therefore, as with all other business investment decisions, there will continue to be a need for e-business investments to be identified and justified on a rational basis. The rational and objective view made possible by the use of this model cannot help but be a useful aid in justifying decisions on such investments.
- (d) The approach to e-business adopted by this research is one of specific functions rather than grand designs. As such it takes a different approach from other "models" in the e-business literature. Such literature abounds with "models" (for example, Bakker et al, 2008; Burn and Ash, 2005; Cullen and Webster, 2007; Hafeez et al, 2006; Jackson and Sloane,

2007; Power, 2005; Stockdale and Standing, 2006 are more recent examples), that find ways in which e-business activity can be categorised so that its structure can be understood. While all of these can provide useful insights into the e-business concept, such high level categorisation is not what the model that has been the object of this research attempts.

- (e) This research has addressed the issue of helping organisations better specify the detailed functions that might be relevant for their business. It has done this by considering the objectives characteristics of the enterprise in order to achieve some assessment of the theoretical applicability of the functions. In order to help take account of some of the business attitude factors, it has also addressed the issue of the management concerns that might tend to mitigate or indeed enhance the potential practical (as opposed to theoretical) applicability of those functions in the business environment that the organisation finds itself. The model generated by this approach in effect allows the analysis and presentation of a detailed functional specification of requirements within a day. At the present time the author does not know of any other approach that is capable of producing such a model to the same level of detail. It is recommended that the model created by this research should now be used in real life situations. As this model is used in practice it is expected that it will continue to develop and improve its ability to contribute to what is clearly an issue of significant importance to business in the modern world.

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## Appendix A E-Business Function Descriptions

### Demand Side

#### *Product Development and pre-production Information functions*

**ADP010** Access to customer design documents and drawings

You have the ability to access a customer system to view or download design documents and drawings. Depending on who does the detailed design work, these could be detailed or general arrangement type designs. This could be on a customer web site or use an exchange type facility

**ADP020** Provision of design documents and drawings for customers

On your own web site (or an exchange), you provide technical and other documentation relating to your products, for access by actual or potential customers. Depending on who does the detailed design work, these could be detailed or general arrangement type designs.

**ADP030** Access to centralised Project documentation

The idea here is that the customer has a project management system (managed on his own web site or using an exchange). As a supplier you are a contributor to, and a participant in this system

**ADP040** Provision of Engineering change information

Provision of the ability for customers to track the status of engineering change notifications

**ADP050** Access to research databases

As part of the design process it is necessary to have access to such research databases that contain relevant information for the technical domains involved in the design

#### *Transactional functions*

**ADP210** Reception of product design information from customer

The formal transmission (via EDI or similar web based methods) of product data (e.g. product structures), design content files (e.g. drawings) from customer

**ADP220** Transmission of product design information to customer

The formal transmission (via EDI or similar web based methods) of product data (e.g. product structures), design content files (e.g. drawings) to the customer

**ADP230** Receive engineering change notification

The customer (or other external partner) is informing you of an engineering change that has been effected

**ADP233** Transmission of engineering change request to customer

You have created an engineering change notification/request and it is necessary to inform the customer (or other external partner), to seek approval

**ADP237** Receive engineering change authorisation

In response to your engineering change request, the customer gives you authorisation proceed with it

**ADP240** Confirm release of engineering change order

The customer (or other external partner) is informed of the creation of the appropriate engineering change order

**ADP250** Confirm implementation of engineering change order

The customer (or other external partner) is informed of the completion and implementation of the engineering change order

***Control and Co-ordination functions***

**ADP510** Project initiation and management

These are product design and development projects where you are operating in partnership with your customer and potentially other partners. The project management environment may be hosted on the customer's own web site or using an exchange. Aspects of the project to be managed include people, tasks, documents, and product information

**ADP520** Pre-production enquiry management

Communication relating to engineering aspects of, or the technical feasibility of order enquiries, in situations where some degree of design to order or configure to order is expected. Similar to collaborative projects but likely to be simpler and less formal. May be achieved by e-mail, or by web-based facilities hosted by you, probably linked with customer order configuration facilities.

**ADP530** Design Collaboration

Collaboration with the customer, or other design partner, in the proposing of, creation of, and feedback to design work for sold item. Involves web-based access (e.g. on an exchange) as well as subscribe and notification mechanisms to speed up collaboration.

**ADP540** Change notifications and alerts

Any exception situations or reminders relating to technical projects or engineering issues may be the subjects of notifications (typically by e-mail). These would typically be generated automatically as a result of the customer's systems detecting a deviation from what was expected. Examples include; task overdue warnings; project amendments made by customer, potential engineering related issues from the customer.

**ADP550** Continuous improvement collaboration

The idea here is that there is a collaborative problem management environment (hosted on a customer web site or on an exchange) controlling the identification, notification, assignment, and solution feedback of any type of problem with your customer. The problem can be documented fully and related documents can be attached.

**ADP560** Collaborative performance data collection and presentation

For product design and development, a collaboratively managed performance measurement environment (either hosted by the customer or by an exchange) to which customers, yourself and other operational partners have access for data input and feedback. Your customer will set

objectives and methods of scoring, to which, after appropriate negotiation (and perhaps input), you will presumably have to agree. The customer is also responsible for data collection and presentation of the results that are calculated. In a true collaborative environment, there should also be mechanisms whereby the results can be challenged, explained and if necessary adjusted. Examples include: Response time to engineering requests; recalls attributed to supplier design problems

***Demand Management  
Information functions***

**ADD010** Access to customers issue systems (e.g. quality, complaints)

Some customers provide concern management systems (hosted on their web site or on an exchange). These typically relate to quality issues. You as the supplier can be provided with the ability to access this

**ADD020** Provision of product information for real or potential customers

You wish to provide relevant people (distribution channels, actual or potential customers) details of the products that you make. This should be in a sufficiently structured form so as to guide the user in deciding the most relevant product for his/her requirements. Typically this would be on your web site, possibly on an exchange.

**ADD030** Provision of price list information

You wish to provide relevant people (distribution channels, actual or potential customers) details of the prices of the products that you make. Typically this would be on your web site, possibly on an exchange.

**ADD040** Provision of pricing configurators

You wish to provide relevant people (distribution channels, actual or potential customers) details of how to calculate the prices of the products that you make in the context of the choice of various features and options. Typically this would be on your web site, possibly on an exchange.

**ADD050** Provision of order status Information

You wish to provide relevant people (distribution channels, actual or potential customers) a window into your order processing system so that the details of the current status of relevant customer orders can be established. Typically this would through a web-based customer portal.

**ADD060** Access to last received shipment and in-transit inventory situation

In situations where this information is not provided to you in the form of formal EDI transmission, and/or you do not have the systems capability to integrate usefully this sort of information, you may be reduced to having to access a customer web site (or similar facilities on an exchange) to determine what your actual delivery position is in respect of your customer requirements.

**ADD070** Access to customer supplier measurements

Your customer provides a method of scoring your performance and publishes this on its web site for access by suppliers so that they can monitor their rating on an up to date basis. This facility should also include sufficient back-up information so that the reasons for the rating can be exposed

**ADD080** Provision of Information on excess material for sale



You publish (either on your web site or by using a customer run or third party exchange) details of items (either purchased or manufactured by you) which, being surplus to your requirements, are suitable for selling off. This is likely to be associated with an auction type process.

**ADD090** Access to market research data

This relates to the access to, and integration of market analysis data from external sources. These will probably be professional providers of this service, but could also be customers.

**ADD100** Provision of Inspection Information for customers

Customers may want to see inspection reports on-line. This is perhaps best as part of an internet/internet based inspection data collection, analysis and reporting system integrated with the inbound reception and manufacturing systems of the company.

***Transactional functions***

**ADD210** Notification of invitation to a Buyer Auction

This relates to reverse "Buyer" auctions", usually managed on an exchange to which both you and your customer (the "Buyer" must subscribe. Buyers solicit and manage bids (under terms dictated by the buyer) from multiple suppliers online and award business based on the results. The buyer may choose to let suppliers see information like the current lead time or best price, and let them bid multiple times right up to the closing moments of the bid process. Buyers may choose to have a public bid where any supplier can respond, or they may invite specific potential suppliers that meet some defined criteria to bid. Logically these would be expected to relate to non-engineered commodity type products, but some customers may also use them for engineered products.

**ADD220** Bid in a Buyer Auction

This is a formal offer to provide the goods and services required in a buyer auction in which you are participating.

**ADD230** Initiate a Seller Auction

This is a classical auction situation where you have excess products or purchased items for re-sale and you choose to dispose of them by conducting an auction.

**ADD240** Receive bids in a Seller Auction

Your potential customers make the offer to buy the goods or materials that you have put up for auction

**ADD250** Reception of enquiry for the supply of goods and services

This is the formal request (by an EDI message or equivalent) from your customer requesting a quotation (usually price and delivery date) for the potential supply of goods or services. These would normally be standard but could also apply to the initial pre-design stage of newly designed products

**ADD260** Quotation for the supply of goods and services

This is a formal offer (by an EDI message or equivalent) to provide the goods and services that the customer requested in his enquiry. The message also includes the relevant terms of supply

**ADD270** Contract proposal

In situations where the nature of the business relates to the long-term provision of goods and/or services, this is the formal proposal by the customer of the terms and conditions of the relationship. Aspects covered would include the items covered, prices, scheduling rules, commercial and financial terms, and the logistics of the supply (e.g. carriers,).

**ADD280** Contract acceptance

This is the formal acceptance of the terms of the contract proposal by you, the supplier

**ADD290** On-line generation of quotations

The provision of the facility for the customer (or salesman at customer site) to process a quotation directly in your system using a customer portal provided on your web site

**ADD300** Entry of orders by customers

The customer enters an order directly into your system using a customer portal provided on your web site

**ADD310** Customer configuration of order items

The customer enters an order directly into your system and configures the product that he wants to buy using a configurator provided via your customer portal integrated into your features and options support system. This also includes the ability to present to the customer at order entry time the price (and possibly the delivery time) of the configured product

**ADD320** Instruction to sales force men/dealers

The scenario here is that you have some sort of distributed sales force (e.g., salesmen with remote hand held devices or other methods of communicating with the centre, or a dealer network) to which you wish to pass leads or schedule appointments

**ADD330** Reception / integration of customer repetitive firm demand

The customer transmits to you (normally in the form of a delivery schedule against a long term contract or blanket order) the details of the deliveries that he wants. The contract or blanket order will have established the terms and conditions of supply, and also the normal delivery rules. All that is normally required here is a statement of quantities and dates (with perhaps some delivery reference data)

**ADD340** Reception / integration of customer spot firm demand

The customer transmits to you (in the form of a purchase order message) the details of the deliveries that he wants. This order may be in the context of a pre-existing contract establishing the terms and conditions of supply, but is more likely to be self contained in defining all necessary aspects of the requirement.

**ADD350** Order change

This relates to spot orders and covers the situation where the customer wishes to vary some aspect of the order. The nature of the change that is acceptable to you the supplier would have been the subject of a previous agreement on terms and conditions of supply

**ADD360** Response to an order or delivery instruction

A formal transaction sent to the customer in response to the formal firm demand transaction. The purpose would usually be to promise delivery. Generally only applies to spot type demand

**ADD370** Receipt of order status enquiry

Used by the customer to ask you, the supplier for information on the current status of previously sent spot purchase order(s).

**ADD380** Transmission of order status report

Used by you, the supplier to report on the status of outstanding orders. It can also be a response to an order status enquiry

***Control and Co-ordination functions***

**ADD510** Negotiation relating to potential delivery problems

Rather than sending formal messages and formal responses, the scenario envisaged is where (on an exchange or other web site) there is a collaborative approach to the process of you and your customer negotiating potential delivery issues. The objective is jointly to find the best solution, minimising the impact on both parties, in a spirit of co-operation and knowledge sharing relating to the problems that are affecting supply.

**ADD520** Lead Management

The scenario here is that one of a distributed sales force (e.g., salesmen with remote hand held devices or other methods of communicating with the centre, or a dealer network). From the centre there is the need to pass leads or schedule appointments. The sales force or distribution outlets are expected to provide relevant information such as feedback on leads, qualification of prospects and sales forecasts

**ADD530** Monitor and control auction processes

You participate in auction processes using exchanges. For "buyer" auctions in which you are interested in participating, you need to manage the progress of your active bids, and monitor for possible opportunities to participate in open buyer auctions. If you are conducting seller auctions (e.g. disposing of surplus goods), you need to monitor the incoming bids and ultimately process the accepted bid

**ADD540** Opportunity Management

This describes a collaborative approach to the process of a prospective vendor and customer engaging on a new sales opportunity. Essentially it consists of a systematic sales approach, whereby customer requirements, supplier qualification and feedback, and negotiations are communicated in a structured fashion.

**ADD550** Change notifications and alerts

Any exception situations or reminders relating to customer demand management may be the subjects of notifications (typically by e-mail). These would typically be generated automatically as a result of the customer's systems detecting a deviation from what was expected. Examples include; overdue order warnings; emergency order warnings.

**ADD560** Collaboration in marketing campaigns with external partners.

Collaborative marketing activities (from campaigns for individual products at a local level to high-level marketing plans for the whole company) are based on effective web-based communications between the various parties involved. The marketing manager begins by defining the goals of the campaign. Data is gathered from an external source such as a market research firm, allowing the marketing manager to benefit from external analysis and refine the objectives. The campaign is then designed, approved, and prepared for execution. The external data provider delivers the information needed to allow the marketing manager to develop a target group. The marketing manager then specifies each step for campaign execution and launches the marketing campaign. At this point, feedback from the target group enables the vendor to fine-tune the campaign to make future waves more effective. Ongoing input from the target group leads to further refining and analysis of the campaign's success.

**ADD570** Collaborative performance data collection and presentation

For customer demand management, this involves a performance measurement environment (either hosted by the customer or by an exchange) to which customers, yourself and other operational partners have access for data input and feedback. For customer demand management, the word collaboration is likely to be somewhat of a misnomer. The customer presumably will set objectives and methods of scoring, to which, after appropriate negotiation (and perhaps input), you will presumably have to agree. There is then a process of data collection by the customer and presentation of the results that are calculated. In a true collaborative environment, there should also be mechanisms whereby the results can be challenged, explained and if necessary adjusted. Examples include: Due date delivery conformance; quality of supplied goods

**Supply Chain Planning**  
**Information functions**

**ADS010** Access to customers planning data

The customer chooses to provide a portal where you the supplier can access his system so as to view information such as current forecasts and usage. This is an alternative (sometimes additional) to transactional EDI functions, and collaborative exchange type functions, which may be considered appropriate as a cheap alternative to the expense of integrating this information automatically into your planning system. Whether or not these sorts of facilities are used is under the control of the customer, and you have to use them as best you can.

**ADS020** Provision of capacity information for customers

You are required (or choose) to make available your delivery capacities (e.g. so many per period, ability to flex this capacity by time horizon) to the customer so that he can plan more realistically. This is a more limited situation than the collaborative planning type scenarios described elsewhere, and all you are expected to do is to provide this information to the customer (probably by maintenance of supplier parameters through the customer's a supplier web portal).

**ADS030** Provision of current forecasts for the customer

The scenario here is where you base your planning (in whole or in part) on forecasts of customer demand that you make yourself. You make these forecasts available to the customer (e.g. by maintaining information on your customer's supplier portal, or by giving your customer a window into your systems via your customer portal).

**Transactional functions**

**ADS210** Status of vendor or 3rd party managed inventory

This relates to a "just in time" supply situation, where a buffer stock of inventory owned by you is maintained at the customer or by an advanced warehouse managed by the customer or a third party logistics partner. If it is not your responsibility to generate the orders necessary to replenish these stock levels, you still need to know the movements out in order to account correctly for the change of ownership consequent on its usage. If it is your responsibility to generate the orders necessary to replenish these stock levels, you need the status information to generate the re-supply order at the right time.

**ADS220** Transmission of production schedules to customers

The scenario here is one where you do not adapt your production to short term changes to customer demand. This may be because you are constrained to operate in fixed cycles by plant capacity or raw material availability, and your position in the market allows you to make the customer conform to what you can produce. In this case the customer may be interested in being aware of your current production schedules so that he can plan accordingly.

**ADS230** Reception / integration of customer forecasts

In situations where items are supplied on a regular basis, the customer is usually able to provide forecasts of expected demand. By integrating these forecasts into your planning system, you are able better to plan for your long lead-time purchased items. In some cases customers provide forecasts on the basis of which they authorise the purchase of materials or the manufacture of goods. In these cases it is necessary to retain the history of such forecasts in case of future disputes.

***Control and Co-ordination functions***

**ADS510** Comparison of demand with constrained supply plan

The idea is that you, and the customer, exchange information on what is required and what can be produced, enabling both to create more accurately defined supply network and better production plans. This type of collaboration uses internet based facilities (typically using a supply chain exchange) to share data more effectively and update plans more frequently. The idea can also be extended to having you, your customers and your suppliers, all members of the same information sharing exchange.

**ADS520** Collaboration on forecast exceptions

This idea is a refinement of the process of sending exception messages between you and the customer. The idea is that you both collaborate on exceptions more interactively, enabling problems with the model of the supply network and the production plans to be solved more quickly. This type of collaboration uses Internet-based facilities (typically using a supply chain exchange) to share data more effectively and turn around exception situations more frequently.

**ADS530** Establishment of parameters for partner managed inventory

This relates to a "just in time" supply situation, where a buffer stock of inventory owned by you is maintained at the customer or by an advanced warehouse managed by the customer or a third party logistics partner. As part of the setting up of this facility, the parameters relating to supply (e.g. number of days supply, transfer quantity, transfer lead time, re-supply lead time) need to be established.

**ADS540** Notifications and planning alerts from customers

Any exception situations or reminders relating to demand side supply chain planning may be the subjects of notifications (typically by e-mail). These would typically be generated automatically as a

result of the customer's systems detecting a deviation from what was expected. Examples include; warning of supplier capacity exceeded (if appropriate), forecasts for new items; missing supplier data for planning.

**ADS550** Collaborative performance data collection and presentation

For demand side supply chain management, this involves a performance measurement environment (either hosted by the customer or by an exchange) to which customers, yourself and other operational partners have access for data input and feedback. For customer demand management, the word collaboration is likely to be somewhat of a misnomer, because the customer is likely to dictate the objectives and methods of scoring, the collection of data and the presentation of results. In a true collaborative environment, there should also be mechanisms whereby the results can be challenged, explained and if necessary adjusted. Examples include: Finished goods inventory turn, customer schedule stability, lead times achieved, On-time delivery performance.

**Outbound Logistics**  
**Information functions**

**ADL010** Access to potential carriers

The situation here is when you, the consignor has to arrange transport on an exceptional basis, and needs to find a carrier for this specific job. You may choose to maintain a catalogue of suitable carriers or be part of a logistics exchange, which makes it easier to search for carriers capable of doing the job that you want done

**ADL020** Access to carrier schedules and capacities

If you have to plan transportation on a regular basis with a carrier, it may be appropriate for you to be aware of the current schedules and transport capacities of the carrier to help plan complex transportations

**ADL030** Provision of delivery status information

You wish to provide relevant people (distribution channels, actual or potential customers) a window into your shipping execution system so that the details of the current status of relevant despatches can be established. Typically this would through a web-based customer portal.

**ADL040** Access to carriage status information from carriers and forwarders

We may be interested in knowing (e.g. in the case of significant in-transit times, or important deliveries) to track the subsequent progress of the delivery, and have independent confirmation from the carrier that the goods have been delivered. A major carrier can be expected to operate a tracking system on his web site, which we can interrogate in order to ascertain the current status of our delivery.

**Transactional functions**

**ADL210** Tender for transport services

In the situation where you, the customer organise transport, this is a request for quotation for transport services and can apply both to long-term contract transport services and for the carriage of one-off shipments. Typically this type of transaction is supported on a logistics exchange and may involve a buyer auction for transport services.

**ADL220** Response to tender for transport services

In the situation where you, the customer organise transport, this is an offer to provide (under defined terms and conditions) the transport services previously tendered for, and can apply both to long-term contract transport services and for the carriage of one-off shipments. Typically this type of transaction is supported on a logistics exchange and may in effect be a bid in a buyer auction for transport services

**ADL230** Confirmed transport service order

This is a formal order for transport services under defined terms and conditions. It may or may not follow a prior formal process of tendering or quotation

**ADL240** Instruction to carrier

This is an instruction to an individual carrier to make a specific collection of a specific despatch, usually at a specific time (or within a specified collection window), usually at a specific dock or gate, under the terms of an arranged transport service order.

**ADL250** Instruction for supplier drop shipment

The drop shipment situation is one where your supplier delivers directly to your customer. In accounting and administration terms the process is generally one of "back-to-back" sales order and purchased order. However you may need some way of instructing the supplier when to deliver and how to deliver

**ADL260** Advice of supplier despatch of drop shipment

In situations where your supplier "drop ships" directly to your customer, you need some notification that this has happened so that you can process the necessary accounting and administration (typically that of a "back-to-back" sales order and purchased order). This may be covered by a variant of a supplier despatch advice or a supplier invoice

**ADL270** Forecast of Despatch of Goods

This is sent by the consignor (typically you) to advise the consignee (typically the customer) that the goods required are available and ready for despatch. It is basically an advance warning of a despatch and serves to confirm to the customer (if he needs such confirmation) that his demand will be satisfied

**ADL280** Advice of Despatch of Goods

This is something that you do because your customer demands it of you. At the point in time that you despatch goods to the customer, you transmit a message (by classical EDI type facilities or web based equivalent) advising the customer of the details of what you have despatched. Assuming that your customer has competent receiving systems, he will expect this message to contain sufficient detailed information to allow the physical goods to be received in reference to this shipment notification with the minimum of extra data recording.

**ADL290** Instruction to third party warehouse to despatch

This is used to direct deliveries from a warehouse at a distance; typically when you, the supplier owns stock managed remotely by a third party, and wishes to order a despatch from this warehouse

**ADL300** Pickup confirmation

In the situation where we are organising collection from a remote despatch facility, we may require the carrier to inform us by a specific transaction of the fact that he has collected the goods.

**ADL310** Milestone confirmation

Rather than our having to interrogate a carrier's web tracking system, we may require the carrier to inform us by a specific transaction of the fact that the goods have reached a certain in-transit point in the delivery process.

**ADL320** Delivery confirmation (proof of delivery)

This is a message from the customer recording the fact that the goods have been received and that (if appropriate to the terms and conditions of carriage) the customer has taken ownership of the goods. In situations where the customer was responsible for pulling the goods from vendor or third party managed inventory, this would be in effect the trigger for you to invoice.

**ADL330** Advice of discrepancy from customer

The customer may use this transaction to inform you of any discrepancy between what was advised, and what was actually received. It may also reflect the fact that some of the goods advised were rejected on receipt

**ADL340** Movements from vendor inventory

This is a message reporting the fact that goods have been either received or despatched from vendor inventory where such inventory is controlled either by the customer or a third party logistics provider

**ADL350** Communication to providers of International trade documentation

Provision of the requisite documentation for cross-border trade is often a specialist service provided by a third party. You will need to provide the base despatch and invoice information to this third party.

***Control and Co-ordination functions***

**ADL510** Collaborative transportation planning

Using transportation exchanges, you can adopt a collaborative approach to the synchronisation of transportation plans with a carrier. You can be aware of the current schedules and transport capacities of the carrier to help plan complex transportations. The carrier can be aware of your current despatch plans, and if appropriate these plans can mutually influence each other. The transportation exchange can also be used as a vehicle for tendering for transport jobs if appropriate.

**ADL520** Management of claims

The scenario is one of a collaborative transportation exchange, with appropriate access to information and exception notifications, where claims (by you or the customer) as a result of a failure to perform part of the delivery process can be quickly identified, traced and resolved by negotiation

**ADL530** Alerts and exception notifications

Any exception situations or reminders relating to outbound logistics may be the subjects of notifications (typically by e-mail). These would typically be generated automatically as a result of



the customer's, or yours, or your transport partner's systems detecting a deviation from what was expected. Examples include; status tracking notifications (as an alternative to formal transactions), delayed deliveries, warnings relating to rejections, returns or delivery discrepancies.

**ADL540** Collaborative performance data collection and presentation

For outbound logistics management, a collaboratively managed performance measurement environment (either hosted by the customer or by an exchange) to which customers, yourself and your transportation partners have access for data input and feedback. Both yourself (customer of the transportation organisation) and the customer may have an input to dictating the performance parameters, collecting the data and presenting the results. In a true collaborative environment, there should also be mechanisms whereby the results can be challenged, explained and if necessary adjusted. Examples include: Discrepancy advice levels, in-transit loss levels, in transit lead times, carrier schedule adherence.

***Customer Accounting  
Information functions***

**ADF010** Access to customer accounts payable system

The customer provides a portal where you, the supplier, can access his accounting and payment system so as to view current account status information.

**ADF020** Provision of access to invoice system

You provide your customers with a window into your accounts receivable system so that the details of the current status of the customer's account can be established. Typically this would through a web-based customer portal.

**ADF030** Access to external credit information providers

This relates to the access to, and integration of credit information from external sources, typically professional credit reference agencies

***Transactional functions***

**ADF210** Pro-forma invoice

This may be sent prior to order confirmation and shipment to assist in matters relating to obtaining import licences or foreign exchange allocations, or simply to provide the value of the consignment so that letters of credit may be opened,

**ADF220** Commercial invoice

This is the normal invoice sent by you to the customer, containing the claim for payment of goods supplied under the financial conditions agreed between the buying and selling parties

**ADF230** Response to invoice

This can be sent by your customer, to you, the supplier (possibly vice versa) to show errors in previously received invoices or credit notes, debit notes or self bill invoices. The message includes action to be taken by you or the supplier (depending on to whom the message is sent).

**ADF240** Credit note

Sent by you, the supplier to the customer (possibly vice-versa) to credit all or part of an unacceptable invoice or invoices or to correct one or more debit notes

**ADF250** Remittance Advice

This is sent from the your customer to you, the supplier specifying all payments to a seller at specific dates.

**ADF260** Statement of account

Used for reconciliation of accounts through between trading partners. Sent by you to the customer, (possibly vice versa) detailing the financial transactions and the resulting outstanding balance at a specified date.

**ADF270** Reception and reconciliation of self-bill invoice

This is sent, from the customer to you, the supplier, to notify that (specified) goods have been received and that payment is authorised without further notification, under the financial conditions agreed between you and the customer. It must contain sufficient information for you to match with the appropriate movement of goods and generate the appropriate quasi invoice record for your internal accounts

**ADF280** Changes to the customer's supplier data

Can be sent by your customer to you (and vice versa) to inform of relevant data (or correct existing data) that you need to have about the other in your respective systems to be able to conduct your commercial relationship correctly

**Control and Co-ordination functions**

**ADF510** Exception notifications

Any exception situations or reminders relating to finance may be the subjects of notifications (typically by e-mail). These would typically be generated automatically as a result of the customer's, or your systems detecting a deviation from what was expected. Examples include; invoice matching discrepancies, payment alerts.

**ADF520** Account status notifications

These are reminders (typically sent by e-mail) generated automatically by your accounts receivable system. They would normally be sent in response to your systems detecting accounts currently becoming due or overdue, or remaining overdue for periods of time.

**ADF530** Payment assignment collaboration

Typically this occurs when your accounts receivable system cannot assign your customer's payments to open invoices. You request the customer by an exception notification to assign the open items by using a link into your system (via your customer portal). The customer accesses his account and assigns the open items with appropriate comments, and sends you a notification. You the vendor then access the assignment and accept and close the issue or return it to the customer as appropriate.

**ADF540** Dispute Management

If your customer pays a reduced amount rather than the agreed invoiced amount (for what presumably he considers to be a good reason), there is a dispute, which may involve other

decision-making groups of people. You create a record of this dispute and document all related queries to the customer against this dispute. The entire process can be examined at any time with the help of this documentation. You may, if necessary, transfer responsibility for the dispute to other people or organisations. When the final resolution has been achieved, it is documented, and the dispute closed.

**ADF550** Customer credit management

This deals with the dissemination of credit information within the total sales organisation, which may consist of multiple remote sites managing customer demand and also include dealers and other agents. The credit manager updates the credit scoring of the customer by analysis of customer payment activity and information from external credit information providers. The customer's credit status is available to the demand management systems.

**ADF560** Collaborative performance data collection and presentation

For finance, a collaboratively managed performance measurement environment (either hosted by the customer or by an exchange) to which customer and have access for data input and feedback. Your customer will ultimately be in control of the performance parameters, and will collect most of the data and present the results. In a true collaborative environment, there may be measurements that you should contribute and there should also be mechanisms whereby the results can be challenged, explained and if necessary adjusted. Examples include: Invoice rejects, credit notes and payment performance.

**Service  
Information functions**

**ADV010** Provide Customer service history

You may provide your customers, service organisations and remote field service engineers a window (through an internet based portal) into your service management system where they can view those aspects of the service history of that customer that they are authorised to see.

**ADV020** Provide spare parts location information

You provide your service organisation or remote field service engineers a window (through a web based portal) into your service spare parts inventory management system so that they can locate parts that could be available for use.

**ADV030** Service request tracking

You provide the customer with the ability to track the status of his service requests (created, in process, completed) at all times on the service portal. This would naturally be integrated into the facility to enter the service request through the Internet-based portal

**ADV040** Access to service solutions

You provide your customers, service organisations and remote field service engineers an Internet-based facility on your service portal, by which they can view common solutions to common problems.

**Transactional functions**

**ADV210** Communicate problems and service requests

When a malfunction or concern occurs in relation to a piece of equipment (which could be anything from a complex piece of technical machinery such as a machine tool to an item of consumer goods such as a dishwasher), customers notify the problem to the responsible service organization via the web based service portal.

#### **ADV220** Communicate solutions

It may be possible to communicate a solution to the problem without involving a service visit by a field service representative, especially if the problem is recorded on the database of common problems

#### **ADV230** Enter Service Order

Once the problem or service request reaches a customer services representative it is possible to describe the appropriate actions to be performed by field service representatives in order to resolve the malfunction. The service request can then be entered as a proper service order containing a number "service items". Examples of service items could be, for example "Replace washing machine drum", or "Renew toner". Information regarding how long the individual service items will take to execute is also entered in the item information. Once the necessary items have been maintained, the service order can be released, from which point the items will be visible to the planner of service resources.

#### **ADV240** Despatch Engineer

Your service resource planning system assigns new service items to individual field service representatives based on their current workload and availability, and communicates the next task (or task queue). Field service employees typically use handheld devices (for example, WAP phone, Palm Pilot) when working in the field and (in the situation where they will be working without on-line internet communication) download information about their own assignments from your service management system.

#### **ADV250** Accept Assignment

Field service employees are able to accept or reject assignments that have been assigned. They are also able to maintain information regarding their own availability (for example, a planned medical appointment can be maintained as an absence and overtime hours as an attendance).

#### **ADV260** Entry of orders for material (for task or to replenish stock)

Following examination of the item(s) to be serviced, field service employees may need to order additional material or components, in addition to standard service materials, in order to complete the service job. They may also need periodically to re-order parts to replenish those that they normally are expected to stock.

#### **ADV270** Generate orders for repair work

This relates to the scenario where the product is returned to your manufacturing or service facility for repair and overhaul. These jobs will be subject to a repair order, the scope of which usually is determined when the product is actually received and assessed

#### **ADV280** Record Service Details

Field service representatives are able to confirm the status of their work, which provides the resource planner with information on work progress and enables conflicts to be identified and resolved rapidly. Once an assignment has been completed, the responsible field service employee is able to confirm working times, appropriate error codes, and materials used. This information is

available to the service organization, where it can be used as a basis for creating a billing document and for performing subsequent analyses.

### **Control and co-ordination functions**

#### **ADV510 Management of service contracts**

Service providers and customers make special agreements for the support of the customer's critical installations and systems. Service Level Agreements (SLA's) are defined for the relevant customer products within service contracts, from which performance commitments are derived for service processing within the agreement. The service provider offers the customer a selection of SLA's specifying service parameters such as availability (for example, 5x8 h, 7x24 h) and response time (for example, 4h/12h). Service providers and customers draw up a service contract, which defines the SLA values that the service provider is obliged to adhere to in a service case. The service contract also includes a list of the customer's products that are covered. Different service levels may be agreed upon for different products, according to their importance to the customer.

#### **ADV520 Service resource planning**

In a collaboratively managed service planning environment, to which both you, the service organisation and the individual field service representatives could have access where appropriate, it is possible to see at a glance the general working schedule of a particular service team (for example, 8:00am to 6:00pm), which assignments and assignment statuses (Accepted, Rejected, Communicated, On-Site, Completed) exist for individual field service representatives, and availability data (absences and attendances) for these employees. New service items can be assigned to individual field service representatives based on their current workload and availability.

#### **ADV530 Service alerts**

Any exception situations or reminders relating to service may be the subjects of notifications (typically by e-mail). These would typically be generated automatically as a result of your service system detecting a deviation from what was expected. Examples include; service requests outside service level agreement tolerance, service engineer availability.

#### **ADV540 Collaborative performance data collection and presentation**

For service, a collaboratively managed performance measurement environment (either hosted by the customer or by you) to which customers, yourself and any service partners have access for data input and feedback. From the customer standpoint, the Service Level Agreements will dictate the performance parameters, but there will be others of an internal nature that you wish to measure. Both your service organisation and the customer may have an input to collecting the data and presenting the results. In a true collaborative environment, there should also be mechanisms whereby the results can be challenged, explained and if necessary adjusted. Examples include: Service response time, service availability, service cost parameters, engineer productivity.

### **Supply Side**

#### **Product Development and pre-production Information functions**

##### **ASP010 Access to supplier design documents and drawings**

You have the ability to access a supplier system to view or download design documents and drawings. This could be on a supplier web site or use an exchange type facility

##### **ASP020 Provision of design information to suppliers**

On your own web site (or an exchange), you provide technical and other documentation relating to the form function and fit of items that you purchase (or intend to purchase), for access by actual or potential suppliers

**ASP030** Provision of centralised project documentation

The idea here is that you as the customer have a project management system (managed on your own web site or using an exchange), which you expect your suppliers to contribute to, and participate in.

**ASP040** Access to supplier engineering change information

Tracking the status of engineering change notifications or process changes at the supplier

**Transactional functions**

**ASP210** Transmission of product design information to supplier

The formal transmission to the supplier (via EDI or similar web based methods) of information such as product data (e.g. product structures), design content files (e.g. technical drawings), data files for CNC machining/cutting and material specs

**ASP220** Reception of product design information from supplier

The formal transmission from the supplier (via EDI or similar web based methods) of information such as product data (e.g. product structures), design content files (e.g. technical drawings), data files for CNC machining/cutting and material specs

**ASP230** Transmission of engineering change notification

You create and transmit to the supplier (or other external partner) a notification of an engineering change that you have effected

**ASP233** Reception of engineering change request from supplier

The supplier (or other external partner) has created an engineering change notification/request and it is necessary for you to approve it

**ASP237** Transmission of engineering change authorisation to supplier

In response to the supplier's engineering change request, you give authorisation proceed with it

**ASP240** Reception of confirmation of release of engineering change order

The supplier (or other external partner) informs you of the creation of the appropriate engineering change order

**ASP250** Reception of confirmation of completion of engineering change order

The supplier (or other external partner) informs you of the completion and implementation of the engineering change order

**ASP260** Reception of Process change requests from Supplier

As part of our role in the supply chain, you are required by your customers to exercise control over changes that the supplier makes in his manufacturing processes. We have to be able to receive and monitor such requests

### ***Control and Co-ordination functions***

#### **ASP510** Project initiation and management

These are product design and development projects where you are operating in partnership with one or more suppliers. The project management environment may be hosted on your own web site or using an exchange. Aspects of the project to be managed include people, tasks, documents, design, process and/or product information

#### **ASP520** Pre-production enquiry management

Communication relating to engineering aspects of, or the technical feasibility of order enquiries, in situations where some degree of design to order or configure to order is expected. Similar to collaborative projects but likely to be simpler and less formal. May be achieved by e-mail, or by web-based facilities hosted by the supplier, probably linked with the supplier's order configuration facilities.

#### **ASP530** Design Collaboration

Collaboration with the supplier, or other design partner, in the proposing of, creation of, and feedback to engineering or process design work for purchased items. Involves web-based access (e.g. on an exchange) as well as subscribe and notification mechanisms to speed up collaboration.

#### **ASP540** Change notifications and alerts

Any exception situations or reminders relating to technical projects may be the subjects of notifications (typically by e-mail). These should be generated automatically as a result of your systems detecting a deviation from what was expected. Examples include; supplier process change requests, task overdue warnings; project amendments made by you, of relevance to the supplier.

#### **ASP550** Continuous improvement collaboration

The idea here is that there is a collaborative problem management environment (hosted by you or on an exchange) controlling the identification, notification, assignment, and solution feedback of any type of problem or change request between you and your suppliers. The problem can be documented fully and related documents can be attached

#### **ASP560** Collaborative performance data collection and presentation

For product design and development, a collaboratively managed performance measurement environment (either hosted by you or by an exchange) to which you, your suppliers and other operational partners have access for data input and feedback. As the customer, you will normally set objectives and methods of scoring, and you will expect your suppliers and other partners to agree to these, after appropriate negotiation (and perhaps input). You will need a system of collecting data and presentation of the results. In a true collaborative environment, there should also be mechanisms whereby the results can be challenged, explained and if necessary adjusted. Examples include: Response time to engineering requests; recalls attributed to supplier design problems

### ***Supply Chain Planning Information functions***

#### **ASS010** Access to supplier capacity information

You ask your suppliers to make available their delivery capacities (e.g. so many per period, ability to flex this capacity by time horizon) so that you can plan more realistically (typically if you employ a constraint based planning system). This is a more limited situation than the true collaborative planning type scenarios described elsewhere, and you simply require the supplier to provide this information (probably by maintenance of supplier parameters through the supplier web portal on your system).

#### **ASS020** Provision of supplier access to planning data

You provide a supplier portal where a supplier can gain access to your system so as to be able to view information such as current forecasts and usage. This can be conceived of as a cheap and easy solution for those suppliers for whom transactional EDI functions, and collaborative exchange type functions are unrealistic

#### **ASS030** Access to supplier forecasts

The scenario here is where your suppliers base their planning on their own forecasts rather than yours. It is relevant for you to be able to see these forecasts. They could be accessible via your supplier's customer portal, or your supplier portal or other (e.g. exchanges)

### ***Transactional functions***

#### **ASS210** Transmission of forecasts for suppliers

In situations where your suppliers supply items on a regular basis, it is usually appropriate to provide forecasts of expected demand beyond the period that you wish to consider firm committed demand. By doing this you give the supplier the opportunity to plan ahead so that he can respond better to your firm requirements when you are able to provide them. You may also wish to provide forecasts on the basis of which the supplier is authorised to purchase materials or manufacture goods at your risk in the event that they ultimately prove not to be required.

#### **ASS220** Transmission of production schedules by suppliers

The scenario here is one where you cannot expect the supplier to react to short-term changes to your demand, but typically you must operate within his fixed production cycles. The supplier transmits his production program to you so that you can ensure that your planning takes account of these constraints.

#### **ASS230** Status of 3rd party managed inventory

This relates to a "just in time" supply situation, where a buffer stock of supplier owned inventory is maintained either directly by the supplier or by using a third party logistics partner. Although it may not be your responsibility to maintain these stock levels it would be normal, on a regular basis (typically daily), for the current stock balances to be transmitted to you to assist short term shortage checking. In the situation where it was your practice to order the supplier to replenish the stocks, your planning system will need awareness of the stock levels in order to plan correctly.

### ***Control and Co-ordination functions***

#### **ASS510** Modelling of supply chain (in collaboration with suppliers)

The idea is that you, and the supplier, exchange information on what is required, enabling both to create more accurately defined supply network and better production plans. This type of collaboration uses internet based facilities (typically using a supply chain exchange) to share data



more effectively and update plans more frequently. The idea can also be extended to having you, your customers and your suppliers, all members of the same information sharing exchange.

**ASS520** Comparison of plan with suppliers plan

The idea here is (in a collaborative, exchange based type environment) that you are constantly aware of your own plans and your suppliers' plans and able to react quickly to situations where they become out of step. Exception management type tools must of necessity support this comparison.

**ASS530** Establishment of parameters for partner managed inventory

This relates to a "just in time" supply situation, where a buffer stock of supplier owned inventory is maintained either directly by the supplier or by using a third party logistics partner. The call in, in these situations is typically initiated by a "KANBAN" (or similar min/max process) where usage of a defined quantity of the parts by you, the customer, triggers the re-supply of that quantity from the buffer stock. As part of the setting up of this facility, the parameters relating to supply (e.g. number of days supply, transfer quantity, transfer lead time, re-supply lead time) need to be established.

**ASS540** Collaboration on exception items

This idea is a refinement of the process of sending exception messages between you and the supplier. The idea is that you both collaborate on exceptions more interactively, enabling problems with the model of the supply network and the production plans to be solved more quickly. This type of collaboration uses Internet-based facilities (typically using a supply chain exchange) to share data more effectively and turn around exception situations more frequently.

**ASS550** Notifications and planning alerts for suppliers

Any exception situations or reminders relating to planning issues may be the subjects of notifications (typically by e-mail). These should be generated automatically as a result of your systems detecting a deviation from what was expected. Examples include; warning of supplier capacity exceeded (if appropriate), forecasts for new items; missing supplier data for planning.

**ASS560** Collaborative performance data collection and presentation

This is a collaboratively managed supplier performance measurement environment (either hosted by you or by an exchange) to which you and your suppliers have access for data input and feedback. As the customer, you will normally set objectives and methods of scoring, and you will expect your suppliers and other partners to agree to these, after appropriate negotiation (and perhaps input). You will need a system of collecting data and presentation of the results. In a true collaborative environment, there should also be mechanisms whereby the results can be challenged, explained and if necessary adjusted. Examples include: Purchased item stock turns, cumulative material lead times, percentage of suppliers on delivery schedules, purchase schedule stability, number of planning exceptions.

***Purchasing and Procurement  
Information functions***

**ASB010** Provision of issue resolution systems for access by suppliers

These involve your systems that manage quality and other concerns such as complaints. You may wish to provide your suppliers with access to such systems (hosted on your web site or on an exchange).

**ASB020** Provision of delivery schedules for suppliers

You provide a supplier portal where a supplier can gain access to your system so as to be able to view his current delivery schedules. This can be conceived of as a cheap and easy solution for those suppliers for whom transactional EDI functions, and collaborative exchange type functions are unrealistic

**ASB030** Access to product information of real or potential suppliers

You need to access (typically through a supplier's web based customer portal, possibly on an exchange) details of the products of real or potential suppliers in order to decide the most relevant product for your requirements.

**ASB040** Access to supplier price lists

You need to access (typically on a supplier's web based customer portal, possibly on an exchange) details of the prices of the products of real or potential suppliers.

**ASB050** Access to supplier pricing configurators

You need to access (typically on a supplier's web based customer portal, possibly on an exchange) details of how to calculate the prices of the products of real or potential suppliers in the context of the choice of various features and options

**ASB060** Access to supplier order status information

You are given the opportunity to access a window into the supplier's order processing system (typically through a supplier's web based customer portal) so that you can view the status of your outstanding orders in the supplier system

**ASB070** Provision of supplier performance measurements to suppliers

You have a supplier performance evaluation system and you publish this on your web site (or equivalent) for access by suppliers so that they can monitor their rating on an up to date basis. This facility should also include sufficient back-up information so that the reasons for the rating can be exposed

***Transactional functions***

**ASB210** Creation of catalogues from supplier or other data

As part of the process of improving the efficiency and conformance to policy of the procurement process, catalogues are created of approved items from approved suppliers, so that buyers can select and order parts with the minimum of requisition approval overhead

**ASB220** Initiate a Buyer Auction

This relates to reverse "Buyer" auctions", managed on an exchange to which both you and your supplier subscribe. The idea is that you solicit and manage bids (under your terms) from multiple potential suppliers online and award business based on the results. You may choose to let suppliers see information like the current lead time or best price, and let them bid multiple times right up to the closing moments of the bid process. You may choose to have a public bid where any supplier can respond, or invite specific potential suppliers that meet some defined criteria to bid.

**ASB230** Receive bids in a Buyer auction

This is the formal offer by your potential suppliers to provide the goods and services that you have specified in your buyer auction

**ASB240** Bid in a Seller auction

This is the process of making bids for the purchase of items in situations where the things that you purchase are subject to auction by the sellers.

**ASB250** Enquiry for the supply of goods and services

This is the formal request (by an EDI message or equivalent) from you to your customer requesting a quotation (usually price and delivery date) for the potential supply of goods or services

**ASB260** Reception of quotations for the supply of goods and services

This is a formal offer (by an EDI message or equivalent) from your customer to you, to provide the requested goods and services at a specified price on a specified date under defined terms and conditions

**ASB270** Contract proposal

In situations where the nature of the business relates to the long-term provision of goods and/or services, this is the formal proposal by you, the customer of the terms and conditions of the relationship. Aspects covered would include the items covered, prices, scheduling rules, commercial and financial terms, and the logistics of the supply (e.g. carriers).

**ASB280** Contract acceptance

This is the formal acceptance of the terms of the contract proposal by the supplier.

**ASB290** Direct entry of purchase orders

You, the customer enters the purchase order directly into the supplier's system via a customer portal provided on the supplier's web site.

**ASB300** Direct configuration of purchase order items

You, the customer enter the purchase order directly into the supplier's system and configure the product that you want to buy using a configurator provided via the customer portal provided by your supplier's web site. You would expect this also to present at order entry time the price (and possibly the delivery time) of the configured product.

**ASB310** Transmission of firm repetitive demand to suppliers

You, the customer transmits to your suppliers the details of the deliveries that you want, normally in the form of a delivery schedule against a long-term contract or blanket order. The contract or blanket order will have established the terms and conditions of supply, and also the normal delivery rules. All that is normally required here is a statement of quantities and dates (with perhaps some delivery reference data).

**ASB320** Transmission of firm spot demand to suppliers

You, the customer transmits to your suppliers the details of the deliveries that you want in the form of a purchase order message. This order may be in the context of a pre-existing contract establishing the terms and conditions of supply, but is more likely to be self contained in defining all necessary aspects of the requirement.

**ASB330** Call in from vendor or 3rd party managed warehouse

In "just in time" supply situation, where a buffer stock of supplier owned inventory is maintained either directly by the supplier or by using a third party logistics partner, this is the "KANBAN" (or similar min/max process) where usage of a defined quantity of the parts by you, the customer, triggers the re-supply of that quantity from the buffer stock.

**ASB340** Transmission of order amendments

This relates to spot orders and covers the situation where you, the customer wish to vary some aspect of the order. The nature of the change that is acceptable to the supplier would have been the subject of a previous agreement on terms and conditions of supply.

**ASB350** Receipt of suppliers' responses to orders

A formal transaction sent by the supplier in response to a formal spot type purchase order, or an order amendment. The purpose would usually be to promise delivery.

**ASB360** Transmission of order status enquiry

Used by you, the customer to ask the supplier for information on the current status of previously sent spot purchase order(s).

**ASB370** Receipt of order status report

Used by the supplier to report to you on the status of outstanding spot purchase orders. It can also be a response to an order status enquiry.

**Control and Co-ordination functions**

**ASB510** Negotiation relating to potential delivery problems

Rather than sending formal messages and formal responses, the scenario envisaged is where (on an exchange or other web site) there is a collaborative approach to the process of you and your suppliers negotiating potential delivery issues. The objective is jointly to find the best solution, minimising the impact on both parties, in a spirit of co-operation and knowledge sharing relating to the problems that are affecting supply.

**ASB520** Monitor and control auction processes

You participate in auction processes using exchanges. In the case when you are conducting "buyer" auctions, you need to decide (if appropriate) the potential suppliers who be invited to bid (perhaps based on previous bid history). You need to monitor the incoming bids so that ultimately you can award the business. If you are purchasing items using seller auctions, you need to manage your active bids, and monitor for possible opportunities to participate in other auctions.

**ASB530** Opportunity Management

This describes a collaborative approach to the process when you, the customer and one of your prospective suppliers engage on a new sales opportunity. Essentially it consists of a systematic sales approach, whereby your requirements, supplier qualification and feedback, and negotiations are communicated in a structured fashion.

**ASB540** Entry and approval of purchase requisitions

Requisitions can be entered directly into the web-based procurement system, by the originator. The items requested can be selected from a catalogues of approved items from approved suppliers, so

that the approval process can be simplified. The approval hierarchy mechanism directs the requisition to the correct approver (or sequence of approvers). Approval is entered into the system, and when complete the originator is notified. The purchase order can be generated automatically at this point and sent to the supplier.

**ASB550** Procurement notifications for suppliers

Any exception situations or reminders relating to purchasing or procurement issues may be the subjects of notifications (typically by e-mail). These should be generated automatically as a result of your systems detecting a deviation from what was expected. Examples include; warning of imminent emergency orders; order cancellation or delays.

**ASB560** Collaborative performance data collection and presentation

This is a collaboratively managed supplier performance measurement environment (either hosted by you or by an exchange) to which you and your suppliers have access for data input and feedback. As the customer, you will normally set objectives and methods of scoring, and you will expect your suppliers and other partners to agree to these, after appropriate negotiation (and perhaps input). You will need a system of collecting data and presentation of the results. In a true collaborative environment, there should also be mechanisms whereby the results can be challenged, explained and if necessary adjusted. Examples include: Supplier due date conformance, supplier quality.

***Inbound logistics  
Information functions***

**ASL010** Access to potential carriers

The situation here is when you, the consignee has to arrange transport on an exceptional basis, and needs to find a carrier for this specific job. You may choose to maintain a catalogue of suitable carriers or be part of a logistics exchange, which makes it easier to search for carriers capable of doing the job that you want done.

**ASL020** Access to carrier schedules and capacities

If you have to plan transportation on a regular basis with a carrier, it may be appropriate for you to be aware of the current schedules and transport capacities of the carrier to help plan complex transportations.

**ASL030** Access to delivery status information

You are given the opportunity to access a window into the supplier's shipping execution system (typically through a supplier's web based customer portal) so that you can view the status of your outstanding planned shipments in the supplier system.

**ASL040** Access to carriage status information from carriers and forwarders

Whether or not we organise transport, we may be interested in knowing when the goods have been collected and (in the case of long in-transit times) to track the subsequent progress of the delivery. A major carrier can be expected to operate a tracking system on his web site, which we can interrogate in order to ascertain the current status of our delivery.

***Transactional functions***

**ASL210** Tender for contract transport services and/or spot shipments

In the situation where you, the supplier organise transport, this is a request for quotation for transport services and can apply both to long-term contract transport services and for the carriage of one-off shipments. Typically this type of transaction is supported on a logistics exchange and may involve be a buyer auction for transport services.

**ASL220** Response to tender for transport services

In the situation where you, the supplier organise transport, this is an offer to provide (under defined terms and conditions) the transport services previously tendered for, and can apply both to long-term contract transport services and for the carriage of one-off shipments. Typically this type of transaction is supported on a logistics exchange and may in effect be a bid in a buyer auction for transport services.

**ASL230** Confirmed transport service order

This is a formal order for transport services under defined terms and conditions. It may or may not follow a prior formal process of tendering or quotation.

**ASL240** Instruction to carrier

This is an instruction to an individual carrier to make a specific collection of a specific despatch, usually at a specific time (or within a specified collection window), usually at a specific dock or gate, under the terms of an arranged transport service order.

**ASL250** Forecast of supplier despatch

You may require a communication from the supplier's despatch planning system that your despatch is currently planned and therefore (presumably) can be relied on. This message is sent by the consignor (typically the supplier) to advise the consignee (typically you, the customer) that the goods required are available and ready for despatch.

**ASL260** Receipt of inbound despatch advice from suppliers

At the point in time that your supplier despatches goods to you, the customer, you require him to transmit a message (by classical EDI type facilities or web based equivalent) advising you of the despatch that is coming. The presumption is that you have a goods receiving system, which allows the physical goods to be received in reference to this shipment notification with the minimum of extra data recording. Depending on the characteristics of this system, you will have specified to the supplier the detailed information that you expect to see on this message.

**ASL270** Proof of collection from carrier

Rather than our having to interrogate a carrier's web tracking system, we may require the carrier to inform us by a specific transaction of the fact that he has collected the goods from the supplier.

**ASL280** Milestone confirmation

Rather than our having to interrogate a carrier's web tracking system, we may require the carrier to inform us by a specific transaction of the fact that the goods have reached a certain in-transit point in the delivery process.

**ASL290** Advice of receipt to supplier

This is a message from you to the customer recording the fact that you have received the goods and (if appropriate to the terms and conditions of carriage) have taken ownership. This is generally speaking an authorisation for the supplier to invoice or a trigger for your self-billing process.

### **ASL300** Advice of discrepancy to supplier

You may use this transaction to inform the supplier of any discrepancy between what was advised, and what was actually received. It may also reflect the fact that some of the goods advised were rejected on receipt.

### **ASL310** Recording of and access to inspection results

The idea here is of an Internet (or Intranet) based system where inspection results can be entered at the point of event (e.g. purchase or manufacturing receipt). This facility can be deployed as required to every location with a need to enter this information and to view inspection results, history, or analysis.

### **Control and Co-ordination functions**

#### **ASL510** Collaborative transportation planning

Using transportation exchanges, you can adopt a collaborative approach to the synchronisation of transportation plans with a carrier. You can be aware of the current schedules and transport capacities of the carrier to help plan complex transportations. The carrier can be aware of your current collection plans, and if appropriate these plans can mutually influence each other. The transportation exchange can also be used as a vehicle for tendering for transport jobs if appropriate.

#### **ASL520** Management of claims

The scenario is one of a collaborative transportation exchange, with appropriate access to information and exception notifications, where your claims as a result of a failure to perform part of the delivery process can be quickly identified, traced and resolved by negotiation.

#### **ASL530** Exception notifications

Any exception situations or reminders relating to inbound logistics issues may be the subjects of notifications (typically by e-mail). These should be generated automatically as a result of your, or your transport partner's, systems detecting a deviation from what was expected. Examples include; status tracking notifications (as an alternative to formal transactions), delayed deliveries, warnings relating to rejections, returns or delivery discrepancies.

#### **ASL540** Collaborative performance data collection and presentation

This is a collaboratively managed supplier performance measurement environment (either hosted by you or by an exchange) to which you and your suppliers (the carrier organisations could be just be other suppliers) have access for data input and feedback. As the customer, you will normally set objectives and methods of scoring, and you will expect your suppliers and transportation partners to agree to these, after appropriate negotiation (and perhaps input). You will need a system of collecting data and presentation of the results. In a true collaborative environment, there should also be mechanisms whereby the results can be challenged, explained and if necessary adjusted. Examples include: Discrepancy advice levels, in-transit loss levels, in transit lead times, carrier schedule adherence.

### **Manufacturing Information functions**

#### **ASM010** Access to job status at partner plant/sub contractor

If your subcontract supplier has a web based customer portal, you may have the opportunity to access a window into his manufacturing control system so that you can view the status of your outstanding subcontract orders in the supplier system.

**ASM020** Provision of access to planning system for partners

You provide a supplier portal where a subcontractor or partner plant can gain access to your system so as to be able to view your current manufacturing plans, so as better to be able to anticipate and plan for your up-coming requirements. This can be conceived of as a cheap and easy solution for those subcontractors for whom transactional EDI functions, and collaborative exchange type functions are unrealistic.

**ASM030** Partner plant/subcontractor capacity information

You ask your subcontractors to make available their manufacturing capacities (e.g. so many per period, ability to flex this capacity by time horizon) so that you can plan more realistically (typically if you employ a constraint based planning system). This is a more limited situation than the true collaborative planning type scenarios described elsewhere, and you simply require the subcontractor to provide this information (probably by maintenance of supplier parameters through the supplier web portal on your system).

**Transactional functions**

**ASM210** Advice of supplier materials used

In situations where the supplier is responsible for managing stock at your site, it is typical for this to remain under the ownership of the supplier until it is actually used in production. When such a usage takes place (or is deduced from production completion returns) it is necessary for you to declare this use so that change of ownership can effect take place and the appropriate invoicing actions triggered.

**ASM220** Despatch advice - to partner plant/subcontractor

This relates to manufacturing jobs that are sent to a subcontract partner for manufacturing operations to be undertaken. This is a message sent (by classical EDI type facilities or web based equivalent) to inform the subcontractor the details of what has been despatched.

**ASM230** Receipt advice from partner plant/subcontractor

Also relating to manufacturing jobs that are sent to a subcontract partner for manufacturing operations to be undertaken, this is a message sent (by classical EDI type facilities or web based equivalent) by the subcontractor to acknowledge receipt of the material requiring work.

**ASM240** Despatch advice - from partner plant/subcontractor

At the point in time that your sub-contract partner despatches the completed work to you, require him to transmit a message (by classical EDI type facilities or web based equivalent) advising you of the work that is being returned so that the work can be received and further progressed with the minimum of delay.

**ASM250** Despatch advice from supplier to subcontractor

This relates to you components that are needed by your subcontract partner, which you organise to be despatched directly from your supplier to your subcontract partner. This is a message sent by your supplier (by classical EDI type facilities or web based equivalent) to inform the subcontractor the details of what has been despatched.



**ASM260** Advice of materials provided to partner plant/subcontractor

This relates to components that you are required to supply to your subcontract partner periodically in order to enable him to carry out the manufacturing operations to be undertaken. This is a message sent (by classical EDI type facilities or web based equivalent) to inform the subcontractor the details of what has been despatched.

**ASM270** Notification of materials consumed by partners

If you are required to supply, to your subcontract partner, components that remain your property until used, you need to track these materials at the partner site. This is a message sent (by classical EDI type facilities or web based equivalent) to you by the subcontractor to provide the details of what has been consumed. Alternatively you may calculate the consumption yourself and require the partner periodically to transmit inventory status information, so that your figures can be corrected.

**Control and Co-ordination functions**

**ASM510** Collaborative planning of subcontract work

The idea here is (in a collaborative, exchange based type environment) that you are constantly aware of your own, and your subcontractors' plans, to share data more effectively and update plans more frequently, and you are both able to react quickly to situations where they become out of step.

**ASM520** Alerts and exception notifications

Any exception situations or reminders relating to subcontract manufacturing (planning or execution) may be the subjects of notifications (typically by e-mail). These would typically be generated automatically as a result of your systems or your subcontractor's systems detecting a deviation from what was expected. Examples include; alerts for jobs started which will result in subcontract operations in the near future; emergency orders; order cancellation or delays.

**ASM530** Collaborative performance data collection and presentation

This is a collaboratively managed supplier performance measurement environment (either hosted by you or by an exchange) to which you and your subcontractors have access for data input and feedback. As the customer, you will normally set objectives and methods of scoring, and you will expect your suppliers and other partners to agree to these, after appropriate negotiation (and perhaps input). You will need a system of collecting data and presentation of the results. In a true collaborative environment, there should also be mechanisms whereby the results can be challenged, explained and if necessary adjusted. Examples include: manufacturing lead times, due date performance and quality.

**Supplier Accounting  
Information functions**

**ASF010** Provision of access by supplier to accounts payable system

You provide your suppliers (typically this would through your web based supplier portal) a window into your purchase accounting system so that the supplier can establish details of the current status of his account.

**ASF020** Access to supplier invoice system

The supplier (through his customer portal) provides a portal where you, the customer, can access his sales accounting system so as to view current account status information.

### ***Transactional functions***

#### **ASF210** Reception and approval of invoice

This is the normal invoice sent to you by the supplier, containing the claim for payment of goods supplied under the financial conditions agreed between the buying and selling parties. When you receive this you require access to records of outstanding purchase orders and currently un-invoiced goods receipts.

#### **ASF220** Debit Notes

Sent by you, the customer to the supplier (possibly vice-versa) to debit all or part of an unacceptable invoice or invoices, to reduce an amount in an invoice which has not yet been issued or charge the seller for goods which have been returned.

#### **ASF230** Remittance Advice

This is sent from you to your supplier specifying all payments to a seller at specific dates.

#### **ASF240** Statement of account

Used for reconciliation of accounts through between trading partners. Sent by the supplier to you, the customer, (possibly vice versa) detailing the financial transactions and the resulting outstanding balance at a specified date.

#### **ASF250** Self bill notification

You, as the customer, send this to your supplier to notify that (specified) goods have been received, and that payment is authorised without further notification, under the financial conditions agreed between you and the customer.

#### **ASF260** Response to invoice

You, as the customer, can send this to the supplier (possibly vice versa) to show errors in previously received invoices, credit notes, debit notes or self bill invoices. The message includes action to be taken by you or the supplier (depending on to whom the message is sent).

#### **ASF270** Changes to the supplier's customer data

Your supplier can send this to you (and vice versa) to inform of relevant data (or correct existing data) that you need to have about the other in your respective systems to be able to conduct your commercial relationship correctly.

### ***Control and Co-ordination functions***

#### **ASF510** Exception notifications

Any exception situations or reminders relating to purchasing or procurement issues may be the subjects of notifications (typically by e-mail). These should be generated automatically as a result of your systems detecting a deviation from what was expected. Examples include; invoice matching discrepancies and payment alerts.

#### **ASF520** Payment assignment collaboration

Typically this occurs when your supplier's accounts receivable system cannot assign your payments to their invoice records. Your suppliers request you by an exception notification to assign the open items by using a link into their system (via their customer portal). You access your account and assign the open items with appropriate comments. You send the customer a notification so that he can access the assignments and can either then accept them or raise further issues as appropriate.

**ASF530** Collaborative performance data collection and presentation

This is a collaboratively managed finance process performance measurement environment (either hosted by you or by an exchange) to which you and your suppliers have access for data input and feedback. As the customer, you will normally set objectives and methods of scoring, and you will expect your suppliers and other partners to agree to these, after appropriate negotiation (and perhaps input). You will need a system of collecting data and presentation of the results. In a true collaborative environment, there should also be mechanisms whereby the results can be challenged, explained and if necessary adjusted. Examples include: Invoice rejects, credit notes and payment performance.

**Maintenance  
Information functions**

**ASR010** Provision of access to maintenance history

Although external maintenance providers may have their own management systems it is relevant to maintain maintenance activity history in a system of your own so that you are able to compare maintenance problems and costs between similar manufacturing plants and similar assets from different suppliers. Access is provided to maintenance history so that your external maintenance partners are aware of prior activity on the asset.

**ASR020** Communicate asset availability

Access is provided to current maintenance plans (and current activity) so that relevant external parties are made aware of what is going on.

**ASR030** Access spare parts availability

With the exception of preventive activities, spare parts for maintenance tasks are usually required at random intervals. If you maintain the stocks of these parts, an external maintenance partner needs an overview of potentially necessary parts and their availability. If maintenance is managed in house, the maintenance planner potentially needs access to external stocks of spare parts managed by other partners/supplier.

**Transactional functions**

**ASR210** Maintenance request/problem report

When a malfunction or concern occurs in relation to a piece of equipment a malfunction report is issued for analysis by the external maintenance partner. The equipment itself could generate this automatically.

**ASR220** Despatch engineer

This is relevant to situations where the maintenance planning may be internal but the maintenance resources may be external. The maintenance planner decides to send out a maintenance engineer to the reported object to validate the reported malfunction. The responsible engineer for this is

determined by the planning system and informed using the appropriate technique (pager, telephone, e-mail, alerts).

#### **ASR240** Maintenance Order

As a result of either a scheduled preventive maintenance plan or an analysis by the assigned maintenance engineer of a specific reported problem, a maintenance order (or a notification) is released, and the external service partners find the specified work in a work list.

#### **ASR250** Reserve spare parts

As part of the maintenance planning process, the exact requirements for spare parts or other materials at the required time are determined. If you manage the spare part stocks they can be reserved; otherwise they are procured externally. Reservations and purchase requisitions for spare parts are created either automatically or manually. The relevant departments managing the spare parts procurement process can process these. The material withdrawals are documented by the system and form the basis of usage-controlled materials planning.

#### **ASR260** Record Maintenance activity

Relevant to situations where the maintenance planning may be internal but the maintenance resources may be external, or any other situations where maintenance records are maintained by your own systems. After performing the assigned maintenance activity (investigation of a problem or against a maintenance order) the external maintenance engineers make the relevant recording of their activity. For this purpose, they can use an Internet based time sheet. As a result of such records, other manufacturing activities may be initiated. When the maintenance work is complete, the maintenance planner completes the order.

### ***Control and Co-ordination functions***

#### **ASR510** Collaborative maintenance planning

The scenario here is that maintenance is carried out using external maintenance partners (including your original suppliers) who are not necessarily "inside" your internal systems environment. Maintenance planners, external maintenance service providers and technicians build up a team to ensure the safe and reliable operation of an asset. When setting-up a maintenance plan, the maintenance planner can plan external services by specifying an external workplace inside the company, or by outsourcing the service as a whole.

#### **ASR520** Management of maintenance contracts

You make agreements with external maintenance service providers for the support your installations and systems. Service Level Agreements (SLA's) are defined for the relevant items within maintenance contracts, from which performance commitments are derived for service processing within the agreement. Maintenance service providers draw up a maintenance contract, which defines the performance parameters and the assets that are covered.

#### **ASR530** Planning of preventive maintenance

A regular schedule of routine maintenance activities can be planned collaboratively with the maintenance service provider, such planning being integrated with resource scheduling and your planned asset capacity in your planning system.

#### **ASR540** Maintenance resource planning

In a collaboratively managed maintenance environment, to which both you, and the maintenance partner has access, it is possible to see at a glance the general working schedule of a particular maintenance and which assignments exist for team members. New service items can be assigned to individual field service representatives based on their current workload and availability.

**ASR550** Maintenance tracking

Your responsible management, the external service provider and your maintenance planner (if appropriate) can monitor the progress of maintenance activity. At any stage of the process, each party involved can document comments or specify problems in a notification.

**ASR560** Maintenance alerts

Any exception situations or reminders relating to maintenance may be the subjects of notifications (typically by e-mail). These could also be used as the mechanisms to report problems or despatch maintenance engineers. Notifications are typically generated automatically as a result of your service system detecting a deviation from what was expected. Examples include; maintenance requests outstanding for greater than a certain time, breakdowns.

**ASR570** Collaborative performance data collection and presentation

Your maintenance system can provide a collaboratively managed performance measurement environment to which your managers, internal maintenance planners (if any) and external maintenance partners have access for data input and feedback. You will be interested in the performance of the maintenance partners against the Service Level Agreements, and also that of the assets from a reliability standpoint. Examples include: maintenance response times, types of damage, damage codes and causes of damage and frequency of problems in comparison with other assets.

**General Finance  
Information functions**

**ASG010** Provision of financial analysis and reporting

You may provide your internal controllers, remote divisions and departments, subsidiaries, affiliates and other business partners with financial and business information based on the general ledger and other sources. Typically this could be via a window (through an internet based portal) into your financial analysis and reporting system, where relevant players can view those financial aspects that they are authorised to see.

**Transactional functions**

**ASG210** Bank transactions

These are provided typically by bank statements and record the actual receipts of cash from your customers and the payments of cash to your suppliers. The idea is that you receive them by automated links and integrate them into your cash management system.

**ASG220** On-Line Foreign exchange dealing

This deals with the process whereby a corporate treasury dealer interacts with a bank to trade in foreign exchange. The process is integrated into the systems of the company and the bank's back-office systems and the deal data only has to be entered once. The process of request, reply and quote, acceptance and confirmation can be managed interactively.

**ASG230** Consolidated Cash management

In this scenario a centralised Treasury Centre is managing the payments to, and collection of payments from, external business partners on behalf of subsidiaries, and creating the appropriate transactions for the internal accounts of the subsidiaries.

### ***Control and Co-ordination functions***

#### **ASG510** Investment Planning / Approval

The concept here is that of an Internet based system that enables the planning, entry and approval of CAPEX proposals, consolidation and analysis of capital spending; the monitoring of available resources, planned costs, and actual costs already incurred; through to links with fixed asset management and depreciation planning.

#### **ASG520** Collaborative Business Planning

This is to support the close collaboration in the business planning processes applicable to organisations with complex relationships between headquarters, subsidiaries and affiliates. Essentially it is intended to support the communication and tracking of the evolving versions of the plan and the fast retrieval of actual data.

#### **ASG530** Collaborative Budget Planning and Cost Control

This is the process by which financial controllers and managers interact to keep track of their cost centres. The costs and revenues are posted on the cost centre. The Manager monitors his costs and revenues by using an Internet based self-service facility, which supports the posting of adjustment requests (in the case of irregularities) and subsequent adjustments by the controller.

### ***Administration Information functions***

#### **ASA010** Personnel documents

Documents such as payslips, pension statements, tax documents can be published on a self service web site and accessed when required by individuals.

#### **ASA020** Personal Data

The scenario is one of a distributed organisation, where you employ people who are not necessarily "inside" (permanently or temporarily) within your internal systems environment. You use Internet-based personnel and administration systems to provide access to information and administration functions from any location with access to a browser. This can also be used for internally located people also.

#### **ASA030** Self training

Training courses (either specifically developed for computer based self study or soft copy of class training material) are published on the web site for access by any authorised employee on a self-service basis.

#### **ASA040** Electronic knowledge and best practice sharing

A knowledge base is maintained using Internet-based tools. Employees have the opportunity to access it and also contribute their own experience and expertise.

### ***Transactional functions***

#### **ASA210** Self service time recording

In situations where employees need to record activity (e.g. for maintenance or project work), they can be entered directly into the web-based system, by the originator. The necessary links to the appropriate management or control system is then generated automatically.

#### **ASA220** Self service expenses

Expenses can be entered directly into the web-based system, by the originator. The approval hierarchy mechanism directs the expense report to the correct approver (or sequence of approvers). Approval is entered into the system, and when complete the originator is notified. The necessary link to the payment system is then generated automatically.

#### **ASA230** Travel Management

An Internet based travel management service creates a collaborative environment where three parties, the travel agency, the employer and the employee streamline the process of planning and administering travel. It supports the decentralized booking of travel services (by the employees themselves) and subsequently the processing of travel expenses.

#### **Control and Co-ordination functions**

##### **ASA510** Resource searches

Your personnel management system can be accessed via the Internet for searches of possible candidates to fill external posts. It can also be used for people interested in employment to log their information so as also to be accessible for personnel searches.

##### **ASA520** Notifications and alerts

Any exception situations or reminders relating to personnel or administration may be the subjects of notifications (typically by e-mail). These are typically be generated automatically as a result of your service system detecting an event. Examples include; expense approved; requisitions approved or rejected, internal employment opportunities.

##### **ASA530** Collaborative performance data collection and presentation

The personnel and administration system can contain a performance measurement environment, which measures the performance of the administration function according to parameters set by you. Examples could include: admin response times and costs.

##### **ASA540** Document Management System

This is envisaged as a central repository for the management of all relevant documents in the enterprise, incorporating all necessary organising, indexing and retrieval tools.

## Appendix B Model Reasons, Concerns and Characteristics

### Model Reasons

#### Demand Side

##### Product Development and pre-production

- DP01 Significant design activity in partnership with customers (could be complexity or quantity)
- DP01N There is no significant customer partnership in the design of our products
- DP02 Significant number of complex pre-production enquiries
- DP03 There are a significant number of complex, one-off, "project" style orders.
- DP04 The processing of enquiries is likely to be significantly resource constrained
- DP05 Significant number of engineering changes that need to be managed with customer
- DP05N Not a significant number of engineering changes that need to be managed with customer
- DP06 The product structure is complex and engineering changes may have serious implications.
- DP07 Our products are technically complex and require much design input
- DP08 Our products tend to be safety critical
- DP09 We design and engineer the products that we sell (and there is a significant amount of work involved)
- DP09N We have no significant input into the design of the products that we sell
- DP10 Customers do a significant amount of the design and engineering of the products we sell

#### Demand Management

- DD01 Quoting for the supply of standard products is a significant aspect of getting business
- DD01A Tendering for business is a significant aspect of getting business
- DD02 Individual customers are powerful
- DD02N There is not a significant number of individual powerful customers
- DD03 There are stable medium term relationships with important customers.
- DD03N There are no significant stable medium term relationships with important customers.
- DD04 Schedule call-offs are used for customer specific, long-term contracts.
- DD04N Schedule call-offs are irrelevant - most of our business is "spot"
- DD05 EDI is a condition of doing business with the customers.
- DD05N EDI is not a condition of doing business with our customers
- DD06 Significant number of customer orders which need to be processed.
- DD06N The number of customer orders is not sufficiently large to justify this activity
- DD07 Significant number of customer orders in progress at any one time
- DD08 There is a significant number of enquiries that need to be processed
- DD08N The number of enquiries that need to be processed is not sufficiently significant
- DD09 Scheduling and promising of demand is dictated by manufacturing schedules reflecting capacity utilisation of key resources
- DD10 Significant number of variants and options
- DD11 A significant number of jobs have to be quoted because they are non-standard in some way
- DD11N Generally jobs are not non-standard and do not have to be quoted
- DD12 Commodity products are sold in significant volumes
- DD13 Volatile Customer base
- DD14 Large number of Customers
- DD15 Significant volume of standard or customisable products
- DD15N Insignificant volume of standard or customisable products
- DD16 Significant number of order changes
- DD16N There is unlikely to be a sufficient number of order changes to justify this function
- DD17 Significant number of dealers or remotely operating salesmen
- DD17N Insignificant number of dealers or remotely operating salesmen
- DS Supply Chain Planning
- DS01 The planning/master scheduling task is of significant size
- DS01N The planning/master scheduling task is of insignificant size



- DS02 Vendor or 3rd party managed inventory in advanced warehouses is necessary to manage customer delivery expectations
- DS04 Forecasts are necessary in order to plan production
- DS04N Forecasts are unnecessary in order to plan production
- DS05 Forecasts are potentially reliable enough to be useful
- DS05N Forecasts are unlikely to be potentially reliable enough to be useful
- DS06 The market is susceptible to abnormal demand patterns (i.e. spiky demand is common).
- DS07 There is a high probability of last minute drop-in orders and changes to the plans.
- DS07N There is low probability of last minute drop-in orders
- DS08 Significant degree of drop shipment co-ordination
- Outbound Logistics
- DL01 There is a significant number of rejects/returns
- DL02 There is a requirement to synchronise deliveries to customer production lines
- DL03 Transportation needs to be managed in significant volumes using external carriers
- DL03N There is no requirement for us to manage transportation using external carriers
- DL04 We deal in significant volumes with major carrier organisations
- DL05 We have long term contract relationships in significant volumes with carriers
- DL06 We have ad-hoc "spot" relationships in significant volumes with carriers
- DL07 Significant volume of despatches
- DL07N Volumes of despatches are insignificant
- DL08 Significant in-transit times
- DL08N Insignificant in-transit times
- DL09 Significant export despatches
- DL09N No significant export activity
- DL10 Significant despatch complexity (multiple orders/loads/drops)

#### Customer Accounting

- DF01 There is a significant volume of invoices
- DF01N The volume of invoices is insufficient to justify this
- DF02 There is significant self-bill requirements

#### Service

- DV01 Significant number of customers requiring service
- DV02 Significant number of service calls
- DV03 Significant number of service engineers
- DV03N Insignificant number of service engineers
- DV04 Significant number of repair and overhaul jobs
- DV05 Significant service history per customer
- DV06 Significant complexity of product (from service point of view)

#### Supply side

##### Product Development and pre-production

- SP01 Significant design activity in partnership with suppliers (could be complexity or quantity)
- SP01N No significant design activity in partnership with suppliers (neither complexity or quantity)
- SP02 Significant number of complex pre-production enquiries
- SP03 There are a significant number of complex, one-off, "project" style orders.
- SP04 Significant number of engineering changes that need to be managed with supplier
- SP05 We design and engineer the products that we buy (and there is a significant amount of work involved)
- SP06 Suppliers do a significant amount of the design and engineering of the products we buy

#### Supply Chain Planning

- SS01 Stock buffers are needed because of characteristics of supply chain
- SS02 Vendor managed inventory can be established with the suppliers
- SS03 There is a significant level of expediting which needs to be carried out.
- SS04 There is a significant level of problems with the supply chain.

- SS05 There is a significant virtual supply chain network
- SS06 The material planning system has to be run frequently due to a large number of planning changes.

#### Purchasing and Procurement

- SB01 There is a high significance of purchased parts and purchasing is of strategic value to the company.
- SB01N Overall we do not purchase enough in value to justify this activity
- SB02 A significant volume of the products purchased are commodity products
- SB03 A significant volume of the products purchased are standard products
- SB04 Purchasing has to fit into the supplier manufacturing schedules reflecting capacity utilisation of key resources
- SB04N We have no concern with the supplier manufacturing schedules reflecting capacity utilisation of key resources
- SB05 There are sufficient volumes of orders with suppliers to warrant automated links
- SB05N There are insufficient volumes of orders with suppliers to warrant automated links
- SB06 There are a significant number of regular suppliers who can operate using schedules and call-offs.
- SB06N There are not a significant number of regular suppliers who can operate using schedules and call-offs.
- SB07 There is a highly competitive supplier base and a significant amount of potential multi-sourcing
- SB08 We are in a powerful position with regard to our suppliers
- SB08N We are in a weak position with regard to our suppliers
- SB09 Significant number of single sourced parts
- SB10 Significant number of suppliers
- SB11 Significant amount of "spot" demand
- SB12 Significant number of variants and options
- SB13 Significant number of purchase order changes

#### Inbound logistics

- SL01 Significant in-transit times
- SL01N In-transit times are insignificant
- SL02 There are significant supplier quality issues
- SL03 There is a significant number of rejects/returns
- SL04 Suppliers are responsible for managing stocks at our site
- SL04N There is no requirement for suppliers to manage stocks at our site
- SL05 Collection or transportation needs to be managed in significant volumes using external carriers
- SL05N There is no requirement for us to manage transportation using external carriers
- SL06 We deal in significant volumes with major carrier organisations
- SL07 We have long term contract relationships in significant volumes with carriers
- SL08 We have ad-hoc "spot" relationships in significant volumes with carriers
- SL09 Significant volume of purchase receipts
- SL10 We do not do a significant amount of inspection of incoming receipts

#### Manufacturing

- SM01 There is a significant amount of sub contract manufacturing activity
- SM01N There are insufficient volumes of subcontract work to warrant automated links
- SM03 There are significant capacity constraint issues at sub contractors / remote partners
- SM04 Suppliers supply significant amounts of material directly to sub contractors / remote partners
- SM05 Subcontractors supply significant quantities of parts to other subcontractors / remote partners
- SM06 We supply significant quantities of materials to subcontractors / remote partners
- SM07 Significant amount of WIP at sub contractors / remote partners at any one time

SM08 Significant material in transit to/from subcontractors / remote partners

Supplier Accounting

SF01 There is a significant volume of invoices

SF01N There is a significant volume of invoices

SF02 There are significant self-bill requirements

SF02N There are no significant self-bill requirements

Maintenance

SR01 Significant number of external maintenance partners or engineers

SR01N There are insufficient numbers of external maintenance partners or engineers to justify automated links

SR02 Significant number of assets requiring maintenance by external partners

SR03 Significant frequency of maintenance activities by external partners

SR04 Significant number of maintenance tasks in progress at one time

SR05 Significant complexity of maintenance tasks

Administration

SA01 Significant number of staff

SA02 Significant number of administration staff

SA03 Significant number of remotely managed requisitions

SA04 Significant number of activities requiring time booking

SA05 Significant number of staff potentially with knowledge to share

SA06 Significant organisational complexity (size of company, number of subsidiaries, number of locations)

SA07N Insufficient activity remote from internal systems

## Model Concerns

### General Concerns

- CG01 We have poor data accuracy
- CG02 There is inconsistent information between departments
- CG03 Systems are incompatible and poorly integrated
- CG04 There is an informal system mentality within the company (private systems, spreadsheets etc)
- CG05 IT investments generally fail to achieve their objectives because we do not use the software well
- CG07 We usually find that the costs of introducing e-business functions cannot be justified in relation to the benefits obtained
- CG09 We are constrained by the shortage of IT skills
- CG12 We do not have the management determination to exploit e-business
- CG13 We have concerns about the security associated with e-business functions

### Demand Side Concerns

- CD01 We cannot rely on our customer's forecasts
- CD01N We can rely on our customer's forecasts
- CD02 Our customers fail to respect industry standards
- CD03 Our customers dictate requirements without concern for the problems they cause
- CD04 Customers fail to communicate requirements clearly or respond effectively to queries
- CD05 We incur expense because of our customer's non-adherence to industry standards
- CD06 Customer lead-time expectations are a significant management issue for us
- CD07 We cannot compete in markets where cost is the dominant factor in getting business
- CD08 We consistently fail to deliver on time
- CD08N We do not have a concern about our on time delivery performance
- CD09 There are significant levels of obsolete manufactured goods
- CD10N We have no concern about high levels of finished goods stock
- CD11 We consistently fail to achieve customer quality expectations
- CD11N Achievement of customer quality expectations is not a current concern
- CD12 We cannot rely on our customer's firm orders
- CD13 Credit Control is a significant issue
- CD13N Credit Control is not a significant issue
- CD14 Our customers consistently impose high penalties for late deliveries
- CD15 We currently consider that we have an insufficient forward view of demand
- CD15N We do not have a concern with our current forward view of demand
- CD16 Currently there are a high number of customer backlogs
- CD17 We do not manage design work and engineering changes well
- CD18N There is no excessive paperwork and clerical activity in Engineering and Design
- CD19 There is excessive paperwork and clerical activity in Customer Order Servicing
- CD19N There is no excessive paperwork and clerical activity in Customer Order Servicing
- CD20N There is no excessive paperwork and clerical activity in Logistics
- CD21 There is excessive paperwork and clerical activity in Service
- CD21N There is no excessive paperwork and clerical activity in Service
- CD22 Our Salesmen are computer illiterate
- CD23 We experience a high level of customer returns
- CD24 We experience excessive field service calls
- CD25 We are constrained by the e-business capabilities of our Customers
- CD26 Our relationship with the customer depends on a personal relationship

### Supply side concerns

- CS01 We consistently fail to give stable schedules to our suppliers
- CS02 Planners make their own decisions what to order rather than following the MRP plan
- CS03 The planning process cannot be relied upon
- CS04 We cannot expect our suppliers to react effectively to our changes of plan

- CS04N We have no concern about our suppliers ability to react effectively to our changes of plan
- CS05 Our major quality problems are caused by quality problems with purchased items
- CS05N Quality problems with purchased items is not currently a major concern
- CS06 We do not have sufficient pull with our suppliers to force them to do what we want
- CS06N We have no concern about our ability to make our suppliers do what we want
- CS07 Most of our suppliers are incapable of using EDI
- CS08 We have significant levels of obsolete purchased material
- CS08N We have no significant levels of obsolete purchased material
- CS09 Most of our suppliers do not even have Internet access
- CS10 We suffer from high scrap levels
- CS11 High yield variation is a fact of life in our business
- CS12 A high level of rework is encountered in our business
- CS13 Excessive supplier lead times
- CS13N There are no excessive supplier lead times
- CS14 Poor supplier due date performance
- CS14N No concern about poor supplier due date performance
- CS15 We experience a high level of expediting
- CS16 We consistently make unnecessary purchases
- CS17 Significant problems are caused by shortages of purchased parts and/or materials
- CS17N There are no significant problems caused by shortages of purchased parts and/or materials
- CS18 There are significantly high levels of obsolete component, material or part finished inventory
- CS19 Our bought-out stock levels are excessively high
- CS19N Our bought-out stock levels are excessively high
- CS20 Excessive safety stock is currently being planned
- CS20N No excessive safety stock is currently being planned
- CS21 Plant maintenance is a significant concern
- CS21N Plant maintenance is not a significant concern
- CS22 Plant reliability is a continual problem
- CS22N Plant reliability is not a continual problem
- CS23 We encounter consistent production overloads and bottlenecks
- CS24N There is no excessive paperwork and clerical activity in Planning
- CS25 There is excessive paperwork and clerical activity in Procurement
- CS26N There is no excessive paperwork and clerical activity in Accounting and Finance
- CS27 There is excessive paperwork and clerical activity in Maintenance
- CS27N There is no excessive paperwork and clerical activity in Maintenance
- CS28 We are constrained by the e-business capabilities of our Suppliers

## Model Characteristics

### Demand Side

#### Sold Items

- CDI02 % Sold Items - Standard products - your specialised products for which you have multiple customers
- CDI03 % Sold Items - Commodities - standard products that are generally available from a number of sources
- CDI04 % Sold Items - Engineer to Order - primarily built to the customer specification on an order by order basis
- CDI05 % Sold Items - Configure to Order - primarily based on your standard products but configured to customer requirements on an order by order basis
- CDI06 % Sold Items - Developed with Customer - designed originally for/with the specific customer and then supplied on a regular basis for the product life
- CDI07 Number of distinct product ranges (i.e. number of different families or major sub-families).
- CDI08 Number of different products (total number, including variants, features, options etc.) in any one year.
- CDI09 Percentage of products which are safety critical and/or have high technical specification
- CDI10 Total turnover (£millions)
- CDI12 Average number of different product options and/or variants per product range (cd7/cd8)

#### Customers

- CDC01 Percentage share of the chosen marketplace.
- CDC02 Number of strong competitors, in the chosen marketplace.
- CDC03 Percentage exported outside UK
- CDC04 Percentage of business where competitors can easily influence short-term customer demand.
- CDC05 Percentage of business where competitors can easily influence medium term customer demand.
- CDC06 Percentage of customers who are loyal in the short term (i.e. do not shift to other suppliers within short term planning horizon).
- CDC07 Percentage of customers who are loyal in the medium term (i.e. do not shift to other suppliers within medium term planning horizon).
- CDC08 Total number of customers kept on file
- CDC09 The average number of customers delivered to per week.
- CDC10 Number of customers who are individually responsible for >10% of demand.
- CDC11 Number of customers who are together responsible for 90% of demand.
- CDC12 Number of dealers or remotely operating salesmen

#### Demand Side Pre-Production

- CDP01 Number of projects per year
- CDP02 Duration of projects
- CDP03 Percentage of Customers involved in pre-production projects
- CDP04 Average number of project steps to monitor
- CDP05 Average number of items to design per project
- CDP06 Percentage of products newly introduced per year (i.e. require a significant engineering / materials change; not trivial variants).
- CDP07 Average number of product design or process changes per week.
- CDP08 Percentage of design effort undertaken by you (sold items)
- CDP09 Percentage of design effort undertaken by Customer (sold items)

#### Demand

- CDD01 Percentage of products where demand can be considered as seasonal (peak in demand twice the value of the trough).
- CDD02 Period of time for which the forecasts are accurate enough to base the manufacturing planning on (as a percentage of customer demanded lead time).

- CDD03 Percentage of production that is geared towards fashion products (total market for the products can change unpredictably).
- CDD04 Percentage of customer orders placed which can be relied on to be 100% firm (within the average customer demanded lead time).
- CDD05 Percentage of demand from customers with long-term contracts (i.e. schedules with call-offs).
- CDD07 Percentage of items supplied from vendor managed inventory
- CDD08 Total number of quotes / product enquiries handled per week.
- CDD09 Average number of spot orders received per week (as opposed to schedule call-offs).
- CDD10 Number of items subject to just-in-time pull by the customer
- CDD12 Average number of schedule call-offs received per week (as opposed to spot orders).
- CDD13 The average order lead-time demanded or tolerated by customer (total working days from placing the order to expected delivery).

#### Planning

- CDS01 Percentage of production that is not started until the customer orders are received (i.e. make-to-order).
- CDS02 Percentage of production that can be considered sell-from-stock (i.e. forecast driven, order point driven or similar).
- CDS08 Total number of master scheduled items (i.e. total number of items for which MPS is carried out).
- CDS09 The average percentage of the master schedule changed within the lead-time horizon due to demand changes.
- CDS10 Percentage of production where planning is significantly capacity constrained (including labour)

#### Outbound Logistics

- CDL01 Percentage of Despatches where transport needs to be organised with external carriers
- CDL02 Number of carriers used
- CDL03 Number of carriers individually responsible for 10% of despatches
- CDL04 Number of carriers collectively responsible for 90% of despatches
- CDL05 Proportion of despatches (excl ex-works) taking more than one week in transit
- CDL06 Average number of orders / schedule call-offs to one despatch.
- CDL07 Number of returns per week
- CDL08 No of vehicle trips per week

#### Finance (Demand Side)

- CDF01 Number of invoices produced per month
- CDF02 Percentage of customers operating self-billing

#### Service

- CDV01 Number of customers requiring after sales service
- CDV02 Number of service calls per year
- CDV03 Number of service engineers
- CDV04 Number of repair and overhaul jobs per year
- CDV05 Number of serviceable parts per serviced products

#### Supply Side

##### Purchased Items

- CSI02 % Purchased Items - Standard products - specialised products of your suppliers for which they has multiple customers
- CSI03 % Purchased Items - Commodities - standard products that are generally available from a number of sources
- CSI04 % Purchased Items - Engineer to Order - primarily built to your specification on an order by order basis

- CSI05 % Purchased Items - Configure to Order - primarily based on standard supplier products but configured to your requirements on an order by order basis
- CSI06 % Purchased Items - Customer developed - designed originally by supplier specifically for you and then supplied on a regular basis for the product life
- CSI07 Total number of purchased parts
- CSI08 Average number of purchased parts per end item
- CSI09 Percentage of parts common to all products within a family.
- CSI11 The cost of purchased parts as a percentage of the total product cost.

#### Suppliers

- CSV01 Total number of production-related suppliers used (i.e. kept on file).
- CSV02 The average number of suppliers per part (who are used regularly to supply the same part).
- CSV03 The average number of parts per supplier (number of different parts supplied by the same supplier).
- CSV04 Percentage of supply value from "selected" suppliers (where there is a semi-permanent or long term relationship).
- CSV05 Percentage of supply value from monopoly suppliers (who deliver on their terms as they are the only source).

#### Supply Side Pre-Production

- CSP01 Number of projects per year
- CSP02 Duration of projects
- CSP03 Number of Suppliers involved in pre-production projects
- CSP04 Average number of project steps to monitor
- CSP05 Average number of items to design per project
- CSP06 Percentage of products newly introduced per year (i.e. require a significant engineering / materials change; not trivial variants).
- CSP07 Average number of product design or process changes per week.
- CSP08 Percentage of design effort undertaken by you (purchased items)
- CSP09 Percentage of design effort undertaken by Supplier (purchased items)

#### Supply Chain

- CSS01 Number of items controlled by me delivered directly from my suppliers to my customers
- CSS02 Number of items controlled by me delivered directly from my suppliers to other partners
- CSS03 Number of items manufactured by sub-contractors
- CSS04 The typical percentage of production (by value) which is sub-contracted.
- CSS05 Percentage of supplies where planning is constrained by suppliers capacity constraints or fixed cycle schedules
- CSS06 Cumulative Manufacturing Lead Time
- CSS07 Cumulative Material Lead Time
- CSS08 Number of subcontractors or remote (from internal systems) manufacturing sites

#### Purchasing and Procurement

- CSB01 Percentage of purchase orders / schedule call-offs received on time.
- CSB02 Percentage of suppliers who deliver on time (for at least 90% of the time).
- CSB03 The average percentage of purchase orders that have quality problems associated with them.
- CSB04 The average percentage of purchased items rejected.
- CSB05 Percentage of parts (by value) delivered direct to the point of production (i.e. as a significant administrative issue)- excluding consumables
- CSB06 Percentage of parts (by value) where provisioning is managed by the supplier (VMI) - excluding consumables/miscellaneous items
- CSB07 The average number of production related items ordered per week (i.e. production related purchases made).
- CSB08 Average number of internal requisitions per week (including non-production-related).



- CSB09 The average number of items ordered per week (i.e. purchases for production and non-production related items).
- CSB10 The average number of schedule call-offs sent to suppliers per week.

#### Inbound Logistics

- CSL01 Percentage of receipts where I need to organise transport with external carriers
- CSL02 Number of carriers used
- CSL03 Number of carriers individually responsible for 10% of receipts
- CSL04 Number of carriers collectively responsible for 90% of receipts
- CSL05 Number of receipts per month taking more than one week in transit
- CSL06 Number of returns per week
- CSL07 No of vehicle trips per week
- CSL08 Percentage of receipts requiring inspection

#### Finance

- CSF01 Number of invoices produced per month
- CSF02 Percentage of suppliers with whom you operate self-billing

#### Maintenance

- CSR01 Number of external organisations providing maintenance
- CSR02 Number of significant assets requiring maintenance by external partners
- CSR03 Number of maintenance requests per month to external maintenance partners
- CSR04 Ratio of fixed assets to turnover

#### Administration

- CSA01 Total number of employees
- CSA02 Total number of employees with administration functions
- CSA03 Total number of employees requiring activity to be recorded/monitored
- CSA04 Total number of technical and professional employees
- CSA05 Total number of remote sites where employees work (including home)

## Appendix C Model Change Log

No	Change
1	Characteristic CSI10 removed as a duplication of CSS04 - replaced by CSS04 in all cases
2	CDS10 to be interpreted as either labour or capacity
3	Changed threshold for CD03, CD04 for ADP030,
4	Reviewed validity of multiplying possible score by model input - decided that this was the best way of managing strong concerns and retained it. Realised that this did prevent the use of "data" answers to characteristics
5	Revised the ADP230/50 area to take into account which partner does the engineering detail - added CDP07 and CDP08 to cover this, creating reasons DP09 and DP10 to reflect impact of this. Created two new activities, ADP233 and ADP237
6	Reviewed wording of ADP010 and ADP020
7	CD02 should only create X results on strong input for transactional functions
8	CD03 should never create X results - thresholds modified
9	CD04 should only create X results on "strong" input for collaboration type functions
10	CD05 should only create X results on strong input for transactional functions
11	Replaced DP07 with DP10 and DP09 for functions ADP220 and ADP230 respectively
12	CG01 removed from ADD20, ADD30, ADD40, ADD50
13	Add reason DP09 to activity ADD090
14	Replaced reasons CD25 with CG13 in ADD210 to make it the same as ADD220 - it is illogical to trigger one without the other
15	CD02 should never create X results for ADD230, ADD240
16	Corrected an error in the model in that it was never triggering N operand type reasons
17	Created a new reason DD01A to reflect the fact that it is quite normal to receive enquiries as a pre-production stage of engineer to order products or new product development. Replaced DD02 with this in the reasons triggering ADD250
18	Amended DD01 description in order to make it clear that this function relates to processing enquiries for all types of products
19	Decided that DD03 was a reason for not doing collaborative marketing (ADD560) rather than a reason for
20	ADS10 was not being triggered when it should - added characteristic CDD02 to reason DS04 - also decided that two characteristics being triggered was enough to make this highly relevant
21	Remove CG1 from ADS530 and ADS540 - in this as in elsewhere, admitting data accuracy problems should not be a cause of not doing other relevant areas, unless there are good reasons for presuming that data accuracy problems would be a major inhibitor/ difficult to solve
22	Adjusted the threshold for DS08 in ADL260 on the basis that accounting for it will always be necessary even if all other functions are not
23	For ADL280, DS05 had been incorrectly coded - should be DD05
24	For ADL280 - added DD03 to this function
25	Added DS02, DS02 and DL02 to ADL320 in order reflect the fact that the possible reasons did not manage the function description in terms of the situations where this function could be relevant
26	Added the number of Delivery trips characteristic and added it as a factor to reason DL07 and DL10
27	Added DL01, DL02, DL07, DL08 and DL10 to ADL530 because relevance of exception alerts goes much further than dealing with carriers
28	Added DD02, DD03, DL07, DL10 and DS08 to ADL540 because relevance of performance measurement goes much further than dealing with carriers
29	Changed how DL09 is triggered in ADF210 so that if it is triggered it is rated H so as to be proof against any of the negative reasons

- 30 ADF230 is over triggered - remove reasons DD02 and DD03. Add reason DF02 as a negative reason
- 31 Add DF01 and DF02 to ADF240 in order to give more a weight to volumes
- 32 Add DD03; DD05; and DF01 as positive reasons for ADF250 - remove DD14
- 33 Add DF01 as positive reason for ADF260
- 34 Remove CG01 from ADF 210, ADF220, ADF230, ADF250, ADF270
- 35 Changed how DF02 is triggered in ADF270 so that if it is triggered it is rated H so as to be proof against any of the negative reasons
- 36 Change how DD03 is triggered for ADF280 so than it is never rated as H - it is just not a strong enough reason to override everything else
- 37 Add reasons DD14 (positive) and CD25 (negative) to ADF280
- 38 Add reasons DD02 and DD03 to ADF510 (positive) - remove CG01
- 39 CD13N should be a blackball for ADF550; also SA06 should never cause an H result
- 40 Created new reasons SP05 and SP06 (same enhancement as 5) to reflect who does the design work
- 41 Replaced CD17 with SP06 in ASP010 - and remove SP03
- 42 Add SP05 to ASP020
- 43 Add SP05 to ASP210 instead of SP03
- 44 Add SP06 to ASP220 instead of SP03
- 45 Add DP01 to ADP230, ADP233, ADP237, ADP240, ADP250 - but not allowed to generate H results
- 46 Create new activities ASP233 and ASP237 and amend the adjacent activities to reflect a similar approach to design transactional activities to that adopted on the demand facing side
- 47 Add SP01 to ASP230, ASP233, ASP237, ASP240, ASP250
- 48 Replace SP04 with SP05 in ASP230
- 49 Add SP06 to ASP233, ASP237, ASP240, ASP250
- 50 Add CG1; CD18N; CG3; CG5; CG09 to the new activity ASP237
- 51 Add CG1; CD18N; CG3; CG5; CS28; CG09 to the new activity ASP233
- 52 Change activity ASP230 to CG1; CD18N; CG3; CG5; CG09 for the negative reasons
- 53 Change activities ASP240, ASP250 to CG1; CD18N; CG3; CG5; CS28; CG09 for the negative reasons
- 54 Replace SP04 with SP06 in ASP240 and ASP250
- 55 Add SP1, SP2, SP3 to ASP540 in order to give it more of a chance of getting triggered - the negative reasons were preventing anything happening far too harshly - I did not want to lose the negative reasons because they all seemed reasonable
- 56 Remove CG01 from ASP 530
- 57 Remove CG02 from ASP510, ASP520, ASP550
- 58 Add SP04 to ASP510, ASP520 and ASP530 in order to give more of a chance of getting triggered - the negative reasons were preventing anything happening far too harshly - I did not want to lose the negative reasons because they all seemed reasonable
- 59 Add SP02, SP03, SP04 to ASP560 in order to give it more of a chance of getting triggered - the negative reasons were preventing anything happening far too harshly - I did not want to lose the negative reasons because they all seemed reasonable
- 60 Added SP02, SP04 to ASP560 in order to give it more of a chance of getting triggered - the negative reasons were preventing anything happening far too harshly - I did not want to lose the negative reasons because they all seemed reasonable
- 61 Added DD14 and DD10 to ADD030 to give this activity more of a chance when it is obviously applicable
- 62 Added DD14 and DD10 to ADD320 to give this activity more of a chance when it is obviously applicable
- 63 Added DD15; DD14 and DD10 to ADD030 to give this activity more of a chance when it is obviously applicable

- 64 Added SS04 to ASS010
- 65 Replaced SB06 with SB04 in ASS220 - an obvious error
- 66 Prevented SB05 from triggering a high reason in ASS220
- 67 Add SB04 and SS04 to ASS510
- 68 Add SB04, SS05 and SS04 to ASS520
- 69 Prevented SB05 from triggering a high reason in ASS520
- 70 Add SS03 to ASS540
- 71 Prevent SB05 and SB06 from generating H reasons in ASS550
- 72 Add SB01 to ASS560 with low R threshold but high H threshold
- 73 Changed SB06 so that it cannot create an H reason for ASB020
- 74 Changed SB05 so that it cannot create an H reason for ASB030
- 75 Add SB01, SB08 and SS05 to ASB070 - Changed SB05 so that it cannot create an H reason
- 76 Corrected an error in the reasons for ASB070
- 77 SB06 should not generate H reasons in ASB270 and ASB 280
- 78 SB05 should not generate H reasons in ASB320, ASB550
- 79 Remove CG1 from ASB310, ASB320, ASB340
- 80 Add SS04, SS05, CS14, CS19 to ASB560
- 81 Change description of ASL040 to reflect the fact that this activity is relevant even if we don't organise transport
- 82 Create new characteristic CSL07 to reflect number of inbound vehicle trips and add this to reason SL09
- 83 SB05 should not generate H reasons in ASL040
- 84 Remove CG01 from ASL260
- 85 Add SB04 but remove SB09 from ASL 250
- 86 Add SL06, SL07 and SL08 to ASL270
- 87 Create new characteristic CSL09 to reflect whether we inspect or not and create reason SL10 to use it
- 88 Add reason SL10 to ASL310 as a blackball
- 89 Add reason SL09 to ASL520 and remove reason CG05
- 90 Add reason SL06 to ASL530
- 91 Add reasons SB01, SS04, SS05 and CS28 to ASL540
- 92 Reviewed the nature and scope of the maintenance functions following Case study A feedback. Decided that most of the functions only make sense, as an e-business activity, in so far as there is a need to communicate with external providers of maintenance services. The presumption is that all assets requiring maintenance to be managed lie within the range of the internal systems of the company. It does not make sense to regard the internal systems of the company as e-business activities even if they involve TCP/IP or intranet type technical solutions. E-business functions relevant to internal maintenance organisations are probably limited to accessing spare parts managed by external partners/suppliers
- 93 Changed the function descriptions to reflect the above rethink
- 94 Deleted activity ASR230 as part of simplifying the maintenance activity and because it cannot be distinguished from ASR260
- 95 Added reasons to maintenance activities for consistency and to reflect rethink of functions
- 96 Added CSR01 to SR02 and SR03 in order to inject more size into significance
- 97 Converted SR01 to a negative reason in order to make it a negative black-ball
- 98 Renumbered SM02 as SM01N to conform to the standards adopted elsewhere in the model
- 99 Added new characteristic CSS08 to reflect size of the issue and added this to activity SS05, SM01, SM01N, SM03, SM06
- 100 Added SF1 and SF2 to ASF010 to reflect value of this function in a high activity supplier

- relationship - also removed CG1 as being unacceptable as a reason not to do this function
- 101 ASF020 is actually a dubious activity - in fact it surely relates to situations where we are in a weak position in respect of suppliers - why else would you bother? - In fact needed to create a new reason SB08N to reflect being in a weak position with suppliers
- 102 Removed CG3 and CG4 from ASF020 as they were not necessary as positive reasons
- 103 Added Characteristic CSB09 to reason SB05 to make sure that volume is sufficiently represented
- 104 Removed CG01 as a negative reason for ASF210 - it is too harsh - doing this still does not cause the function to be triggered for the case study (A), but the rationale seems more reasonable
- 105 Corrected a bug in the model for ASF220 - the negative reasons had been incorrectly coded as positive reasons
- 106 CG01 removed from ASF230 - it may be a problem but it would not prevent you from doing this function if it was otherwise relevant
- 107 Removed CG01 as a negative reason for ASF240 - it is too harsh - doing this still does not cause the function to be triggered for NSK, but the rationale seems more reasonable
- 108 SB06 should not generate H reasons in ASF250, 270, 510, 530 - it prevents balanced decisions
- 109 SA05 and SA06 should never generate H reasons
- 110 CG02 should in fact be a positive reason for ASA040 instead of a negative reason!
- 111 DS02 and DS03 are always used together and DS03 has poor characteristic support - therefore combined the two using the DS02 as the number but the DS03 description and the reasons for both
- 112 CD09 was incorrectly allocated to ADL350 instead of ADL340
- 113 Clarified by description change the use of CDD09
- 114 Add CSS08 to SM04, SM05, SM07, SM08
- 115 Decided that SS02 was a duplication of SL04 - therefore replaced SS02 with SL04 where used solely and deleted it where used together with SL04
- 116 Add DP05 to ADP230, ADP233, ADP237, ADP240, ADP250
- 117 Reviewed and corrected triggering of DP01 to make it the same for every occurrence
- 118 Reviewed and corrected triggering of DP09 to make it the same for every occurrence
- 119 DP01 and DP10 need adding to ADP540
- 120 Remove CD26 from ADP540 - it is irrelevant
- 121 Add DD06 to ADD340
- 122 Change trigger for DD3 - it should not force high relevance in any context
- 123 Remove the possibility of an H trigger for DD04 except for ADD330
- 124 DD17 changed to a "not" reason (DD17N) created for CDC12 and used as a blackball for ADD520
- 125 Remove CDL4 and CDL2 from DL04 and DL05 - they were causing ridiculous triggers
- 126 Add CDL8 to DL03, DL04, DL05, DL06 to make sure that No of trips is always a factor
- 127 Converted DL07 to a negative reason DL07N so that it is used as a blackball to suppress functions when the volumes clearly render them irrelevant
- 128 Some of the Supply side purchase design questions could have been answered more positively if tooling had been considered
- 129 Removed CG01 and CG09 from ASS210 - It is not as though they are irrelevant reasons - it is simply that they would be overcome if other considerations made this functions otherwise relevant
- 130 Clarified the meaning of CSB05 and CSB06 that they exclude consumables and miscellaneous items
- 131 Created a negative reason SL04N to blackball ASS230 in situations where Supplier managed inventory is irrelevant - however left the positive reason SL04 in the function to ensure that there was a positive reason for triggering if it was relevant - this is the

- first occasion that this technique has been used - it may be of wider relevance
- 132 CS04N was being used instead of CS04 as a negative reason in ASB310 - added CS04N as a positive reason
- 133 Again reviewed the point of function ASF020 - is it conceivable that anyone should want to access the sales accounting system of their suppliers? - Decided that the only possible reason was a weak position in respect of suppliers and therefore the need to keep an eye on their view of you - still seems pretty weak and therefore will continue to keep it under review - for now converted SB05 to a negative SB05N for use as a blackball and de-tuned SB08N to avoid high relevance being generated
- 134 Decided that DD14 should be based on the total number of customers rather than the average delivered to in any week - created new characteristic CDC08 to cover this
- 135 In ADD320, DD17 is converted to DD17N used as a blackball
- 136 Removed CG09 from ASG210 - it doesn't stop you using bank transactions
- 137 Add CSR02 to SR03 to reflect better the possible significance of maintenance activities
- 138 CS21 reversed to be a positive reason for rather than the absence being a reason against
- 139 CS27 reversed to be a positive reason for rather than the absence being a reason against
- 140 Addressed the problem whereby SB02 and SB03 were being triggered despite there being no standard/commodity products - this was because of the "volume" characteristics - Decided that the best way to handle this was to ensure while the volumes were necessary to trigger the reasons they were not sufficient - so increased the matched reason score to 2 for the CSI02 and CSI03 characteristic
- 141 Model error in ASG010 reason SA06 causing a H response rather than a R response
- 142 Once again needed to correct DP01 - it should never generate H reasons and it should be consistently used
- 143 Corrected DP02 to operate consistently - should never generate H reasons
- 144 Reason DP09 must be added to ADP040 because the function is only relevant if we do the design work
- 145 CDP01 needs to be added to DP01 otherwise volumes are not adequately reflected
- 146 DP09N created as a negative reason to DP09 and used to blackball ADP020
- 147 DP09N added as a blackball to ADP220, ADP233, ADP237, ADP240, ADP250
- 148 Remove DP04 from ADP250 - it is clearly out of place
- 149 CG04 and CG09 are in fact reasons for ADD550 rather than reasons against!
- 150 Considered whether CG05, CG05, CG12 should be activated to suppress ADD570. This function is customer facing and therefore should not be stopped "e-business cynicism" type functions - Decided to suppress CG12
- 151 ADD090 is not necessarily design related - DP01, DP02, DP03 are better triggers than DP09
- 152 Similar issue to ADD570 for ADS550 - Decided to remove CG12 from this also
- 153 CD13 should be a positive reason for ADF030 as well as a negative blackball
- 154 Considered whether ASP550 and ASP560 should have been triggered - there are similar issues here with ADD570 - in fact for both of these it was a tie largely caused by the "e-business cynicism" concerns - decided to leave these unchanged because collaboration with suppliers is likely to be more affected by such cynicism
- 155 Removed the possibility of SB05, SB06 and SB09 generating H reasons for all activities - it prevents balanced decision making
- 156 Removed the possibility of SL04 generating H reasons
- 157 CS07 needed to be added to ASB330, ASB340, ASB350, ASB360, ASB370
- 158 SB08 needed to be detuned so that it is more difficult to generate H reasons
- 159 Model changed so that if there is an exact balance between R and N reasons, then the verdict is "?" rather than "N"
- 160 DL09N created as a negative version of DL09 and added to ASG220
- 161 Introduced new characteristic CSA05 - involving the number of remote sites where

- employees work
- 162 Beefed up the definition of organisational complexity (reason SA06) to include CSA05 and CSS08
- 163 CSA05 added to SA03 to reflect that remote management is involved here
- 164 Mistake corrected in the model - SA01 was coded for ASB540 instead of SA03
- 165 Created reason SA07N to represent insufficient remote activities. Added these to ASG010, ASG230; ASG510; ASG520; ASG530; ASA010; ASA020; ASA030; ASA040; ASA210; ASA220; ASA510; ASA530; ASA540
- 166 CDC11 should have been answered low
- 167 Model changed so that CDD05 should be enough on its own to trigger DD03 on its own - although this is still fixed so as never to generate H reasons
- 168 CD18N removed from ADP040 - it is not of sufficient weight to be allowed to act as an opposing counter to the other reasons
- 169 Decided that DD02 (individual customers are powerful) should not on its own trigger ADD210 and ADD220. So reversed the reason (DD02N) so as to use it as a negative pointer for these two activities
- 170 Customer thought that ADD250 should have been triggered - decided in the end that the customer should have answered CDI06 positively - so reworded the characteristic to make it more clear
- 171 Customer challenged the concept of collaboration in relation to ADD570. Changed the wording of the function description to admit that the word is really a misnomer - we are talking about customer-enforced collaboration!
- 172 ADS030 should not have been triggered. DD16 was removed as being really irrelevant. CD01 and CD12 added since these seem logical reasons for presenting this sort of information
- 173 Customer challenged the concept of collaboration in relation to ADS570. Changed the wording of the function description to admit that the word is really a misnomer - we are talking about customer-enforced collaboration!
- 174 Created Reason DL03N in order to prevent ADL030 being triggered when it clearly shouldn't - i.e. when transport is not our responsibility - also added this as a possible blackball to all those Activities to which I had added DL07N
- 175 Customer felt that ADL520 should not have been triggered - decided on balance that the model was giving a reasonable result
- 176 Added a new activity ASP260 to cover reception of process change requests from Supplier - also changed the descriptions of activities ASP040, ASP510, ASP030, ASP040
- 177 Reason SB05N description was wrong
- 178 Characteristic CSV02 was incorrectly entered
- 179 Reason SB05 should not on its own trigger ASS220 - decided to reverse it to a negative using SB05N
- 180 Customer thought that ASL290 should not have been triggered - decided that the activity was over-triggered and added SF02N as a possible blackball - this causes a debatable answer - decided that this was the right answer
- 181 Turnover characteristic added to reason DD12 and the description changed - an obvious necessity in the context that it is being used
- 182 Turnover characteristic added to reason CD09 and the description changed - an obvious necessity in the context that it is being used
- 183 Turnover characteristic added to reason CS18 and the description changed - an obvious necessity in the context that it is being used
- 184 CDD9 added to DD16 in order to get a "size of issue" dimension
- 185 Remove DD06 from ADD350 - the volume issue is dealt with by other reasons
- 186 Negative version of DD16 created to be used as a negative against ADD350 representing insignificant volumes
- 187 DD17 removed from ADD230 and ADD240 - It is irrelevant
- 188 Questionnaire respond for CDD08, and CDD09 changed - the volumes were not high

enough to justify the functions triggered by "high" ratings  
 189 Many of the recommendations around the transactions area seem far too heavy for the case. But there does not seem any fault in the reasoning - which leads to the question of whether I should "ban" some functions from small organisations - decided on balance that this was not necessary because (a) ways of achieving such transactions are becoming cheaper (web EDI) and (b) if functions were arbitrarily banned from small organisations the model would be useless for small organisations  
 190 The relevance threshold needed increasing for DD07 - both characteristics need to be triggered for the reason to be triggered  
 191 CDD09 added to CD16 to inject a "size of issue" dimension and the description changed  
 192 CDD09 added to DD09 to inject a "size of issue" dimension  
 193 For ADS030, CD01 converted to a negative to be used negatively - the negative can be a stopper, but the positive cannot be reason for  
 194 Added DS04 to ADS030; it is clearly necessary as a positive reason  
 195 DL03N and DL07N should also be added to ADL 310  
 196 CDV01 had been accidentally missed from DV05  
 197 DV03N created and added as a negative reason to ADV240 and ADV250 - clearly these functions are not relevant unless there are a significant number of engineers  
 198 DV03N added to ADV520 - it is clearly indicated  
 199 Added characteristic CDI10 to SB08 and SB08N because companies with small turnover are unlikely to be in a powerful position with their suppliers  
 200 The relevance threshold was inconsistent for SB01 - rationalised  
 201 Created a new reason SB01N to allow for the fact that, although purchasing is important, it is just not big enough in value terms to justify the activity  
 202 SB01N introduced as a negative reason for ASB210, ASB220, ASB230  
 203 SL04N needed adding to ASB330  
 204 Removed CS04N as a positive reason for ASB310 - it was over the top  
 205 Created SB05N as a negative version of SB05 and used it as a negative reason against ASB310  
 206 Model had incorrectly coded CSB10 for reason SB11 - should have been CSB09  
 207 SB05N should be used as a negative reason for ASB340 rather than SB05 as a positive reason  
 208 New reason SB13 created - for purchase order changes  
 209 After some soul searching decided that activities ASB340, ASB350, ASB360, ASB370 should be blackballed by SB01N - because these activities can only be relevant to the big boys  
 210 SB05 changed to SB05N and used negatively for ASL250 - positively it is not enough to make it relevant, but negatively it is enough to stop it  
 211 DD15N created as the reverse of DD15 and used as a negative reason for ADD030  
 212 DD08N created as the reverse of DD08 and used as a negative reason for ADD270 and ADD280  
 213 Threshold Adjusted For SR03 - Prevented it from generating H reasons  
 214 Turnover characteristic added to SM01 to reflect size dimension  
 215 SM01N created as a negative of SM01 and used to blackball SM functions  
 216 DP09 should never generate H reasons  
 217 CDP03 needs adding to DP05 - it is clearly relevant for the function as described  
 218 Created DP01N as a negative blackball and added it to ADP010, ADP020, ADP030, ADP210, ADP220, ADP230, ADP233, ADP237, ADP240, ADP250; ADP510, ADP530, ADP540, ADP550, ADP560  
 219 DP07 should not generate H reasons  
 220 ADD070 should not have been triggered - CG02, CG03, CG04 should not be positive reasons for ADD070  
 221 ADD070 should not have been triggered - Question CDC11 answered wrongly



222 ADS210 should have been irrelevant - caused by a model miscoding error  
 223 DS07 should not generate highly relevant verdicts for ADL020 and ASL030 - it has far too strong an effect  
 224 DL07N should not generate a negative black ball - it was far too strong  
 225 DL09 and DL09N needed more characteristics - percentage was not enough - Added CDC09 and CDC08 - i.e. the same as DL07  
 226 Prevented SP02, SP01 from generating H results - they were swamping other issues  
 227 SB11 be added to ASB250; ASB260  
 228 For consistency with ASB260 CG01 removed from ASB250  
 229 ASB310 and ASB320 need to be made consistent - Remove CG09 from ASB310 and add CG03 to ASB320  
 230 SL04N was being triggered as well as SL04! - Needed to adjust the triggering threshold to stop this happening  
 231 Decided that SB01 should not be generating H verdicts  
 232 The triggering threshold for an H verdict for SL09 was too low  
 233 Model Error - reason SM05 was missing a characteristic  
 234 Added CDP05 to DP01N in order to make it the true reverse of DP01N  
 235 Created DP05N as a negative of DP05 in order to tend to prevent functions being triggered when the volumes were insignificant  
 236 Decided that CD17 should never be used as a positive reason for a transaction function - therefore removed it from ADP240, ADP250, ASP230, and ASP260  
 237 Added DD08N to ADD250, ADD260 to provide a "low volume" effect - but decided to make this generate N rather than X reasons  
 238 DS04 was too noisy - it was detuned so as to reduce probability of H verdicts  
 239 ADL030 needed a negative criteria to reflect the probability of last minute orders - on the assumption that this might justify giving other partners a window into your shipping execution system  
 240 DL04 was too noisy - it needed to be less easy to generate H reasons  
 241 Model Error - CD13N has the sign coded wrong  
 242 Decided that DD05 would work better as a negative reason DD05N - the fact that EDI is a condition of doing business is not in itself a positive reason for a function if there is no other indication in favour  
 243 Decided that DF02 should not generate H verdicts  
 244 Decided that DD03 was a reason for not doing ADF280 rather than a reason for  
 245 The triggering threshold for an R verdict for SL04 was too low  
 246 Decided that SB06 was not a reason for ASL250 - Also created SB04N to enable the negative to have a negative influence  
 247 Felt that ASL290 was in danger of being over-triggered - added SB06 as an extra negative reason on the basis that organisations which set up a scheduled call off supplier base should not need to do this sort of thing (unless there were positive reasons e.g. quality)  
 248 The SM01N blackball (for the case that no sub contract activity was taking place was needed to be more consistently applied  
 249 Created the negative SF01N and added it to ASF240 to give more emphasis to the lack of volume situation  
 250 Characteristics supporting DP03 clearly inadequate - added CDP02 and CDP05  
 251 DD04N created as a negative blackball to stop ADD060 triggering in absence of schedule relationship  
 252 Although ADD300 was giving a reasonable answer, felt that not enough reasons were influencing it. Added DD10 and DD14 as positive reasons and DP07 and DD06N as negative reasons  
 253 Basic problem with EDI being too schedule oriented - added CDDC11 and CDD09 to Reason DD05, and DD05N in order to give reasonable answers for spot only demand  
 254 Went back on No 242 to some extent. The fact that EDI is a condition of doing business

is some sort of a positive reason even if the function is otherwise irrelevant. So reinstated DD05 but retained the DD05N negative. Also made sure that there were negative reasons in place where appropriate (DF01N, DD04N, DD06N)

255 DL10 should not generate H reasons - it is not a good enough reason to overwhelm potential negatives

256 Decided to reverse change 29 - DL09, if triggered is surely not strong enough to generate H reasons that can overwhelm any negative indications - after all we are not talking about the need for the business process per-se - we are talking about the relevance of "e-business support" for it

257 For reason SP06 changed the possible score to 2 for characteristic CSP09 so that this function cannot be triggered unless suppliers perform a significant amount of design effort

258 Adjusted the triggering threshold for SP04 and SP05 because it seemed pointless to generate an H reason in isolation from all other considerations

259 SB08 needed to be further detuned so that it is impossible to generate H reasons - on reflection the fact that one is in a very powerful position with one's suppliers is not so powerful a reason for doing something that it should overwhelm everything else

260 SB04 detuned so that it does not generate H reasons - it was not so much producing any wrong answers - but it was in effect "blotting out" the pluses and minus and therefore preventing balanced assessment

261 DS01 detuned so that it does not generate H reasons - again it was not so much that the answer was wrong - but the reason should not be sufficient to "blot out" the pluses and minus

262 DS06 also detuned so that it should be more difficult to generate H reasons - again it was not so much that the answer was wrong - but the reason was not sufficient to "blot out" the pluses and minus

263 Scoring and triggering thresholds for DP01 and DP01N were failing to take into account when the customer had no part in the design activity in situations where there was nevertheless a lot of design activity - Changed the scores and threshold so that if CDP03 was null then Reason DP01 could not be triggered and DP01 must be triggered

264 DP02N and DP03N added to ADD010 because it was potentially being triggered by concerns only when characteristics did not justify it

265 CD105 added to DD15 and DD15N because customisable products are also relevant to the uses of this reason

266 Detuned DS04 for Activity ADS010 - it was the only activity where this reason was generating a H reason and decided to make the same as the others (in effect reversing change 20 and reinforcing change 238)

267 ADS010 was triggered when it should not - There were not any customers with the capability to support this. Added DD02N and DD03N to tend to suppress this activity in situations where there are not likely to be a significant number of customers able to usefully use this function. In addition added DS01N, DS04N and DS05N as negative reasons (although not affecting this case)

268 Removed CS22 as a positive reason for ADS230 - the link was too tenuous

269 Added DD02N and DD03N to ADS520 to tend to suppress this activity in situations where there are not likely to be a significant number of customers able to usefully use this function (although it did not affect the answer)

270 Decided that DL03 and DL06 should not be generating H reasons - they were making too much noise and drowning out the other factors

271 ADF260 was unexpectedly inconsistent with all the other related functions. Removed DD14 from AF260 and added DD05, DD05N, DF01N, DD01, DD01N, DD03

272 Added DV06 to ADV230 because complexity of product is relevant for this also

273 Added DV02 to ADV210 because volume of service calls is relevant

274 Created negative reason SP01N and used it every time that SP01 is used in order to tend positively to suppress activities if there is no significant design activities with suppliers

275 Adjusted the triggering threshold for SB03 because it seemed pointless to generate an H reason causing all other considerations to be ignored

276 ASB350 was triggered while ASB320 was not - this seemed illogical - caused by the presence of CS04 as a positive reason. Although there was a logical reason (less ability to react = more need to send "can't do" responses to orders), it seems better to use the negative as a negative reason. Also implemented the same change for ASB370

277 CS14 was being used to help trigger ASB360 and ASB370 - decided to create the negative reason and use this to help suppress the activities

278 Although the case study results were OK, realised that I had not reflected earlier improvements to the outbound logistics transportation functions into the equivalent inbound functions - therefore expanded the inbound model accordingly

279 The wrong reason (DD06) was being used in ADD290 - it should have been DD08

280 DD11N created as a negative of DD11 and added to ADD290 so that the absence of the reason tends positively to suppress the activity

281 CD19 should not be a positive reason for doing ADD290, in the absence of other reasons - therefore converted this into a negative reason for not doing it

282 Added DD05 and DD05N to ADD350, ADD360, ADD370, and ADD380 - it was clearly relevant to discourage these activities if EDI was not a relevant part of doing business

283 Further detuned DS04 for Activity ADS010 and others - decided that it was inappropriate for this to generate H reasons under any circumstances

284 DS07N should never act as a blackball - it's effect was too clumsy

285 DS08 was accidentally generating H reason for ADL260 - but nowhere else

286 DL02 was blackballing ADL290 - this is not incorrect but was actually caused by a bug in the model! Putting the error correct made the answer N rather than X - which in reality was just as good

287 DL08N created as a negative influence on ADL310 in situations where in-transit times were insignificant

288 DF01 (but not DF01N) removed as a reason for ADF240 - it can be used to suppress the function but not to support it

289 DD05, DD05N and DF01N added to ADF210

290 SL04N added to ASS530 for consistency with ASS230

291 CS08, CS13, CS19, CS20 work better as negatives against rather than positives for ASS230 and ASS530 also CG1 and CG3 should be possible reasons against rather than for.

292 SB02 triggering threshold also need to be suppressed to avoid generating H reasons

293 CS08, CS13, CS19, CS20 work more logically as negatives against, rather than positives for, ASB330. Also the SL04N threshold was incorrect

294 ASB550 should have been more relevant - added SB01 and SB08 also removed CS28 on the basis that suppliers do not need (much) e-business capabilities to receive notifications! Having realised this, checked the model and removed CS28 from ASP540, ASS550, ASM520

295 CS17 was causing a false positive on ASL040 - replaced it with the negative reason as a negative factor

296 Forced SL05N to be a negative blackball to prevent false positives in the absence of any requirement to deal with carriers

297 SM01, SM07, SM08 needed their triggering thresholds raised - they were too noisy and swamping other considerations

298 Detuned SA06 so that it was not generating H reasons - a normal balanced reason was quite enough

## Appendix D Model Input Questionnaire

Company Name					
Please give numerical answers to the following characteristics where possible. In addition (ideally) or as an alternative please indicate whether you consider that the answer for the characteristic should be regarded as significantly high (enter 1) or not significant (enter 0) as far as the application to your company is concerned					
<b>Demand Side</b>					
<b>Sold Items</b>					
	CDI02	% Sold Items - Standard products - your specialised products for which you have multiple customers			
	CDI03	% Sold Items - Commodities - standard products that are generally available from a number of sources			
	CDI04	% Sold Items - Engineer to Order - primarily built to the customer specification on an order by order basis			
	CDI05	% Sold Items - Configure to Order - primarily based on your standard products but configured to customer requirements on an order by order basis			
	CDI06	% Sold Items - Customer developed - designed originally for the specific customer and then supplied on a regular basis for the product life			
	CDI07	Number of distinct product ranges (i.e. number of different families or major sub-families).			
	CDI08	Number of different products (total number, including variants, features, options etc.) in any one year.			
	CDI09	Percentage of products which are safety critical and/or have high technical specification			
	CDI10	Total turnover (£millions)			
	CDI12	Average number of different product options and/or variants per product range (cd7/cd8)			
<b>Customers</b>					
	CDC01	Percentage share of the chosen marketplace.			
	CDC02	Number of strong competitors, in the chosen marketplace.			
	CDC03	Percentage exported outside UK			
	CDC04	Percentage of business where competitors can easily influence short-term customer demand.			
	CDC05	Percentage of business where competitors can easily influence medium term customer demand.			
	CDC06	Percentage of customers who are loyal in the short term (i.e. do not shift to other suppliers within short term planning horizon).			
	CDC07	Percentage of customers who are loyal in the medium term (i.e. do not shift to other suppliers within medium			

		term planning horizon).			
	<b>CDC08</b>	Total number of customers kept on file			
	<b>CDC09</b>	The average number of customers delivered to per week.			
	<b>CDC10</b>	Number of customers who are individually responsible for >10% of demand.			
	<b>CDC11</b>	Number of customers who are together responsible for 90% of demand.			
	<b>CDC12</b>	Number of dealers or remotely operating salesmen			
<b>Demand Side Pre-Production</b>					
	<b>CDP01</b>	Number of projects per year			
	<b>CDP02</b>	Duration of projects			
	<b>CDP03</b>	Percentage of Customers involved in pre-production projects			
	<b>CDP04</b>	Average number of project steps to monitor			
	<b>CDP05</b>	Average number of items to design per project			
	<b>CDP06</b>	Percentage of products newly introduced per year (i.e. require a significant engineering / materials change; not trivial variants).			
	<b>CDP07</b>	Average number of product design or process changes per week.			
	<b>CDP08</b>	Percentage of design effort undertaken by you (sold items)			
	<b>CDP09</b>	Percentage of design effort undertaken by Customer (sold items)			
<b>Demand</b>					
	<b>CDD01</b>	Percentage of products where demand can be considered as seasonal (peak in demand twice the value of the trough).			
	<b>CDD02</b>	Period of time for which the forecasts are accurate enough to base the manufacturing planning on (as a percentage of customer demanded lead time).			
	<b>CDD03</b>	Percentage of production that is geared towards fashion products (total market for the products can change unpredictably).			
	<b>CDD04</b>	Percentage of customer orders placed which can be relied on to be 100% firm (within the average customer demanded lead time).			
	<b>CDD05</b>	Percentage of demand from customers with long-term contracts (i.e. schedules with call-offs).			
	<b>CDD07</b>	Percentage of items supplied from vendor managed inventory			

CDD08	Total number of quotes / product enquiries handled per week.			
CDD09	Average number of spot orders received per week (as opposed to schedule call-offs).			
CDD10	Number of items subject to just-in-time pull by the customer			
CDD12	Average number of schedule call-offs received per week (as opposed to spot orders).			
CDD13	The average customer demanded lead time (total working days from placing the order to expected delivery).			
<b>Planning</b>				
CDS01	Percentage of production that is not started until the customer orders are received (i.e. make-to-order).			
CDS02	Percentage of production that can be considered sell-from-stock (i.e. forecast driven, order point driven or similar).			
CDS08	Total number of master scheduled items (i.e. total number of items for which MPS is carried out).			
CDS09	The average percentage of the master schedule changed within the lead-time horizon due to demand changes.			
CDS10	Percentage of production where planning is significantly capacity constrained			
<b>Outbound Logistics</b>				
CDL01	Percentage of Despatches where transport needs to be organised with external carriers			
CDL02	Number of carriers used			
CDL03	Number of carriers individually responsible for 10% of despatches			
CDL04	Number of carriers collectively responsible for 90% of despatches			
CDL05	Number of despatches per month taking more than one week in transit			
CDL06	Average number of orders / schedule call-offs to one despatch.			
CDL07	Number of returns per week			
CDL08	No of vehicle trips per week			
<b>Finance (Demand Side)</b>				
CDF01	Number of invoices produced per month			
CDF02	Percentage of customers operating self billing			

<b>Service</b>				
CDV01	Number of customers requiring after sales service			
CDV02	Number of service calls per year			
CDV03	Number of service engineers			
CDV04	Number of repair and overhaul jobs per year			
CDV05	Number of serviceable parts per serviced products			
<b>Supply Side</b>				
<b>Purchased Items</b>				
CSI02	% Purchased Items - Standard products - specialised products of your suppliers for which they has multiple customers			
CSI03	% Purchased Items - Commodities - standard products that are generally available from a number of sources			
CSI04	% Purchased Items - Engineer to Order - primarily built to your specification on an order by order basis			
CSI05	% Purchased Items - Configure to Order - primarily based on standard supplier products but configured to your requirements on an order by order basis			
CSI06	% Purchased Items - Customer developed - designed originally by supplier specifically for you and then supplied on a regular basis for the product life			
CSI07	Total number of purchased parts			
CSI08	Average number of purchased parts per end item			
CSI09	Percentage of parts common to all products within a family.			
CSI11	The cost of purchased parts as a percentage of the total product cost.			
<b>Suppliers</b>				
CSV01	Total number of production-related suppliers used (i.e. kept on file).			
CSV02	The average number of suppliers per part (who are used regularly to supply the same part).			
CSV03	The average number of parts per supplier (number of different parts supplied by the same supplier).			
CSV04	Percentage of supply value from "selected" suppliers (where there is a semi-permanent or long term relationship).			
CSV05	Percentage of supply value from monopoly suppliers (who deliver on their terms as they are the only source).			
<b>Supply Side Pre-Production</b>				

CSP01	Number of projects per year			
CSP02	Duration of projects			
CSP03	Number of Suppliers involved in pre-production projects			
CSP04	Average number of project steps to monitor			
CSP05	Average number of items to design per project			
CSP06	Percentage of products newly introduced per year (i.e. require a significant engineering / materials change; not trivial variants).			
CSP07	Average number of product design or process changes per week.			
CSP08	Percentage of design effort undertaken by you (purchased items)			
CSP09	Percentage of design effort undertaken by Supplier (purchased items)			
<b>Supply Chain</b>				
CSS01	Number of items controlled by me delivered directly from my suppliers to my customers			
CSS02	Number of items controlled by me delivered directly from my suppliers to other partners			
CSS03	Number of items manufactured by sub-contractors			
CSS04	The typical percentage of production (by value) that is sub-contracted.			
CSS05	Percentage of supplies where planning is constrained by suppliers capacity constraints or fixed cycle schedules			
CSS06	Cumulative Manufacturing Lead Time			
CSS07	Cumulative Material Lead Time			
CSS08	Number of subcontractors or remote (from internal systems) manufacturing sites			
<b>Purchasing and Procurement</b>				
CSB01	Percentage of purchase orders / schedule call-offs received on time.			
CSB02	Percentage of suppliers who deliver on time (for at least 90% of the time).			
CSB03	The average percentage of purchase orders that have quality problems associated with them.			
CSB04	The average percentage of purchased items rejected.			
CSB05	Percentage of parts (by value) that are delivered direct to the point of production (i.e. as a significant			



	administrative issue).			
CSB06	Percentage of parts (by value) where provisioning is managed by the supplier			
CSB07	The average number of production related items ordered per week (i.e. production related purchases made).			
CSB08	Average number of internal requisitions per week (including non-production-related).			
CSB09	The average number of items ordered per week (i.e. purchases for production and non-production related items).			
CSB10	The average number of schedule call-offs sent to suppliers per week.			
<b>Inbound Logistics</b>				
CSL01	Percentage of receipts where I need to organise transport with external carriers			
CSL02	Number of carriers used			
CSL03	Number of carriers individually responsible for 10% of receipts			
CSL04	Number of carriers collectively responsible for 90% of receipts			
CSL05	Number of receipts per month taking more than one week in transit			
CSL06	Number of returns per week			
CSL07	No of vehicle trips per week			
CSL08	Percentage of receipts requiring inspection			
<b>Finance</b>				
CSF01	Number of invoices produced per month			
CSF02	Percentage of customers operating self billing			
<b>Maintenance</b>				
CSR01	Number of organisations providing maintenance			
CSR02	Number of assets requiring maintenance			
CSR03	Number of maintenance requests per month			
CSR04	Ratio of fixed assets to turnover			
<b>Administration</b>				

CSA01	Total number of employees			
CSA02	Total number of employees with administration functions			
CSA03	Total number of employees requiring activity to be recorded/monitored			
CSA04	Total number of technical and professional employees			
CSA05	Total number of remote sites where employees work (including home)			
<b>Please indicate which of the concerns below apply to you</b>			2=Strong 1=Yes Blank=No	
<b>General</b>				
XG01	We have poor data accuracy			
XG02	There is inconsistent information between departments			
XG03	Systems are incompatible and poorly integrated			
XG04	There is an informal system mentality within the company (private systems, spreadsheets etc)			
XG05	IT investments generally fail to achieve their objectives because we do not use the software well			
XG07	We usually find that the costs of introducing e-business functions cannot be justified in relation to the benefits obtained			
XG09	We are constrained by the shortage of IT skills			
XG12	We do not have the management determination to exploit e-business			
XG13	We have concerns about the security associated with e-business functions			
<b>Demand side concerns</b>				
XD01	We cannot rely on our customer's forecasts			
XD02	Our customers fail to respect industry standards			
XD03	Our customers dictate requirements without concern for the problems they cause			
XD04	Customers fail to communicate requirements clearly or respond effectively to queries			
XD05	We incur expense because of our customer's non-adherence to industry standards			
XD06	Customer lead time expectations are a significant management issue for us			
XD07	We cannot compete in markets where cost is the dominant factor in getting business			
XD08	We consistently fail to deliver on time			
XD09	We have significant levels of obsolete manufactured goods			

XD10	We have high (i.e. higher than planned) levels of finished goods stock		
XD11	We consistently fail to achieve customer quality expectations		
XD12	We cannot rely on our customers firm orders		
XD13	Credit Control is a significant issue		
XD14	Our customers consistently impose high penalties for late deliveries		
XD15	We currently consider that we have an insufficient forward view of demand		
XD16	Currently we have a high number of customer backlogs		
XD17	We do not manage design work and engineering changes with our customer well		
XD18	Excessive paperwork and clerical activity - Engineering and Design		
XD19	Excessive paperwork and clerical activity - Customer Order Servicing		
XD20	Excessive paperwork and clerical activity - Logistics		
XD21	Excessive paperwork and clerical activity - Service		
XD22	Our Salesmen are computer illiterate		
XD23	We experience a high level of customer returns		
XD24	We experience excessive field service calls		
XD25	We are constrained by the e-business capabilities of our Customers		
XD26	Our relationship with the customer depends on a personal relationship		
<b>Supply side concerns</b>			
XS01	We consistently fail to give stable schedules to our suppliers		
XS02	Planners make their own decisions what to order rather than following the MRP plan		
XS03	The planning process cannot be relied upon		
XS04	We cannot expect our suppliers to react effectively to our changes of plan		
XS05	Our major quality problems are caused by quality problems with purchased items		
XS06	We do not have sufficient pull with our suppliers to force them to do what we want		
XS07	Most of our suppliers are incapable of using EDI		
XS08	We have significant levels of obsolete purchased material		
XS09	Most of our suppliers do not even have internet access		
XS10	We suffer from high scrap levels		
XS11	High yield variation is a fact of life in our business		

XS12	A high level of rework is encountered in our business		
XS13	Excessive supplier lead times		
XS14	Poor supplier due date performance		
XS15	We experience a high level of expediting (planned or unplanned)		
XS16	We consistently make unnecessary purchases		
XS17	Significant problems are caused by shortages of purchased parts and/or materials		
XS18	We have high levels of obsolete component, material or part finished inventory		
XS19	Our bought-out stock levels are excessively high		
XS20	Excessive safety stock is currently being planned		
XS21	Plant maintenance is a significant concern		
XS22	Plant reliability is a continual problem		
XS23	We encounter consistent production overloads and bottlenecks		
XS24	Excessive paperwork and clerical activity - Planning		
XS25	Excessive paperwork and clerical activity - Procurement		
XS26	Excessive paperwork and clerical activity - Accounting and Finance		
XS27	Excessive paperwork and clerical activity - Maintenance		
XS28	We are constrained by the e-business capabilities of our Suppliers		

## Appendix E Rules for calculation of the rating for a function

### 1 - Overall Rating

If there are no reasons triggered (having used N reasons to cancel R reasons)

Then

If there are no reasons rated as X

Then overall rating = "-" (=no reason to consider this appropriate)

Else

Overall rating = X (=reasons to consider this highly inappropriate)

Else

If there are no reasons rated as X

Then overall rating = the Highest Rating Found (HRF) in the triggered reasons (see rule 2)

Else

If there are one or more reasons rated H

Then overall rating =? (=reasons to consider this both highly appropriate and highly inappropriate)

Else

Overall rating = X (=reasons to consider this highly inappropriate)

### 2- Highest Rating Found (HRF)

If there are H ratings

Then HRF=H (=Considered to be very appropriate)

Else

If there are more R ratings than N ratings

Then HRF=R (=On balance, considered to be appropriate)

Else

HRF="N" (=On balance considered to be inappropriate)

(Note that the situation where R ratings exactly equal N ratings has already been taken care of)

Appendix F E-Business Research Project Questionnaire

Company/organisation		Date	
Number of Employees		Number of different items sold	
Annual turnover		Number of items manufactured	
Number of Customers		Number of purchased items - production	
Number of Suppliers		Number of purchased items - other	

Please tick the e-commerce activities that you currently undertake and/or plan to undertake in the next 2 years. Please also indicate your level of satisfaction with current e-business activity (or, if appropriate, non-activity)

		Now	Plan within 2 Years	Level of satisfaction with current activity		
				Low	OK	High
Simple use of Internet	Access customer web sites to access or provide information					
	Access supplier web sites to access or provide information					
	Provide information for access on your own web site					
	Receive or send e-mail notifications from/to customers					
	Receive or send e-mail notifications from/to suppliers					
Transmit data between you and your customers using traditional EDI	Pre-production / product development					
	Receiving Customer Demand					
	Planning					
	Logistics and transportation (e.g. shipping notifications)					
	Accounting					
Transmit data between you and your customers using the Internet	Pre-production / product development					
	Receiving Customer Demand					
	Planning					
	Logistics and transportation (e.g. shipping notifications)					
	Accounting					
Transmit data between you and your suppliers using traditional EDI	Pre-production / product development					
	Planning					
	Logistics and transportation (e.g. shipping notifications)					
	Procurement					
	Accounting					
Transmit data between you and your suppliers using the Internet	Pre-production / product development					
	Planning					
	Logistics and transportation (e.g. shipping notifications)					
	Procurement					
	Accounting					
Participate in collaborative industry exchanges	Pre-production / product development					
	Supply Chain Planning					
	Logistics and transportation					
	Procurement					

Any other e-business activities that are worth mentioning

If appropriate, could you identify up to three main concerns that you feel may inhibit e-business in your organisation

What would you say are the three most important benefits that you have achieved with e-business?

Would you like to see the results of this survey in order to compare yourself with organisations of a similar type and size.

Yes

No

Would you be interested in using our research model to predict your e-business requirements?

Yes

No

Name

E-mail

Position

Please return to  
Professor Ashok Kochhar, Aston University, Birmingham B4 7ET

Fax 0121 359 2967

Thank you!