LAURA

IST-2001-33251

Adaptive Zones for Interregional Electronic Commerce based on the concepts of Request-Based Virtual Organizations and sector-specific Service Level Agreements

Document Title:

Analysis of technology / market trends based on interaction and feedback with other frameworks

Date:	24 February 2003
Work Package:	WP1
Task:	1.2
Lead Participant:	CARIS, Kingston University
Version:	2.0
Confidentiality:	Public
Reference:	WP1/T1.2/CARIS/SOA
Filename:	SOA Final 240203.PDF

Project funded by the European Community under the "Information Society Technology" Programme (1998-2002)

List of Contributors

Name	Company
Bob Roberts	CARIS
Adomas Svirskas	CARIS
Badawi Malik	CARIS
Kostas Petropoulos	01P
Achilleas Balatos	01P
George Zompolas	01P
Yiannis Ignatiadis	CERTH-ITI
Alexiou Theodoros	HAYE
Panagiotis Giannikos	MECCI
Larisa Sotiropoulou	KIS
Vladislav Jivkov	ARCFUND
Dirk Wilke	IAF

History Change

Date	Version	Reason for change	Revised by
28/11/02	0.1	Draft Issue	01P
29/11/02	0.2	Draft Issue	CERTH-ITI
13/12/02	0.3	Draft Issue	CARIS
21/01/03	1.0	First Release	CARIS
20/02/03	1.1	Revision	01P
24/02/03	2.0	Release for Review	CARIS

Distribution List

Name	Company
ALL	ALL

Reviewer List

Name	Company
ALL	ALL

TABLE OF CONTENTS

FIGURES

TABLES

1 Introduction

The LAURA project aims to promote electronic commerce in general and introduce new ways to conduct business using the Internet by proposing new models of collaboration and implementing a prototype using best-of-breed technologies. It is important to understand the current state of the art in the e-commerce field and to grasp future market and technology trends. These will inform a viable framework to serve as a basis for future inter-regional virtual organisations. Therefore, this report summarises both business and technical perspectives to serve as the reference point for LAURA endeavours.

2 Purpose and Scope

2.1 Objectives, Audience and Value of the Report

Along with the objectives mentioned above this report serves as a means of knowledge dissemination, both inside the LAURA project community and outside it. The report aims to discuss electronic commerce from different angles, starting from business factors and drilling down into technical aspects, therefore it is of use for both a business and technical audience. Participants of the LAURA consortium represent different types of business, research and technology professionals with very different skill sets, so it is vital to share a common vision in order to achieve the goals of the project. This, in essence, reflects the situation around e-commerce in general – business and technical parties often need some help to achieve a common point of understanding. The report is intended to share this common vision between different types of parties involved.

Another benefit of the report is a collection of references to the latest developments in e-commerce: standards, methodologies, research reports, industry initiatives and alliances, non-profit consortiums, commercial products, etc. While these sources were analysed from a particular perspective in this report, they can serve as a good starting point for anyone interested in modern e-commerce systems.

2.2 Organisation of the Report

The report starts with a discussion of the concept of virtual organisations (VO), since VO is the cornerstone of the LAURA project itself. VO's are analysed from both conceptual and technical standpoints and various points of interest are outlined. Chapter 4 is an overview of e-commerce services in general, existing business models and market drivers are discussed, main standards are mentioned and European initiatives are referenced. Also, the current position in LAURA project countries is presented. Specific points of interest such as e-negotiation and service level agreements are also outlined. Chapter 5 then is dedicated to e-commerce enabling technologies in a broad sense: from analysis and design methodologies to architectural frameworks and commercial implementations. Chapter 6 outlines other non technical considerations and Chapter 8 concludes the report with a summary of the main ideas covered in the report.

3 Virtual Organisations

3.1 Virtual Communities

Before going into definition of Virtual Organisation (VO) and discussion of various aspects of it, let us position VO in the context of various virtual formations or communities.

> *"Virtual Communities describe the union between individuals or organizations who share common values and interests using electronic media to communicate within a shared semantic space on a regular basis. [64]"*

Figure 1 shows a convenient breakdown of the vocabulary and semantics of Virtual Communities. They can be seen from two different points of view: based on the aspect of the underlying medium (in the classic sense of a communication channel) or from the perspective of the purpose they serve [64]. As we state in our definition, communities are motivated by a common interest. In this context, on the first level we speak of "Communities of Interest".

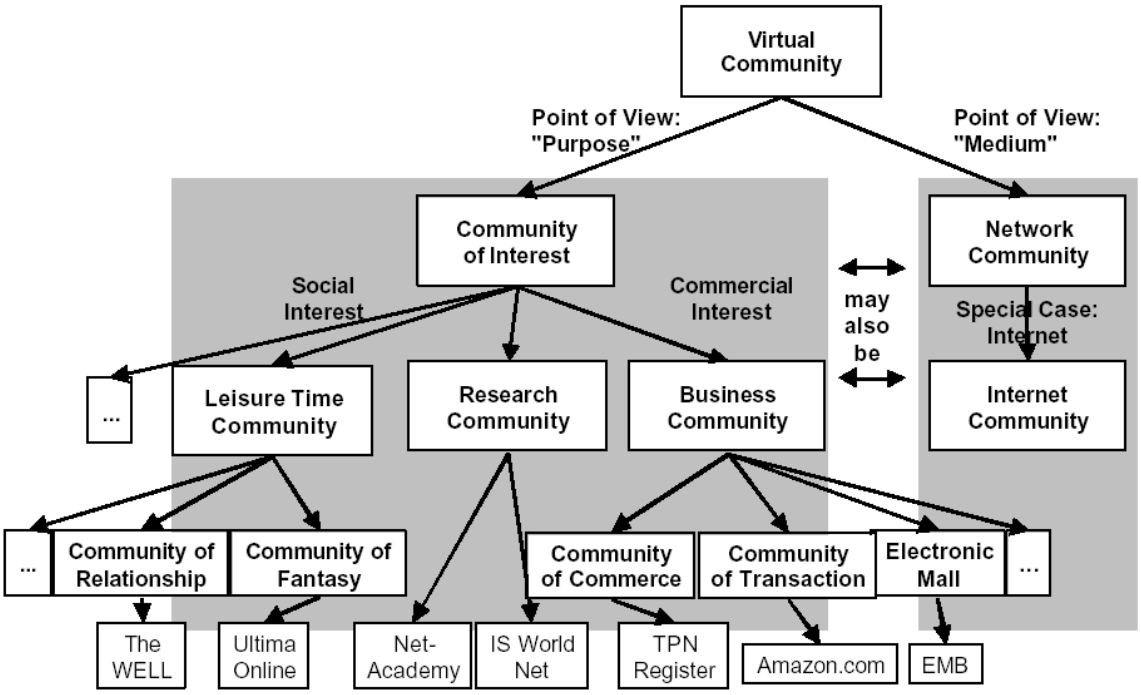


Figure 1 - Virtual Communities: Categorization Scheme ([64])

Depending on the motivation of their members (social, academic, business, etc.) we distinguish between "Leisure Time Communities", "Research Communities", and "Business Communities". Leisure Time Communities may appear in the form of Hobby Communities, Communities of Relationship, Communities of Fantasy whereas Communities of Commerce, Communities of Transaction, Electronic Malls, and so on are forms of Business Communities. An Internet Community is a Network Community,

which evolves on the Internet (not to be confused with the Internet Community as a whole, which is the total number of all Internet users).

This report focuses on business-related communities and mostly from business-to-business perspective. If we use the categorization below, VO can be referred to as both Virtual Communities of Commerce and Transaction. Communities of Commerce focus on business-to-business alliances between partners at all levels of the value chain. Their aim is a joint value creation. Communities of Transaction deal more with the exchange of goods and services, or more specifically *the purchase transaction* itself. Communities of Transaction can emerge between business-to-business partners as well as between companies and consumers [64]. Both aspects are important within the scope of the LAURA project.

3.2 The Concept of VO

There are various definitions of VO, which reflect different perceptions of the concept. Some broad definitions of VO's are:

> *A VO or company is one whose members are geographically apart, usually working by computer e-mail and groupware while appearing to others to be a single, unified organisation with a real physical location [55]*
>
> *A temporary network of independent companies that come together quickly to exploit fast-changing opportunities [11]*
>
> *An opportunistic alliance of core competencies distributed among a number of distinct operating entities within a single large company or among a group of independent companies [21]*
>
> *Less a discrete enterprise and more an ever varying cluster of common activities in the midst of a vast fabric of relationships [13]*

A VO is described in most cases as a network among organisations and/or individuals. Another opinion is that VO's should not be viewed solely as networks among organisations or individuals but as a radical approach to management, or a strategic approach that leads to dynamically re-configurable enterprises [42]. In such cases, the inherent limitations of being able to plan in an uncertain environment are taken into account by creating high structural flexibility [48].

Because the term 'VO' is relatively new, it is understood that there is not any broadly accepted framework or description for it, but instead it is usually adjusted to suit each specific case. Manthou et al [34] have looked at the development of *supply collaboration* and the establishment of dynamic e-networks between enterprises to create VO's. They believed that VO's are the result of an advanced stage in the evolution of supply chains, where sophisticated supply chain management concepts (e.g. CPFR – Collaborative Planning, Forecasting and Replenishment) are deliberately established between

previously segregated business partners. These are expected to create shared resources and synergies that can be used collaboratively "to optimise the use of mutual assets, to reduce costs to a feasible minimum, and surpass consumer expectations" [34. -pp234]. In other words, these partners proactively integrate their supply & demand information and processes within a *single* value chain with an emphasis on making these transparent and facilitating real-time responses with the purpose of meeting *shared aims and objectives*. These may include: advanced planning and forecasting, enhanced inventory management, co-ordinated distribution management, etc., and can usually be used to gain long-lasting competitive advantages over firms that are outside the collaboration.

The above interpretation implies that there is a very strong link between the concepts of '**collaboration**' and 'VO's', with the former supporting the latter. Generally, partners that intend to form a VO will *negotiate* a set of agreements on how they will allocate their relative resources, skills, and roles in the new set up. This is the essence of ***'c-commerce'*** (i.e. '***collaborative commerce'***), and leads to a number of previously segregated firms that collaborate in trade as an apparent 'single' VO – i.e. the ***'extended enterprise'***. The 'virtualisation' that has occurred is understood to mean that although the business partners remain physically discrete, they appear to all intents and purposes to behave in unison as a single encompassing business unit that stretches along much of a value chain.

Manthou et al [34] have classified and compared four supply chain 'levels of development' that are driven by the demands of e-business. These range from the most primitive level i.e. 'Inception', through 'Co-ordination' and 'Innovation', to the most advanced level i.e. 'Collaboration', as measured by their scope/orientation and their deployment of e-business applications. They are illustrated in Figure 2:

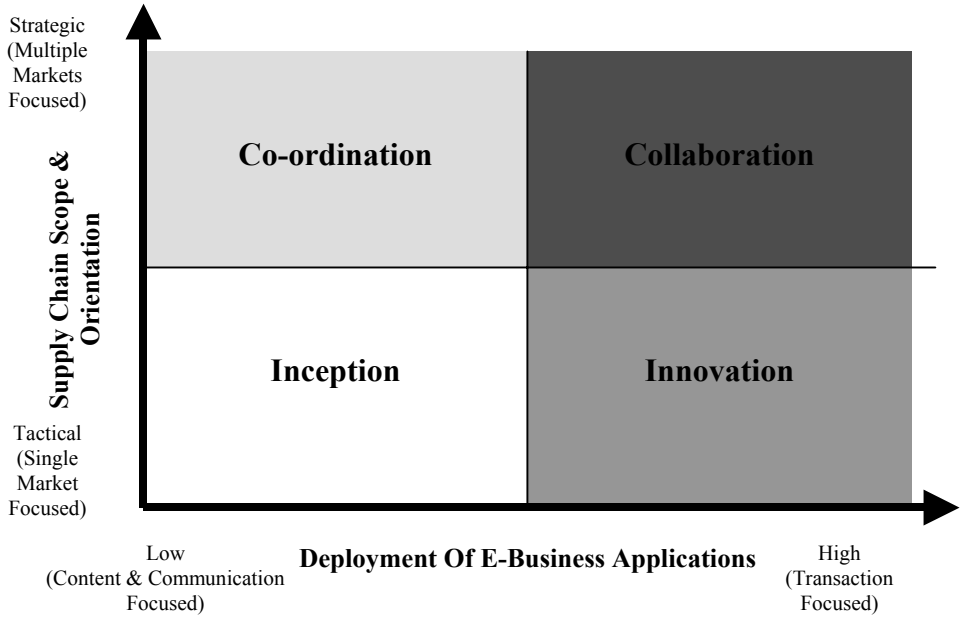


Figure 2 - Supply Chain Transformation Grid (adapted from [34])

The comparison of these classifications lists a number of key similarities and differences between them that cover partner relationships, information and decisions, related business strategies and use of technology.

Looking specifically at collaboration in the above model, *advanced information systems and technology* are understood to be essential for communication and exchange of electronic information, which is necessary to facilitate collaboration and orchestrate co-ordinated real-time responses to potentially unstable and uncertain market conditions and customer demands. The use of advanced IS/IT would seem to be especially relevant and cost effective for the smooth operation of VO's where partners are geographically remote - as is probable in the **LAURA Project,** Figure 3.

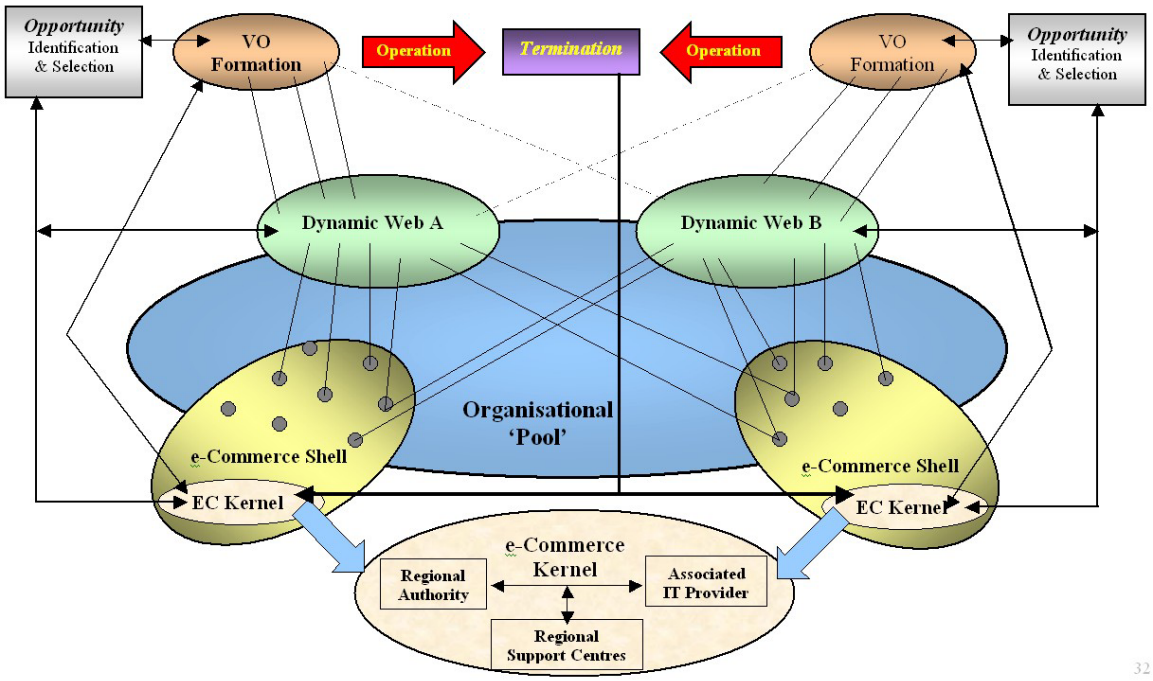


Figure 3 - Laura - A Proposed Framework

The strong tie-in between VO's and collaboration is plainly stated by Manthou et al [34] where organisational structures that enable collaboration are described as being *virtual*, dynamic and rapidly re-configurable - presumably in response to ever-changing business/competitive environments.

Furthermore, the need for *trust* between business partners in collaboration is clearly mentioned as being high to share their value chain processes. It is beyond any reasonable doubt that trust is one of the most (if not the most) important elements that make strategic alliances, partnerships and networks of small firms successful [27]. Trust has been described as being largely composed of a mixture of "competence, benevolence, integrity, and predictability" between partners, and is believed to be essential for commercial relationships, especially where risk, uncertainty, or interdependence exist [35]. This is presumably the same environment for the LAURA Project where a new concept like a VO is being formed, and so proactive steps should be taken by facilitators

or the partners themselves to create 'favourable conditions' where trust between internal partners can be built, managed, and maintained. These conditions are believed to include objective *"structural assurances"* e.g. a suitable legal/regulatory framework, reliable technological solutions, etc.; and subjective *"situational normality"* e.g. an enterprising environment, a sense of order and stability, etc. [35. –pp46]. Ishaya et al [27] identified a five-stage trust building process suitable for VO's:

1. *Transparent* Process. Trust at this stage emerges from the fact all participants have been tested and filtered to meet specific requirements and thus should be trusted, even doubtfully.
2. *Calculative* Process. Role assignment is a way to build trust. In the specific case of the LAURA Project, the calculative process takes place after the formation of a VO from the 'pool' of all participants.
3. *Predictive* Process. Trust in this stage emanates from past behaviour and success, perhaps from a past collaboration.
4. *Competence* Process. Early successes greatly influence this stage. In virtual environments where many times the credibility of a participant is judged upon previous results (since there is no direct contact), this stage is very important.
5. *Intensive* Process. The final stage, which is also the most desirable, involves the mutual understanding of the needs of all participants aiming at specific objectives and goals.

As well as trust they will also require a high level of *inter-enterprise knowledge management* for them to function effectively. This concept is believed to be essential for all types of collaborating organisations - including virtual ones - as it improves their efficiency and effectiveness at developing innovative products and services and at optimising existing operations. Effective knowledge management and sharing occurs when efficient communication channels exist and when there is trust among individuals or groups that share the information. Linthicum's view [32] is that "the flow of information must be unimpeded among all members of the supply chain" – i.e. all communication barriers should be removed within the VO - for value chain integration to succeed. This raises questions that will be considered in detail later as to the necessary form and capabilities of business integration technologies required to overcome technical obstacles between multiple partners in the extended enterprise as well as *within* individual business partners/enterprise in the collaboration. It also raises issues related to the need to tackle 'softer' concerns within the VO that might hold back the project i.e. cultural and organisational issues (e.g. the willingness of partners to share their information) that will be looked at later under Change Management.

Rabin's view [38. -pp70] is that "while the benefits of collaboration are often touted, the processes and procedures required for success are a little less clear". His view is that c-commerce can succeed only if the key areas of *integration, automation, and collaboration* are addressed in a VO/extended enterprise. Integration and automation are mostly technical issues aimed at improving communication channels between business partners in a VO (e.g. the need to employ EAI and B2Bi technologies). However, collaboration is a much wider issue that relates to the *desire* by business partners to use

their information for their own benefit as well as for the benefit of other partners in the extended enterprise.

The 'true collaboration' is not just simply about providing a Web-enabled front-end to businesses, or speeding up services and/or providing self-service facilities to business partners. The competitive advantages to be gained in this way without changing (improving) the underlying *relationships* between transacting partners are believed to be only tactical and short-lived because they can be easily copied by rivals [60]. White [59] has examined the transformation of **e-marketplaces** (see later for description) into VO's that can engage in c-commerce. He emphasised the compelling feature of the collaborative model as focus on the 'relationship' between business partners, as opposed to the 'transaction' between them – he noted that transactions are the preoccupation of e-marketplaces. White's view could be interpreted as meaning that c-commerce should be geared to encourage and support *stable relationships between business partners* that can sustain *repeatable* automated transactions between them *for the near future* and support the sophisticated supply chain management processes described earlier. In contrast, e-marketplaces are geared to facilitate ad-hoc, often one-off transactions between enterprises that only behave as business partners for the short-lived duration of the transaction. It is not even clear from White's view whether e-marketplaces can be considered in type as a collaborative business model, let alone as VO's, because they are made up of very loosely associated participants. The latter can and do change business partners regularly and freely (thus only collaborating in the very slightest and fleeting sense, if at all), because of the essentially 'chaotic' nature of their component enterprises.

3.3 Models

3.3.1 Integrated Model of VO's

First, in all types of VO's, there is a population of organisations, groups and individuals that could, at some point in the future, form a VO. Inside this population, it is assumed that some alliances and partnerships are likely to be formed from groups of potential allies. When such a group results in the formation of an alliance, this becomes the genesis of a VO. Figure 4 displays a model showing the possible states of organisation:

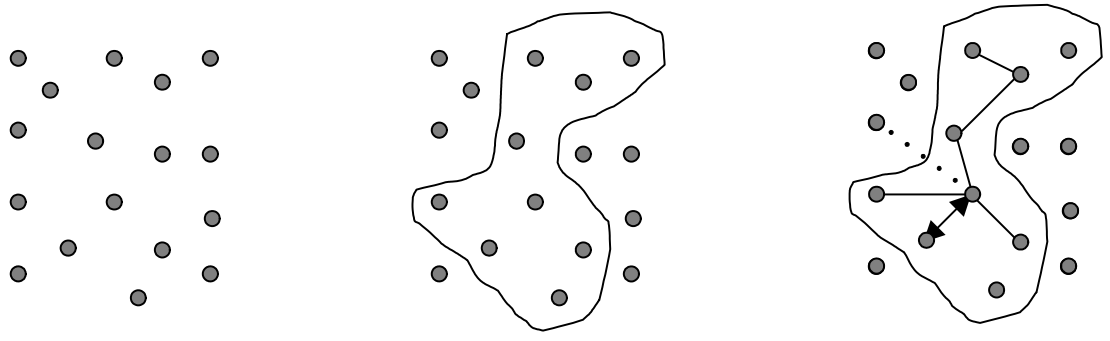


Figure 4 - Integrated Model of VO's [42]

A *Universe of Modules* may contain organisations, groups, or individuals with similar or completely different objectives, strategies, competencies and resources. The possibility of a module to exploit a market opportunity depends heavily on its relative strength compared to other modules. All modules are potential participants of VO's that may be established at some point in the future based on market needs.

A *Dynamic Web* is a form of alliance among modules that work together for the accomplishment of various tasks and the establishment of a potential VO. At this stage, specific market needs are analysed and some modules agree for what purpose, when and how they want to co-operate. A dynamic web might be, for example, a set of organisations and/or individuals that work in the food industry.

Finally, a *Dynamic VO* is the co-operation within a subset of a dynamic web. Specific objectives and market needs trigger the establishment and operation of the dynamic organisation. It should be underlined that organisations outside a dynamic web might participate in the VO in special cases.

3.3.2 VO Life-Cycle Model

Apart from that, it is essential to investigate the life cycle of a VO in order to be able to decide on the necessary operations through each stage. The life cycle of a VO is divided in four distinct periods: Identification, Formation, Operation and Termination. Figure 5 provides a more detailed analysis of the periods:

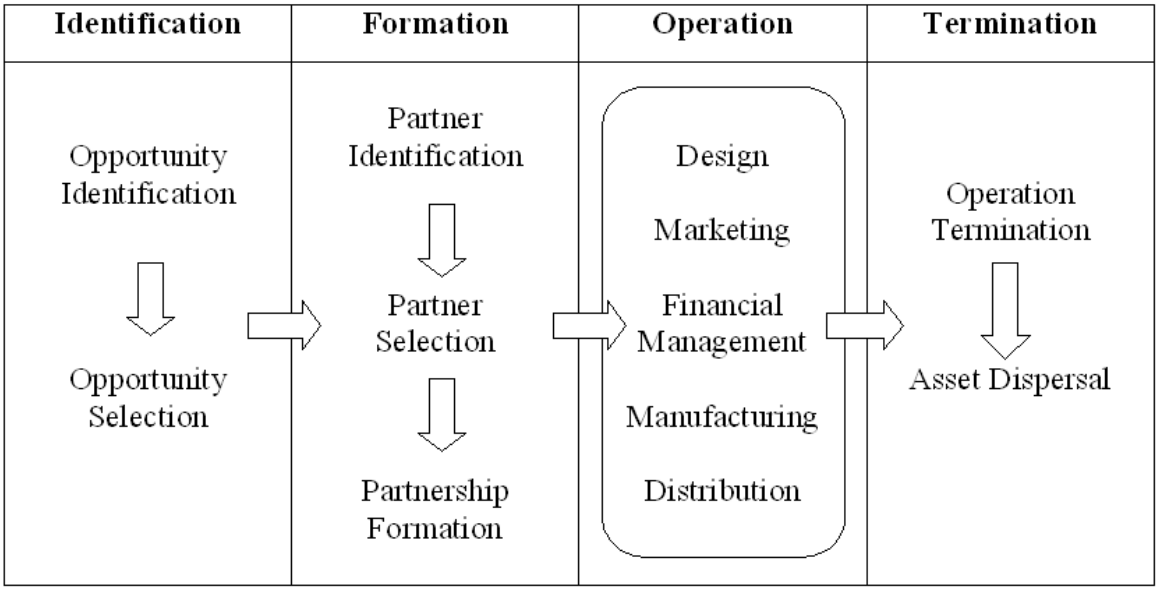


Figure 5 - VO Life-Cycle Model [51]

1. *Identification*. At this stage, the identification of potential market opportunities and communication to all organisations takes place. Of course, each organisation has the ability to identify opportunities itself.

2. *Formation*. After the opportunity selection, an agreement is made about which organisations will participate and the role assignment is conducted.
3. *Operation*. At this stage, all participants work towards a common target.
4. *Termination*. At this stage, a report is composed. Asset dispersal takes place.

VO's may be relatively stable over time or change dynamically. However, it is likely that an established cooperation remains virtually unchanged over a certain period. On the other hand, there are some cases where co-operation may arise on demand and thus have a much shorter life cycle. The latter case is representative of the LAURA project where it is given the name 'Request Based VO's (RBVO's)'. In the LAURA project, sharing and co-operation relationships can vary dynamically over time in terms of resource sharing, participants involved and the level of access to resources.

It is expected that the process of establishing virtual organisations might follow a two-phase process as described in [61]. The first one is the *development phase* where the concept "changes rapidly and is applied in a very specific or narrow form". The second is the *diffusion phase* "which is one of rapid spread where the form changes slowly if at all as it comes into routine use and is embedded in a social matrix (i.e. made widely accepted in the participating community)" [61. – pp547]. The diffusion stage appears to be particularly important and highlights the dangers for facilitators who seek to establish a virtual community without fully taking into account the users' perspectives.

3.3.3 Categories of Business Process Interaction

It is important to bear in mind most common types of business processes, when thinking about potential formations of VO's, since understanding of these processes is crucial factor for collaboration automation effectiveness. Processes can be grouped into three categories: process-to-process; person-to-process; person-to-person [63]. Figure 6 depicts these process categories around the axes of process complexity and process duration. Process complexity refers to how complex or simple a process is. A simple process may involve an application-to-application data transfer, such as an ERP transaction, while a complex process may involve several applications and people, such as a product development process. Process duration refers to the length of the process from start to finish. An ERP transaction typically involves simple data transformation and as such, is a short duration process. The product development process, on the other hand, can take months to complete.

The process-to-process category generally falls on the low end of process complexity and the short end of process duration. These processes are discrete and focused on data transformation. The goal is to get business objects from one application to another; the challenge is defining the business logic of transforming those business objects.

Transaction-centric processes are often defined by person-to-process interactions, such as individual validation of an automated task or resolution of an exception to an otherwise scripted process. For this reason, transaction-based process management typically involves repeatable processes with few variations between instances. It is usually state-

based, involving person-to-process intervention at specific steps, while the remaining steps are automated (for example, the credit approval process for loans).

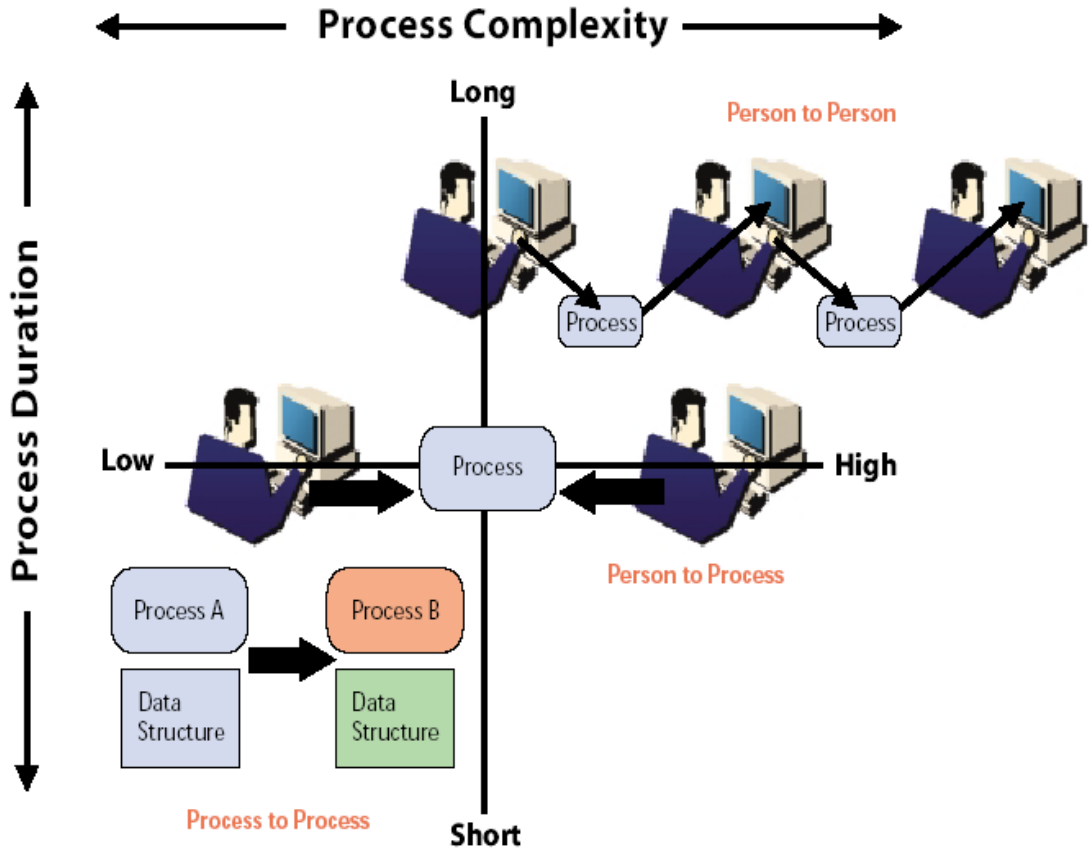


Figure 6 - Categories of Business Processes (from [63])

Finally, there is the person-to-person category of processes. In this type of process, people are connected for the purpose of collaboration. Collaboration can be process-driven or knowledge-driven and involve explicit or tacit knowledge. While resource scheduling may be more process-driven and based on explicit knowledge, actual business activity management is typically more knowledge-driven and based on tacit knowledge.

3.4 Variant Interpretations

As seen earlier, B2B e-marketplaces (***e-marketplaces***) are arguably a form of VO. When operating over the Web, these marketplaces potentially enable a large number of buying and selling business partners to interact more easily and cheaply than would probably be possible in the physical world [61]. In the case of SME's with their limited resources, e-marketplaces are expected to allow them to increase their market visibility as sellers, and gain access to a large and geographically diverse number of potential partners as both buyers and sellers. As transactions can be largely standardised and automated in e-marketplaces and the solution itself is easily scalable to match the growth of business,

this is expected to reduce costs for all participants, e.g. by aggregating supply and demand, reducing the need for direct sales forces, reducing costs of market research, etc.

Most e-marketplaces are understood to fit into either the horizontal exchange or vertical exchange moulds [53]. ***Horizontal e-marketplaces*** are usually aimed at supporting the trade of *highly commoditised* items (e.g. office supplies, electronics components, etc.) between a wide range of partners. Here, perfect competition is the order as there should be too many buyers and sellers in the model for any of them to influence price individually. It is also understood that the 'brand' of goods being sourced must not be a significant issue otherwise the buyer would have an incentive to exit the e-marketplace and seek a more favourable price directly with the seller. White's view [59] is that the crucial result is that the seller (whose margins are always under downward pressure through the need to reduce the *cost of transactions* embodied in the e-marketplace model) is increasingly motivated to defect to a model that focuses on *relationships* instead of bare transactions (i.e. they will seek to start collaborative-commerce). Thus, this seems to imply that the traditional e-marketplace model is fatally flawed in e-commerce as it continually undermines itself and may fall apart because of its own success in homogenising prices. Conceivably, sellers might even use the e-marketplace as a matchmaking tool to find and target buyers, and then transact with them collaboratively on the outside. White's view [59] with regard to horizontal e-marketplaces is that ultimately pricing and margins may become so eroded that no one would supply the commodity– although one could also argue that the exit of suppliers might cause prices and margins to recover.

However, White [59] believes that the trading of *differentiated* products on e-marketplaces means that collaborative strategies can be developed by participants to ensure that they *all* 'win' commercially. This is in contrast to the 'zero-sum game' embodied in models that trade commoditised products where one partner can only win at the expense of another. ***Vertical e-marketplaces*** tend to pertain to particular industries and usually support the trading of specialised and/or differentiated products between more close-knit partners where the 'relationship' between partners is of most importance – thus collaboration and the development of a VO may be a distinct possibility. When e-marketplaces are integrated with automated procurement processes and customer requirement management systems, then supply chain collaboration may take place between business partners that is closer to the view of the VO model presented earlier.

Tumulo [53] has noted that a typical problem faced by (all) e-marketplaces is how to balance the need for revenues (i.e. fees) to keep going, against the downward pressure on their fees that comes from the need for users to realise the cost-saving potential of participating. Thus a determinant of the success of an e-marketplace is its ability to attract a critical mass of suppliers to service the demands of buyers, and her conclusion is that the e-marketplaces most likely to survive in the long-term are those with backing from significant players in the industry.

3.5 Enabling Technologies

It was mentioned earlier that integration and automation of business partners is a necessary prerequisite for a VO to function effectively. The technologies that could be used to facilitate this will now be introduced and discussed in more detail. These are named and positioned relative to one another in the matrix shown in Figure 7 and discussed below.

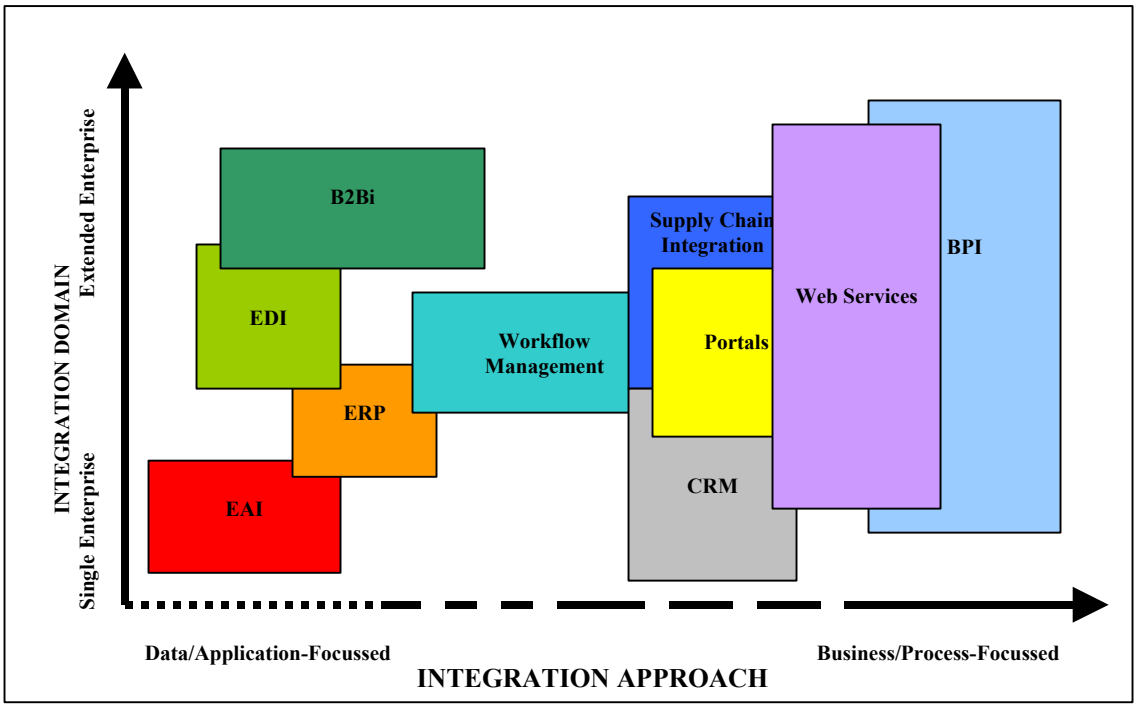


Figure 7 - Integration Solution Spaces (A Broad Classification)

3.5.1 EDI (Electronic Data Interchange)

EDI (Electronic Data Interchange) has been broadly defined as "corporate-to-corporate exchange of business information electronically between business partners in a structured format" [39. – pp186]. EDI is widely used in a number of industries where it enables users to integrate and share information, and thus it is concluded can largely support the development of a VO. However, it has been pointed out that EDI does not really improve or automate (or presumably integrate) business processes to effect real business changes, because it is "message-centric" (i.e. not 'process-centric') [50]. Furthermore, Vollmer [57] has stated that "there is a pressing need to connect 'smaller' trading partners to existing integration systems", in recognition that this was something EDI traditionally had not been good at doing. This is mainly because of the relatively high cost to a small company of investing in EDI technology [58], and is clearly a point of major relevance to the LAURA project where SME's are the focus. Thus, Vollmer [58] has also described the promise of emerging *Web-based* EDI systems that will improve the potential reach of

EDI to those who cannot afford a traditional private point-to-point or proprietary VAN (value-added network) link.

3.5.2 EAI (Enterprise Application Integration)

EAI (Enterprise Application Integration) tools were developed by vendors to mitigate the above problems by rapidly integrating data from a disparate range of applications and systems *within an enterprise's firewall*. A cost comparison by Bass and Lee [4] appears to have shown that despite the cost of the initial investment (hardware, licences, etc.) required to support a good EAI solution, the EAI route is usually much cheaper overall in the long run than custom integration. This is because a typical EAI tool has in-built enhancements (e.g. graphical user interfaces to assist in mapping the applications' interfaces, etc.) and flexible adapters that are capable of creating, maintaining, and (most especially) reusing application interfaces, which lead to increasing cost advantages over custom integration as initial and additional integration projects are undertaken. Therefore, it could be concluded that EAI tools are typically *data/application-centric* in terms of business integration, because they generally deal with data exchange issues and application interfaces at the data/application layer of enterprises, rather than say business process issues and layers. However, the downside is that using data/application-centric technologies to integrate enterprise applications usually requires the laborious and often expensive development and upkeep of many application programme interfaces (APIs) through extensive coding programmes.

3.5.3 ERP (Enterprise Resource Planning)

ERP (Enterprise Resource Planning) integration solutions became very popular in the 1990s when users saw them as resolving their integration issues arising from merger and acquisition (M&A) activities, globalisation needs, and the wholesale replacement of legacy systems as the Y2K problem loomed [6]. Embedded within a 'monolithic' software suite, their *inclusive EAI tools* worked at the data/application layer level to integrate with some success the back-office systems of manufacturing, human resources, and finance processes. However, they were generally recognised as less successful in integrating front-office systems like CRM and e-commerce applications, and SCM (Supply Chain Management) processes [40]. Although ERP vendors have been recently adding CRM and SCM functions to their products to sidestep these problem issues, it is believed that this has forced many of their clients into unwelcome vendor dependency. Other major drawbacks of ERP solutions included that for various reasons most enterprises found that they were typically very expensive and time consuming to implement and customise (as was often necessary to comply with bespoke business needs), and were also extremely difficult and costly to undo if required as they became very pervasive in the business [6].

However, it is believed that companies which attempted to integrate their internal data, and then their internal applications through using EAI tools and ERP solutions are now looking to develop an effective *outward-looking e-business strategy.* The latter not only optimises their internal integration, but can also leverage the competitive advantage opportunities that the Internet presents for supply-chain collaboration and enhancing

distribution to market. According to Skinstad [50. – pp4], EAI and ERP solutions were fine within their limited internally-focussed sphere, but were perceived by users to be lacking in viable solutions between the boundaries of companies due to their proprietary nature - especially in messaging technologies, platform support (J2EE, .Net, etc.), and their reluctance to deal with application changes. These inadequacies could make it very difficult for business partners to share their commercial information and integrate their business processes seamlessly to form an 'extended enterprise', i.e. a VO.

3.5.4 Workflow Management

Workflow management solutions also exist in the integration market to complement or enhance the functionality of EAI/ERP solutions in a business environment by bringing the integration of *people* into the equation. It is understood that the main difference is that EAI software automatically manages dataflow between disparate *applications*, whereas workflow management tools automatically manage dataflow and processes between *people* as well as applications (e.g. between company employees and their desktop/mobile device applications). Although workflow management tools are available as stand alone solutions, they are often integrated and synchronised into EAI solutions as seen in Figure 4. Here it is concluded that both can communicate and work together seamlessly to increase the customer responsiveness of the business, where human and application driven processes are often intertwined within the same overall business process e.g. where human intervention is needed in handling exception reports from computers [29]. Ultimately however, because workflow management tools manage workflow messages between people and/or applications, they are understood to be data/application focussed, and thus suffer from many of the vagaries of EAI/ERP solutions e.g. costly development and upkeep of many APIs, etc.

3.5.5 B2Bi (Business to Business Integration)

B2Bi (Business-to-Business integration) solutions using Web-orientated technologies and data-sharing standards can integrate the internal applications of disparate business partners to create an extended enterprise. However, like EAI/ERP and EDI solutions, B2Bi solutions are also typically data/application-centric [2]. This means that they too require the expensive development and upkeep of multiple application interfaces within and between disparate companies for an extended enterprise to develop. However, it is recognised that in their support, B2Bi solutions can leverage Web-based open standards to integrate many smaller traders, thus overcoming one of the main problems of traditional EDI. This makes these technologies potentially suitable for use as a general integration technology for LAURA trading partners.

3.5.6 BPI (Business Process Integration)

It is believed that the overriding problem of finding a new generation of *flexible* solutions that can also integrate disparate companies to form an *extended enterprise* has created the market demand and led to the recent emergence of ***Business Process Integration (BPI)*** solutions. Unlike the solutions seen so far (EAI & ERP, EDI, and B2Bi), BPI solutions are *business/process-orientated* because they integrate at the 'process layer' of a business

instead of at its data or application layers. Therefore, it is concluded that they have the upper hand over EAI, B2Bi, etc., because they are not usually thwarted in their aim of integration by the potentially ever-changing and rich variety of business applications and middleware that are linked to business processes. In addition, by integrating at the process layer, BPI solutions are understood to have an inherent flexibility that makes them naturally responsive to changes in the processes themselves. Moreover, as BPI is based on the interfacing of business processes - that are by their inherent nature often more stable over time than applications and the data flows between them – this is concluded to make it a mostly welcome and simple approach for internal and inter-enterprise integration for many firms.

It is believed that the process-centric focus of BPI has the great appeal of being able to move and manipulate information freely in the extended enterprise to organise business processes that will open up and leverage value chains through c-commerce, without paying undue concern and effort as to how the underlying applications can be technically integrated. For example, Schultz [46] has described BPI as the "additional independent co-ordination layer" needed that is non-invasive to the technological infrastructure. Thus, his definition seemed to emphasise one of the main features of BPI solutions by implying that the underlying applications can be changed on an ad hoc basis without significantly reducing the effectiveness of business integration. Karpinski [28] has described BPI as the practice by companies whereby they describe their 'key activities' (processes) - e.g. this is how we handle a purchase order, this is how we approve the workflow, etc. - "…and then design high-level, loosely-coupled interfaces into those processes". His definition could be said to emphasise the inherent flexibility of BPI solutions, which empower users to modify integrated processes with ease. These thoughts and definitions all seem to highlight the *internal focus* of BPI solutions relative to the enterprise. They can be summarised as meaning that a good BPI solution is middleware that would 'empower' an enterprise to manage its human and non-human processes accurately and efficiently give it the flexibility and agility to handle changes in its applications and processes at much lower effort and cost than using a data/application-centric solution. The latter would treat the same changes as a major revision or coding job within the enterprise's technical infrastructure.

Conversely, Ulrich's definition of BPI [54] seemed to emphasise its *external focus* by proposing that it is important to think of BPI as being an *inter-enterprise* project as well as an intra-enterprise one. He described it as being a business-driven (rather than a technology-driven) approach, which enables functional integration to take place across discrete business units and extends vertical process management into supply and distribution chains. In his definition, it can be seen how BPI in effect 'virtualises' user firms engaging in c-commerce by allowing previously segregated units to appear to collaborate as a 'single' virtual entity (i.e. the 'extended enterprise') by integrating their processes in the value chain.

Aubin [2] and Pinkston [37] have predicted that the current distinction between EAI and B2Bi solutions will blur as the integration market continues to evolve. They seemed to believe that the growth of VO's and the appeal of c-commerce to traders would eventually

make it imperative for most companies to integrate their applications and systems both within *and* beyond their firewalls.

3.5.7 Enterprise Portals

Enterprise or corporate portals (they will simply be called 'portals' from now on) provide users with Web-enabled access to multiple resources on the extranet or corporate Intranet presented on or through a single desktop or mobile device screen. Portals focus user access to these resources (e.g. disparate applications, information from various internal databases and other external sources, etc.) on to a *single page* that the user can *customise* to present the information that they consider most relevant to do their job, thus creating an experience centred around their needs. At the desktop or mobile device screen, this integrated information and resource access also helps to give users a real-time holistic view of their world that would otherwise be fragmented and obtainable only with some difficulty from disparate sources. Typically, this view is presented through a Web-browser whose widespread familiarity and ease of use would be expected to increase users' productivity and reduce their training needs in handling information and access to resources. Therefore, it is concluded that the main difference in the approach to business integration between a portal and the other solutions seen so far is that a portal generally does *not* integrate applications or processes themselves; it simply integrates *access* to them by presenting this in a friendly and convenient way to users.

From the above, it can be clearly seen why organisations have also been attracted to portals as a key integration solution that can help them to manage *information overload* from the point of view of their Web-enabled employees - who now generally have to interact with ever more applications and sources of data [49]. End-users can use a portal to aggregate and present personalised views of these on their own screens, and so manage the effectiveness of information and their own productivity.

Portal tools are also useful as business integration solutions that can give Web-enabled front ends to legacy applications [49] - thus extending the business life of legacy systems and avoiding or delaying their wholesale and costly replacement.

Intuitively, it would be expected that a firm could give its suppliers and clients direct access to its portal, and its portal could contain embedded links to the portals of other partners in the supply chain. The beneficial result could be to create an integrated network of information and services that could support a VO and e-commerce, where as far as users would be concerned, the boundary between internally and externally sourced applications and services would have faded dramatically. Moreover, by using a portal to integrate its business information with its clients and suppliers, it is believed that a firm can also open opportunities to improve its CRM and SCM processes e.g. some global delivery companies provide a portal to their clients to track and check the delivery of items.

3.6 Case Study Issues

Henriksen et al [24] have attempted to identify the issues that help to drive the adoption of B2B e-commerce. Their survey of various industrial sectors in Denmark indicated that there was a complex interplay of assorted determining criteria that were similar for companies of different size – *i.e. they were apparently the same across the full spectrum of companies, including SME's*. They found that the primary drivers were related to a) *market & power issues* – e.g. the prevailing state market competition, regulations, and uncertainty, etc.; and b) *soft organisational issues* – e.g. employees' readiness to accept change, top management drive, etc. Rather surprisingly they found little evidence that *technical issues* (i.e. those that might lead to gains in business efficiency and effectiveness) played an important role as drivers to adopt B2B e-commerce, although they also acknowledged this finding was controversial and required further investigation.

When looking more specifically into the needs of SME's in Europe Milopoulos et al [36] have found in the context of market and power issues that the *'local' environment* (i.e. provincial and industrial sector variations) is more influential and specific driver in predisposing SME's to adopt e-commerce than simply the general business environment. They also reported that SME's were generally hampered in adopting e-commerce solutions by their lack of awareness of intended benefits and hence their ability to engage in e-commerce effectively. They were also held back by their general lack of specialised (technical) skills, and their relatively low resources that make them avoid long-term investment strategies – although it has also been argued that because of their relative sizes SME's are more adept and nimble in exploiting newer technologies than large companies [39]. Thus Milopoulos et al [36] have concluded from their findings that SME's will need great support and encouragement (e.g. from regional facilitators/support centres, technology providers, etc.) to adopt e-commerce strategies, especially in the early stages of engaging in e-commerce.

3.7 Change Management

Caldeira & Ward [12] undertook a detailed examination of European SME's (Portuguese manufacturers) to identify and understand the factors that influence how successful they are in the adoption of IS/IT. Their findings indicated that there were two specific factors that heavily determined success. These '**Determinant Factors**' were a) the *perspectives and attitudes of top management (i.e. CEO or owner) towards IS/IT adoption and use*, and b) the *development of in-house IS/IT knowledge and skills*. It should be noted that both of these factors were positive in their effect and are 'internal properties' of the SME firms and thus are presumably well within their sphere of control. The Determinant Factors can be thought of as prime factors that are essential for SME's to address immediately to improve their chances of success. In the case of a), the most successful examples of IT/IS adoption and use in SME's occurred when the CEO (or owner) was directly involved in decisions as the 'IS/IT champion' and for example could give the leadership/drive/vision as well as overcome internal resistances or stakeholder conflicts. The in-house development or possession of IS/IT knowledge and competencies (or ready access to others with these) was found to be a great advantage to SME's as it helped them

for example to understand the overall capabilities of IS/IT and implement it effectively, and to communicate their needs and liase well with IT vendors.

As will be seen from the above, there are other factors that could easily influence the success of IS/IT adoption and use by SME's, e.g. internal resistance to IT use, effectiveness of dealing with IT vendors, etc. Caldeira & Ward have termed these as '**Consequential Factors**' because of their 'secondary' influence on the success of IS/IT adoption and derivation from the Determinant Factors. They also identified **'Situational Factors'**, i.e. background factors that although they influenced the level of IS/IT adoption and use, did not themselves fully explain the degree of success achieved. A broad framework listing the contents of all the three types of factors and the way they interact to influence the level of success of IS/IT adoption and use in an organisation is shown in Figure 8:

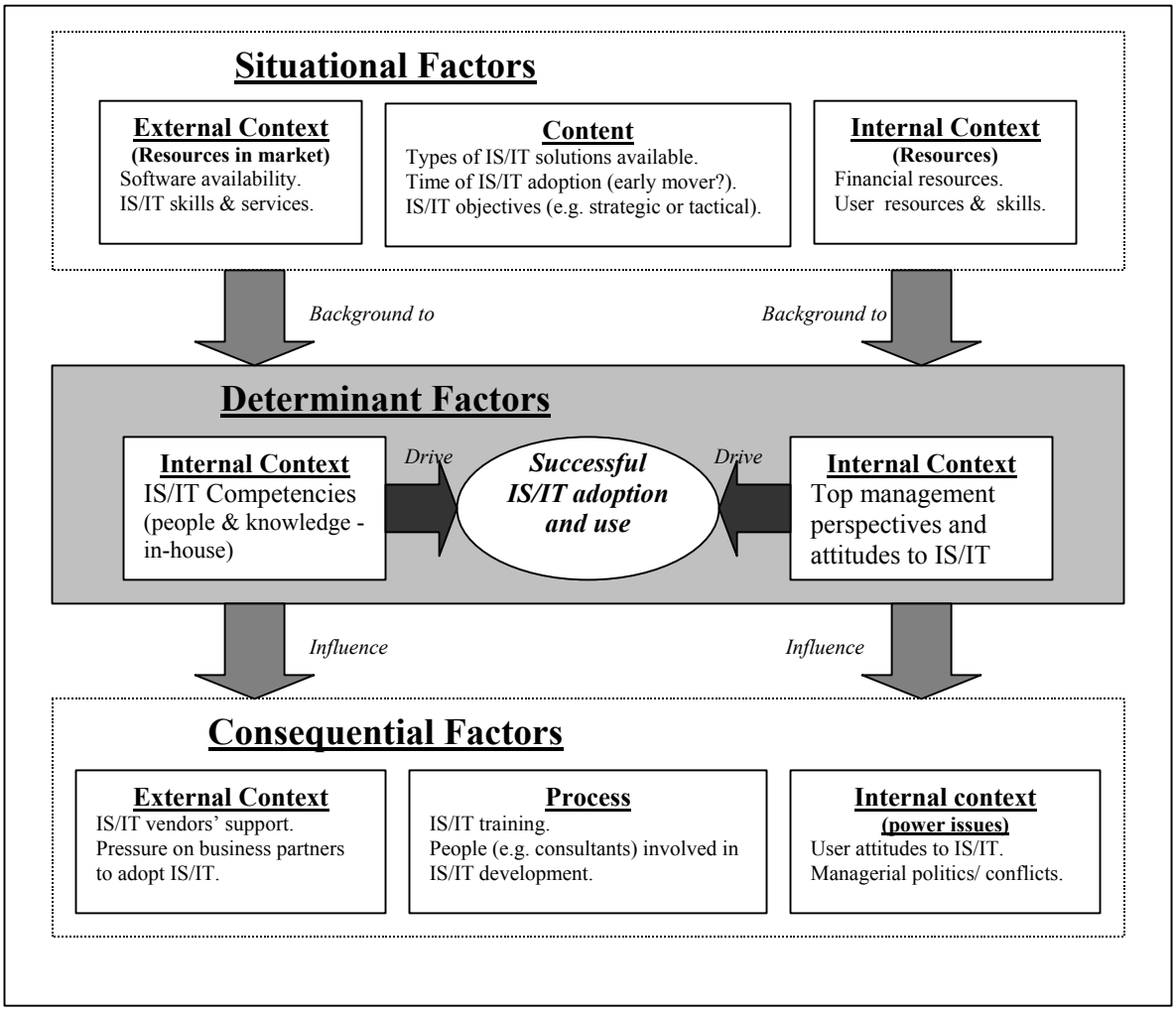


Figure 8 - Possible Relationships Amongst Factors Affecting IS/IT Adoption and Success (adapted from [12])

In relation to the LAURA Project, the main conclusion to be drawn from the work of Caldeira and Ward is that it is essential for the facilitators and other influential

stakeholders to concentrate on making sure that the Determinant Factors are in order within each potential business partner. This should help to ensure that the long-term change in working practices and trading relationships that the establishment of a VO entails could take place most smoothly and successfully. Dealing directly with the Determinant Factors would also have a secondary and positive effect on the Consequential Factors that should compound the initial successes. However, the Situational Factors seem to be pre-given - related largely to the local region and market involved - and might require the use of tools at a regional political level to influence them if necessary. A closer look will now be taken at some of the general issues that might be involved in operating the change management programme.

3.7.1 Security and Privacy of Information

Trading partners in the extended enterprise also need to consider issues related to the security and privacy of Web- and wireless-based transactions and data. There is a strong business case for adequate security, including protection from financial damage and a subsequent loss of market reputation [19. – pp29-32]. Moreover, the issue of maintaining transactional security in the Internet public domain seems to be widely considered as a major concern [10][22][23], and various resolutions e.g. XML digital signatures, Web Services Flow Language (WSFL), etc. are currently being developed to overcome this problem [33]. Hence, partners would be recommended to review carefully their internal information, security, and privacy policies for weaknesses when integrating them with their e-business strategies – perhaps bringing them into line with ISO 17799. The review should also include proper configuration of their firewalls. Firewalls restrict the access of untrusted outsiders to each partner's internal IS applications. However, Ghosh [19] has indicated that there is an unresolved dilemma of how a firewall can be configured properly to carry out this role fully and yet let through SMTP (e-mail) and HTTP (Web) messages that are necessary for a VO to function. In other words how will the firewall distinguish between who is within the company and who is on the outside in the extended enterprise and beyond, when the borders between 'internal' & 'external' in c-commerce are fading anyway? Nonetheless, the conclusion is clear that by being integrated into a VO, each firm must accept new responsibilities to secure its data and information systems *as well as* those of its trading partners.

3.7.2 Strategic Implications

Bingi et al [6] believed that a company which implements ERP should consider the strategic implications carefully with close involvement of its top management because of the profound impact that the solution may have on its competitive advantage. Their view could also be extended further to cover most integration solutions. For example, a company, which intends to implement a BPI solution, will need to rethink substantially its own business processes based on whether they can be integrated logically and successfully on an internal basis and/or with other companies' processes in the value chain. These considerations would also include the cost of operating and managing the processes; whether the processes exploit its core competencies; the strategic need (if any) to continue to own the processes; and its ability to make the processes secure and protect any of its intellectual property rights. The result could be that its internal business

processes might need to be *re-engineered* to integrate with its e-commerce or c-commerce strategies so that it can attain the optimum commercial benefits. Furthermore in externally–focussed solutions like BPI or SCI, it is understood that some processes might have to be redistributed to other partners in the value chain to take advantage of their core competencies or lower cost-base. This should lead to the legal issues being considered e.g. how to manage power imbalances and conflicts in the supply chain and how to share the benefits between trading partners [15].

3.7.3 Partnership Dependency & Trust

Virtualisation of companies to form a extended enterprise means that if one partner (e.g. a manufacturer, an application service provider, etc.) improvises or fails a process execution, then the whole network may break down because all partners are taking part in the same overall logical business process. For example, Bingi et al [6. – pp11] described how "the ripple effect of mistakes in one part of the business unit pass on to the other departments in real time" when a company has been integrated internally by an ERP solution. This risk of greater dependency and the need for trust is anticipated to be a general one that comes with *tight* business integration whether it takes place internally in a company or within an extended enterprise.

3.7.4 Business Disruption

During the time taken by a company to complete a BPI project, it will generally be more exposed to business risks and a continuously changing technological environment *whilst* its internal processes are being re-engineered or integrated in the meantime [16]. It can be presumed that other business integration solutions can also lead to processes being re-engineered and so it can be concluded that the same risks seem to apply to these too. Furthermore, the company must be capable and willing to devote much of the time of some of its best staff to the project for it to be implemented successfully irrespective of whether processes need to be re-engineered. It could be concluded that in all cases, the company's project management capabilities and its ability to deal generally with disruption will be highlighted, as will be the impetus from the project sponsor or top management. It will also need to be adept at relating to its trading partners, e.g. managing the migration of its suppliers and clients smoothly to the new e-commerce delivery channel, and handling their objections thoughtfully.

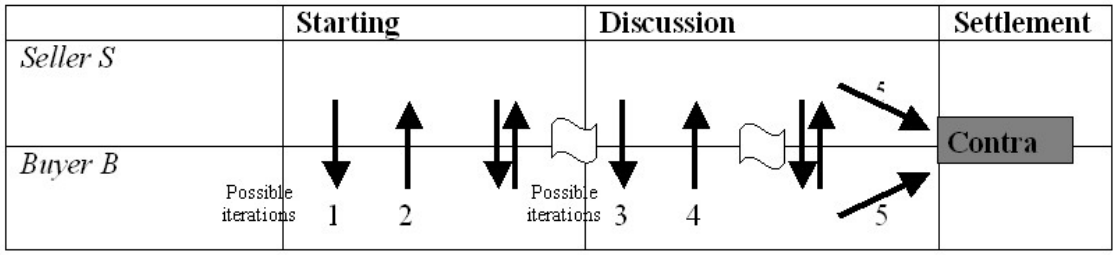
3.8 Electronic Negotiation and Contracting

Electronic contracting focuses on *negotiating* the terms and conditions of contracts [3]. *Negotiation* is clearly an interactive process and can be defined in the context of e-commerce as "the process by which two or more parties multilaterally bargain resources for mutual intended gain, using the tools and techniques of electronic commerce" [3]. In technical terms, 'negotiating' can be thought of as being a discussion between a number of parties that will result in an agreement between them or an abort.

Negotiation can be carried out 'virtually', as in a VO through using IS/IT as a tool. The process itself will involve the interaction of economics, software engineering, computer

science, and telecommunications disciplines as well as a strong consideration of legal issues for forming contracts. Ayed et al [3] have decomposed the B2B negotiation process into three distinct stages: Starting, Discussion, and Settlement. The full process and stages are illustrated in Figure 9. Clearly, IT tools can be employed to complete on-line the work embodied in the arrows.

An *e-auction* is expected to have a different negotiating process from that of B2B as it involves three parties (buyer, seller, and auctioneer). Nevertheless, Ayed et al [3] have identified the same three stages of negotiation here as well.



1 Offer or invitation to make offer
2 Generation of an alternative offer by B
3 Offer or invitation to make an offer
4 Creation of alternative offer by B
5 Transformation of the offer into a contract

Figure 9 - Negotiation Process in The Context Of B2B (From [3])

It is understood that IT and telecommunications tools that support *synchronous* negotiation should be used as these can provide a real-time interactive experience for the negotiating partners. Other essential requirements for the technology to support the negotiating process are believed to revolve around maintaining guaranteed security of the information/communication flows and include: *authentication techniques* (e.g. electronic certificates, etc.)*; mechanisms to maintain the confidentiality of data and negotiations;* and *non-repudiation mechanisms*. Furthermore, *tracking services* for record-keeping, *notification & acknowledgement services,* and *system performance measurement services* will probably be needed, and there is room for third-party provision here – i.e. these services need not necessarily be carried out by the negotiating partners themselves.

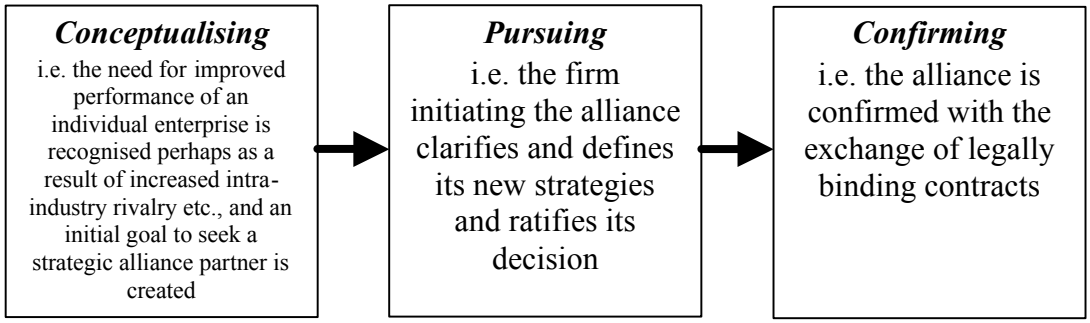


Figure 10 - Partner acquisition process (from [15])

Ferguson [15] looked closely at the issues involved in creating strategic alliances between potential business partners in a VO/ extended enterprise, i.e. partner acquisition. He

identified the partner acquisition process as being composed of three stages, as shown in Figure 10.

3.8.1 Service Level Agreements

In its most basic form, a service level agreement (SLA) is a contract or agreement that formalizes a business relationship, or part of the relationship, between two parties. Most often, it takes the form of a negotiated contract made between a service provider and a customer and defines a price paid in exchange for an entitlement to a product or service to be delivered under certain terms, conditions, and with certain financial guarantees.

The concept of SLAs in the LAURA project is present in "invisible" Request-Based Virtual Organizations (RBVOs) that lack of any physical structure. This type of Virtual Organizations (VOs) exists only on the Internet, selling its products as files, which the customer downloads, so that no physical product is involved. Those companies use alliances with their product suppliers, they are displaced in that one visits them from anywhere in the world, and they are invisible in that there is no physical structure viewed by the customer. SLAs in "invisible" RBVOs are necessary in order to provide a method of monitoring performance and measuring. This will help in managing and improving the service quality in both intra and inter-enterprise operations among a collaborative network of enterprises.

In many e-commerce contracts, the service provider agrees to guarantee a certain level of Quality of Service (QoS) for each class of service, and in return, each business agrees to pay the service provider for satisfying the QoS guarantees in serving its set of customers. Those contracts are based on a Service Level Agreement (SLA) between each business and the service provider that defines the QoS guarantees for a class of service, the cost model under which these guarantees will be satisfied, and the anticipated level of per-class requests from the customers of the e-business.

The SLAs specified for the e-commerce sites define different classes characterized by specific Quality of Service (QoS) requirements. Most QoS guarantees are based on availability and throughput (delivery success), or, to a lesser extent, average delay measures. However, a critical issue for e-commerce applications and services concerns the efficiency with which the differentiated services are being provided, as delays experienced by customers of a business can result in lost revenue for that business.

Per-class SLAs usually have clauses where the service provider gains revenue for each request satisfying the per-class SLA, and incurs a penalty for each request failing to do so. Hence, in order to maximize profits, one needs to pay attention to resource management issues, so that customers can be served according to the restrictions defined in the SLAs.
In the telecommunications industry, SLAs are contracts that specify the performance parameters within which a service is provided. As such, the SLAs define such parameters as the type of service, data rate, and what the expected performance level is to be in terms of delay, error rate, port availability, and network uptime. Response to system repair

and/or network restore procedures also can be incorporated into the SLA, as can penalties for non-compliance.

At a minimum, a *paper-written* SLA should contain the following components [73]:

- Background: This section should contain enough information to acquaint a non-technical reader with the application.
- Parties: This should include the responsible party within IT and within the business unit and/or application user group.
- Services: This section should quantify the volume of the service to be provided.
- Timeliness: This section should provide a qualitative measure of most applications to let end users know how fast they can expect to get their work accomplished.
- Availability: This section should describe when the service would be available to the end users.
- Limitations: This section should describe the limits of the service to be provided, for example during conditions of peak period demand, resource contention by other applications, and general overall application workload intensities.
- Compensation: This section should put teeth into the agreement for both parties using some form of compensation and/or penalties for non-compliance.
- Measurement: This section should describe the process by which actual service levels will be monitored and compared with the agreed upon service levels, as well as the frequency of monitoring.
- Optional services: Provides for any services that are not normally required by the user, but might be required as an exception.
- Administration: Describes the processes created in the SLA to meet and measure its objectives and defines organizational responsibility for overseeing each of those processes.
- Renegotiation: This section should describe how and under what circumstances the SLA could be changed to reflect changes in the environment.

Service Level Agreements (SLA's) can detail the responsibilities of an IT services provider, the rights of the service provider's users, and the penalties assessed when the service provider violates any element of the SLA. An SLA also identifies and defines the service offering itself, plus the supported products, evaluation criteria, and Quality of Service that customers should expect.

There are 3 types of Service Level Agreements (SLAs)

- In house: Those are agreements negotiated between the service provider, such as an IT department, and an in-house user department.
- External: Those are agreements that any company purchasing services such as IT from an external provider cannot be without. This type of SLA is a legally binding contract.

- Internal: Those are usually informal agreements within a department for achieving certain performance goals, and for measuring performance in achieving these goals.

There are 3 main aspects of Service Level Agreements:

- Legal: Provides for the negotiations between customer and service provider about the legal aspects of the contract.
- Operational: Provides for the execution of the services under the SLA.
- Financial: Provides an assessment of the financial implications in the SLA.

SLAs can follow a life cycle, which includes the following phases:

- Product/Service Development: Templates and entitlements are developed.
- Negotiation & Sales: Contracts are negotiated and executed.
- Implementation: Service orders are generated and provisioned, and SLAs are monitored.
- Execution: SLA performance is monitored, operated and maintained.
- Assessment: Performance is assessed and templates are reassessed. This final step may serve as an input to the first step (Product / Service Development)

A company could decide to implement different levels of Service Level Agreements according to the needs of the customer and the financial gains. Those levels could be for example Platinum, Gold, Silver, Bronze, etc.

The ebXML language incorporates Service Level Agreements (SLAs). The minimum set of SLA properties that have to be defined is as follows [79]:

- Time to Acknowledge Receipt
- Time to Acknowledge Acceptance
- Time to Perform
- Authorization Required
- Non-Repudiation of Origin
- Non-Repudiation of Content
- Non-Repudiation of Receipt
- Retry Count
- Confidential Transport Required

Additional SLA properties for consideration include, but are not limited to: Authentication Required, Digital Signature, and Encryption.

3.8.2 Electronic Negotiation

Given the increasing zero-sum nature of competitive markets on the Internet, one is primarily interested in the magnitude of conflict in business negotiations. There is an important distinction between *distributive* (high conflict) bargaining in which parties bargain over a fixed pie, and *integrative* (low conflict) bargaining in which parties may

"expand the pie" through problem-solving, creativity, and identification of differences in priorities and/or compatibility of interests [69]. One can identify four issues associated with a purchase agreement: unit price, purchased quantity, time of first delivery and warranty period.

In *distributive* (high conflict) negotiations, the four issues are weighted similarly for buyer and seller. Price is given the most weight, followed by quantity. The two least important issues are delivery time and guarantee period.

In *integrative* (low conflict) negotiations, the buyer's most important issue is usually quantity, followed by delivery time. The two least important issues are usually warranty period and price. For the seller, price is usually the most important issue, followed by warranty period. Delivery time and quantity can be seen to be the least crucial issues.

Past research and our common experiences, demonstrate that even in simple negotiations, people often settle on sub-optimal agreements, thereby "leaving money on the table". To this end, information systems can help tremendously in supporting negotiation processes and improving negotiation outcomes by either assisting human negotiators or serving as negotiation participants. Information systems in the former case have been much studied in the area of Negotiation Support Systems (NSS) research, while those in the latter case are often referred to as automated negotiation software agents or Electronic Bargaining Agents (EBA). With developments in NSS and EBA research, there is now a significant opportunity for e-commerce technologies to help people and firms achieve superior settlements in multiple-issue, e-commerce negotiations.

The challenges of negotiation and the cognitive limitation of human negotiators have led researchers to pursue computer support of negotiations in the form of Negotiation Support Systems (NSS) [69]. By incorporating computer-based decision tools to assist negotiating parties reach an agreement, NSS offer the potential to enhance the analytically complex problem-solving process and help alleviate cognitive and socio-emotional stumbling blocks to successful negotiation.

Empirical research in NSS has indicated that NSS effectiveness is likely to be moderated by the type of negotiation situation or the amount of conflict between the negotiators. In particular, in integrative (low conflict) negotiations, compared to dyads with no computer support, NSS-supported dyads achieve higher joint outcomes and better contract balances (fairer outcomes). However, in distributive (high conflict) bargaining situations, comparable joint outcomes for both groups were found. Thus, NSS may not be particularly useful in distributive bargaining situations where negotiating parties tend to "split the difference" in coming up with a reasonably efficient and fair settlement by using a satisfying strategy. It has also been shown that negotiators using NSS achieved better outcomes than those using an e-mail messaging facility for negotiation.

There is potential for web-based Negotiation Support Systems (NSS) to benefit business negotiators involved in integrative (low conflict) remote decision-making activities by supporting alternative generation and evaluation as well as suggesting contracts that optimise values and make available joint gains. In view of the flourishing number of B2B

e-commerce portals, the inclusion of web-based NSS in such e-commerce portals can help remote buyers and sellers engage in more optimal and efficient multiple-issue business negotiations. The potential of web-based NSS is especially pertinent for online supplier-manufacturer and manufacturer-retailer/wholesaler dyads in industrial procurement negotiations.

Although powerful and effective, NSS still require near-constant human input and communications. Recent studies of autonomous software agents in distributed artificial intelligence and evolutionary computations have opened up new possibilities for automated negotiation in e-commerce whereby the negotiation roles of human buyers and sellers are performed by Electronic Bargaining Agents (EBA). Unlike NSS supporting human negotiators, EBA negotiation involves two or more EBA (employing artificial intelligence techniques) in a virtual environment governed by computational rules. Examples of computational techniques include a concession model that hard-codes a general strategy of concession in multiple-issue negotiations, a case-based reasoning to planning and support of negotiations, and artificial adaptive agents using a genetic algorithm-based learning technique. EBA have the potential to save human negotiators' time and find better deals in combinatorial and strategically complex settings.

Several implications for practical application of Electronic Bargaining Agents (EBA) can be drawn. First, using EBA saves time and efforts of human negotiators without jeopardizing the outcome of negotiations. Hence, EBA are suitable for supporting negotiations in e-commerce, which often take place across different time zones in a global, distributed manner. Second, the strategies of concession adopted by EBA have a huge impact on their performance. EBA developers should keep in mind the importance of bargaining strategies as well as their flexibility. Ideally, such bargaining strategies should lead to negotiation outcomes comparable to, if not better than, that of human negotiators assisted by Negotiation Support Systems (NSS) [69].

4 E-Commerce Services

4.1 Business Models

Timmers [52 -pp32] has defined a *business model* as follows:

- An architecture for product, service and information flows, including a description of the various business actors and their roles; and
- A description of the potential benefits for the various business actors; and
- A description of the sources of revenue

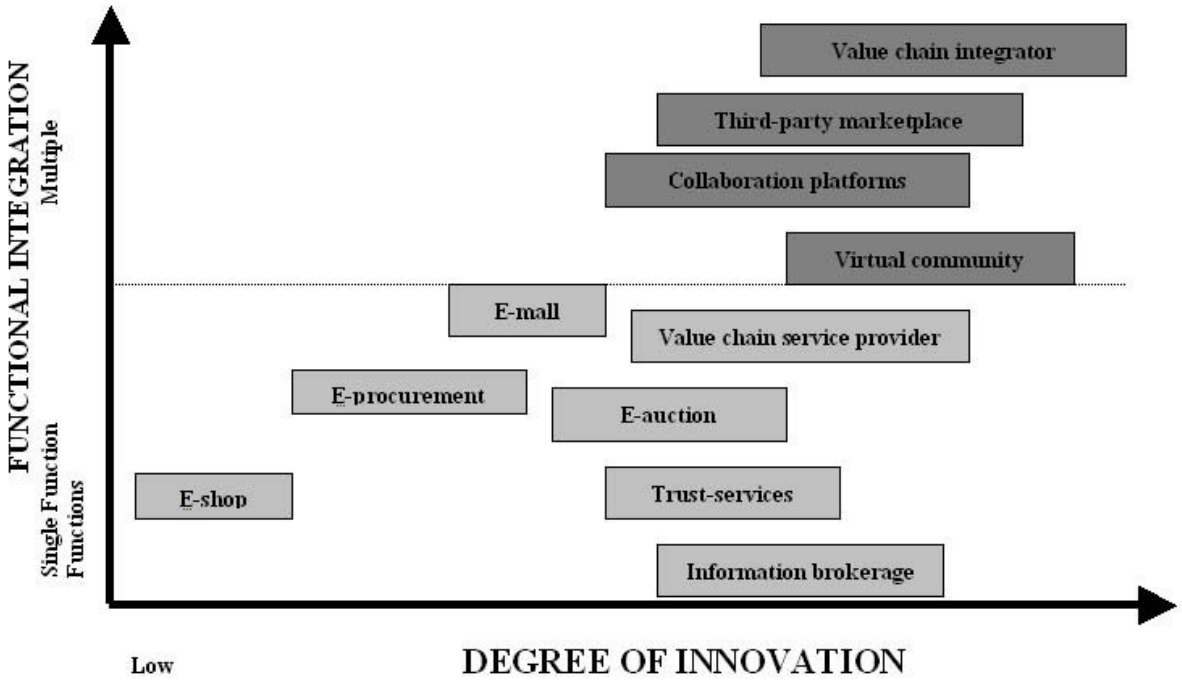


Figure 11 - A Selection of E-Commerce Business Models (Adapted from [52])

Based the above definition, Timmers [52] identified 11 types of business models based on Internet e-commerce. He distinguished them according to how they can be positioned on a two-dimensional matrix covering the 'Degree of Innovation' and the type of 'Functional Integration' they involved. These are listed and shown Figure 11, and range from e-shops "which are merely electronic versions of traditional ways of selling" to a value chain integrator which is "critically dependent on IT for letting information flow across networks and creating added value from integrating these information flows" [52 -pp42]:

- **E-shop**: simple Web site/presence seeking cost reduction in sales & promotion, additional outlet (seeking demand perhaps globally)

- **E-procurement**: seek cost reduction in sourcing, additional outlet (seeking suppliers)
- **E-auction**: electronic bidding (no need for prior movement of goods or parties)
- **E-mall**: collection of e-shops, aggregators, industry sector marketplace
- **Third-party marketplace**: common marketing front end and transaction support given by a third party for multiple businesses
- **Virtual community**: focuses on the added value of communication between members to share information that is not necessarily business-driven
- **Value chain service provider**: supports specific part of the value chain (e.g. logistics, payments, etc.)
- **Value chain integrator**: adds value by integrating multiple steps of the value chain
- **Collaboration platforms**: business process co-operation e.g. collaborative design
- **Information brokerage**: business information & consultancy
- **Trust services**: trusted third-party services

All of the above models are understood to be forms of VO as broadly defined earlier in this paper, however because of their differing stances on Functional Integration and Degree of Innovation, they present different implications as the potential bases for the LAURA concept of VO's. The **e-shop** and **e-procurement** models are very narrow and basic exploitations of the concept of VO's and their potential benefits, and are being widely used in e-commerce already. These models, as well as **e-malls** and **e-auctions** are also largely non-collaborative, being based around transactions between interacting parties rather than relationships and thus may suffer from the problems identified earlier by White [59]. The **value chain service provider**, **information brokerage**, and **trust services** models can be used as the bases of models for LAURA infrastructure institutions like the regional facilitators, banks, marketing services providers, authentication/certification authorities, logistics, etc. [see 36].

The remaining models (above the dotted line in the diagram) represent those that support collaboration and appear closest to the concept of a VO envisaged in LAURA. The **virtual community** is understood to be more of an 'add-on service' to the existing services of collaborating partners. The **third-party marketplace** seems to require a higher authority to organise and run it and Timmers has commented that it "strengthens local presence and geographic concentration, which can especially benefit small retailers" [52. –pp39]. The **collaborative platforms** and **value chain integrator** models are the models that most clearly support the establishment and running of an extended enterprise.

4.2 E–commerce Market Structure and Trends

4.2.1 Market for e-Commerce Solutions

4.2.1.1 Market Maturity

The advent of IT and Internet usage in the 1990s provide a new business paradigm and signified a more far-reaching and fundamental change than previous attempts had done. E-commerce has emerged as an integral part of business strategy offering a range of services and opportunities for electronic trading in the global marketplace [11]. As a global network, the Internet has the advantage of ubiquity combined with a low cost of operation and a user-friendly environment. Statistics reflect these developments; for example two-thirds of surveyed enterprises in the European Union (EU) had a connection to the WEB (68%) including a high proportion amongst SME's (67%) (See Figure 12). Moreover, in the more advanced regions of Europe, companies, and especially big enterprises, have adopted electronic commerce even more extensively.

Of course, the initial optimism of the mid 1990's for the use of e-commerce in the way that companies do actual business, proved to be very optimistic. Even though the usage of IT systems has spread into most European enterprises regardless of its size (more than 92% make use of computers (Eurostat, [6]), the global economic uncertainty has led the e-commerce market into a prolonged slowdown. Recent policy reports in the EU and in the USA mention that the take up of e-commerce has disappointed initial expectations and faces particular difficulties.

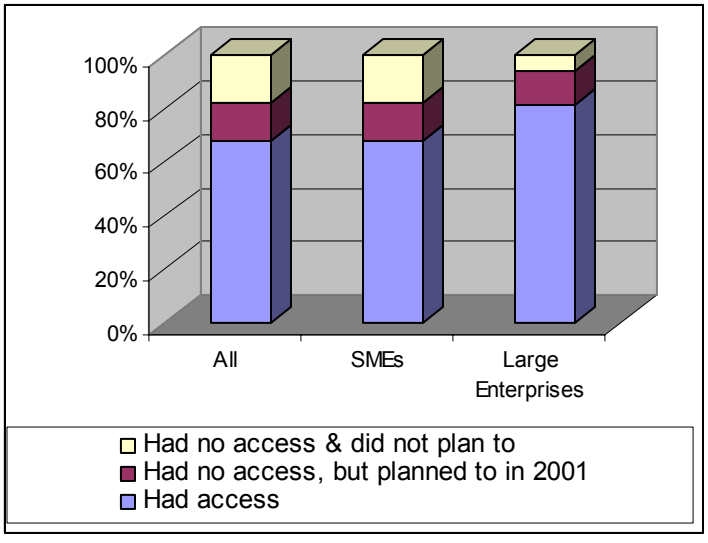


Figure 12 WEB access by enterprise size class, end 2000(e-Commerce database, Eurostat, [6])

One of the main reason, for this unexpected e-commerce lag is considered the placement of badly considered targets. In most of the cases, these targets were impossible to hit,

causing disappointment and discouraging investors [1]. However, the diffusion of new technology can take decades, and involves more than simply reproducing and distributing the technology [16]. However, this crisis in e-commerce businesses gave the opportunity for Europe to close the gap with the United States. Concerns in 1998 had centred on Europe missing out on the e-commerce growth which would have implications for the competitiveness of European economies which would suffer accordingly. [3]

4.2.1.2 Business-to-Business and e-Marketplaces

Nevertheless, the business-to-business (B2B) part of e-commerce did grow enormously, and accounted for the main share of electronic commerce. According to CAGR, the money volume of B2B exceeds that of B2C by about 10 to 1, with 149.1 billion € in 2001 for B2B in Western Europe compared with 22.5 billion € for B2C. [14]

Specifically, in the trading part of e-commerce, enterprises look to be generally more active in purchasing by electronic means than selling. While one-quarter of surveyed enterprises (26%) were using e-commerce (both via EDI and Internet) to purchase at least some of their goods and services, the respective proportion for selling falls to 18%. The above proportions are even less for SME's. In general terms, large enterprises are much more prone to engage in e-sales than smaller ones, as can be seen from Figure 13.

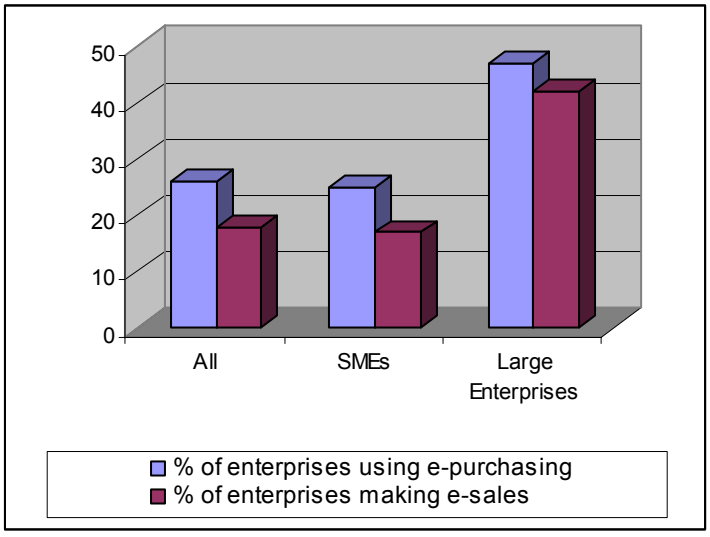


Figure 13 Use of e-purchasing and e-sales by enterprise size class in EU, first half 2001 (e-commerce database, Eurostat, [6])

An evolution of the initial forms of B2B application is the emergence of e-Marketplaces that could be described as a WWW site where a community of buyers and sellers make their trading transactions over the WWW. It allows buyers and suppliers to meet each other virtually and to trade. There are four types of e-Marketplaces:

- Seller-driven Markets, where the e-marketplace has been created by a consortium of suppliers or distributors in order to sell their products in this electronic market.

- Buyer Driven Markets, where the e-marketplace has been created by a consortium of customers, mainly of the same industrial activity, in order to buy the necessary products or services through the WEB.
- Independent Markets, where independent organizations undertake the task to create an electronic marketplace in order to bring together trading partners and provide a supportive platform for e-commerce.
- Technology Providers, where IT application providers develop an electronic marketplace, in order to sell the according services to customers or suppliers.

Based on global scale statistics (5), the independent type of e-markets preserves the largest proportion of the market as a percentage at 64% while buyer-driven markets follow with 29%, technology providers with 5% and seller-driven markets with 2%.

The reasons for independent market domination are due to factors such as:

- Providing flexibility to customers and suppliers
- Minimizing the risks in terms of investment for customers and suppliers
- Minimizing the functional and maintenance costs for customers and suppliers

At this moment, only a small percentage of the companies in the EU seem to participate (see Figure 14). Nevertheless, the predictions indicate great opportunities in this particular area of e-commerce.

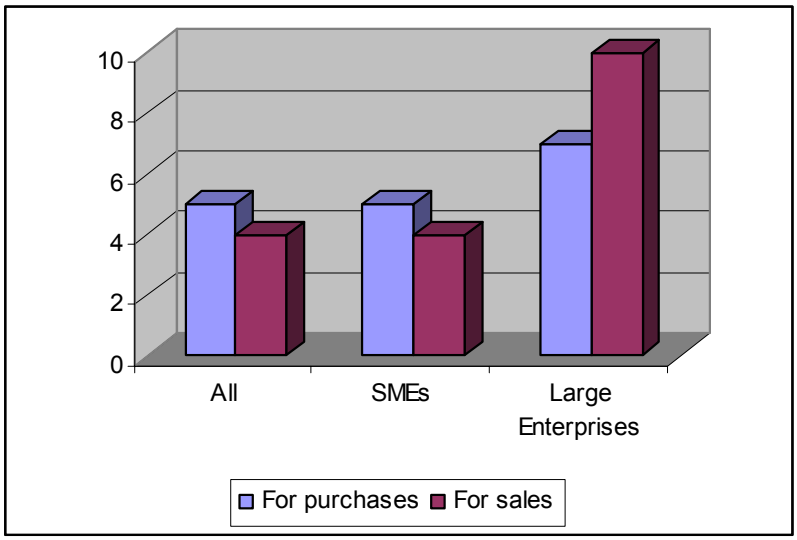


Figure 14 Use of Specialized B2B marketplaces by enterprise size class, first half 2001 (e-commerce database, Eurostat [6])

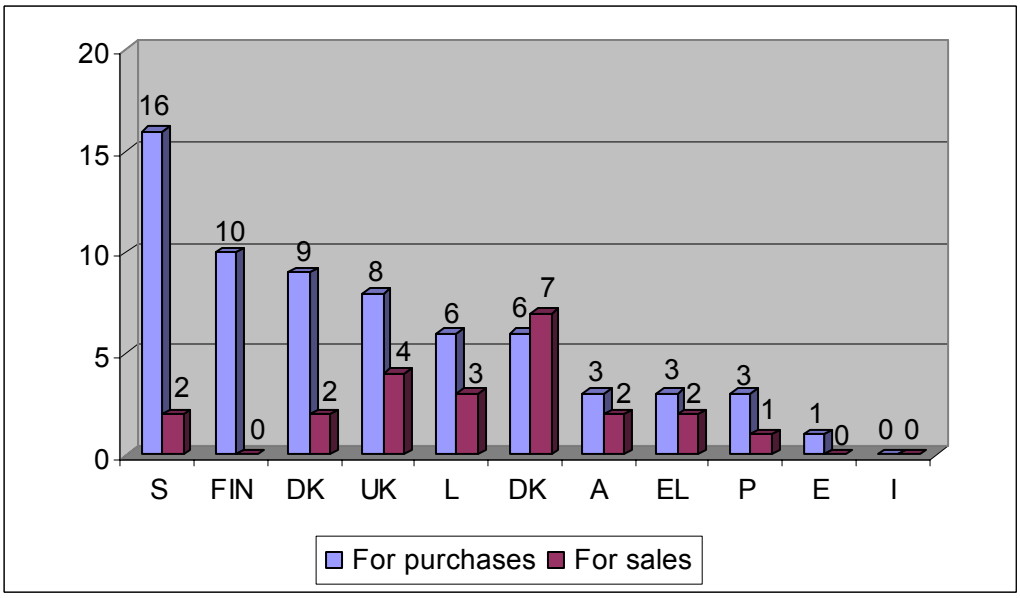


Figure 15 Use of specialized B2B marketplaces in the Member States, first half 2001 (% of enterprises using B2B marketplaces), (e-commerce database, Eurostat [6])

4.2.1.3 Market Penetration

The penetration of e-commerce has been different across European's countries. The European countries could be divided into three categories regarding the speed of e-commerce development in the European Union. This categorization follows the "digital divide" between the Nordic, the Western and the Southern European countries [1]. Specifically:

- **The Pioneers** – The Nordics: Finland, Sweden and Denmark are the most developed e-commerce markets and innovative leaders in global scale.
- **The Followers** – Western Europe: Austria, Belgium, Germany, Ireland, Netherlands, UK, France and these are the countries that follow the Pioneers and in some cases surpass them.
- **The Laggards** – Southern Europe: Greece, Portugal, Spain and Italy that have the slowest pace towards e-commerce in the European Union even though they have the opportunity to take advantage of the increasing maturity of technologies.

Beyond the regional factor, other factors that could differentiate the success of e-commerce introduction are:

i. **Different industrial sectors.** The most successful ones are those that are depending on the significance of the role of information exchange in their value chain. The level of e-commerce adoption by the major industrial sectors in European region can be visualized as in Figure 16.

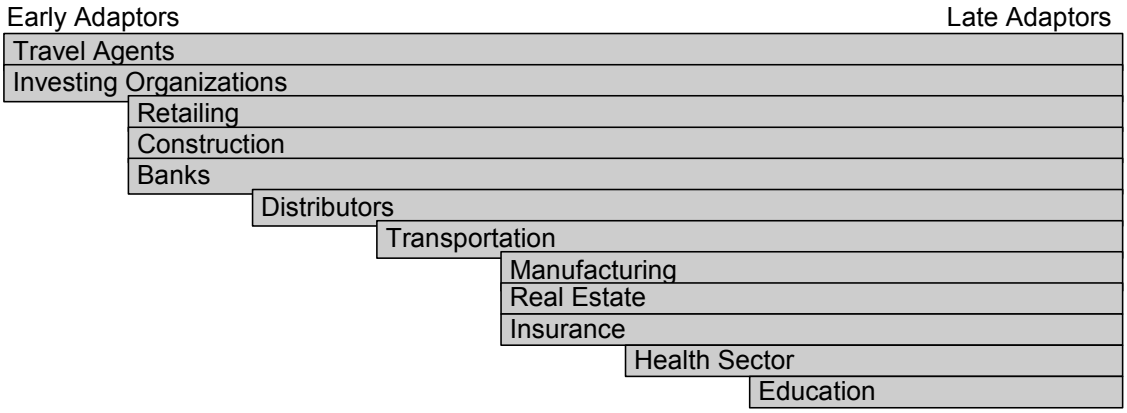


Figure 16 Adaptation Level of e-Commerce in the major European industrial Sectors (e-business Forum)

ii. **Size of the companies.** Small and medium enterprises (SME's) are facing more difficulties in adopting these technologies and moving to the stage where they consider e-commerce as an integrated part of their general business processes. In most of the cases companies provide access to the Internet for their personnel or they have a presence on the Internet through a static WEB site but they tend to be very hesitant to move to the next stages of e-business integration. This gap between the large organizations and SME's appears to be due to:

- Implementation cost. A company that intends to possess a functional WEB application that will cover its requirements and support its internal or external business processes would typically need to pay a considerable amount of money for implementation costs. This cost could be an important obstacle to such an implementation.
- The scarcity of human resources with the appropriate technical skills who will take responsibility to operate and manage e-business operation. This lack of IT personnel results in premium wages that the SME's often find difficult to afford.

For example, the German association for the Internet economy (Electronic Commerce Forum) mentions that the gap in e-commerce usage among the large enterprises and SME's is continually widening due to the lack of IT expertise and the limited capabilities of SME's to make such an investment. (4)

The LAURA project aims to provide help overcome these inhibitors by providing a supporting infrastructure for SMEs to take the next step forward with e-commerce.

4.2.2 E-commerce Inhibitors

In order to progress to the next of e-commerce evolution a number of inhibitors should be overcome. These inhibitors can be categorized as in Table 1.

Table 1 - Obstacles for conducting electronic business (Empirica [17])

Financial Bottlenecks	Customer Confidence Issues	Organization Issues
a) Increased pressure on margins as a result of increasing competition and price transparency b) SME's: e-business technology too expensive compared to economic potential / underestimation of launching costs c) Marketing expenditures to establish brand name d) Little or no decrease of transaction costs	a) Product not suitable for on-line purchase b) B2C-commerce concentrated in few product categories c) Data security concerns d) Attainability of new customers e) No implementation of CRM f) Supply of adequate services	a) Difficulties with the technological implementation and integration of on-line processes into "normal" operating procedures b) Lacking qualification of own staff c) Skills shortage d) Inexperience of management e) Lack of co-operation of smaller enterprises, e.g. for online procurement

Beyond the above three inhibitors, the social barriers should also be considered as an additional factor that could inhibit on-line commerce. Social barriers include:

- Lack of trust in information technology in general
- Cultural issues such as language problems
- Lack of knowledge about conducting business on-line and lack of IT skills of staff
- Lack of awareness about possible uses of the Internet

4.2.3 Effect of e-commerce to the public

4.2.3.1 Impact of E-Economy on Sectors

The impact of the e-commerce varies substantially from sector to sector. Information-rich sectors such as digital goods, information services, financial and business services witness the emergence of new business models and increased market competition. In industries where entry barriers are higher, such as construction and heavy engineering, the impact is likely to be more gradual. As a general rule, the more information-dependent sectors are, such as for example financial services and ICT products and services, the higher the cost reductions and/or productivity gains realised and the deeper the extent of organizational transformation. For sectors, which have already implemented efficient production processes and operate in a highly competitive environment (e.g. automotive), e-business represents an incremental change and additional efficiency gains, rather than a revolution.

Conversely, the more diversified the market structure of a sector, the greater the potential benefits from e-business. The textile industry, for example, with its highly fragmented structure, strong cross-border component, and rapid product rotation has been described as an ideal industry to benefit from e-business. Similarly, the tourism industry has been at

the forefront of Internet use. This has been characterized by existing players re-engineering their business processes and concentrating on added value services, and on the emergence of new Internet-specific players. Another yardstick for the extent of transformation brought about by e-business is the degree of specialisation of an enterprise. Highly specialised SMEs have tended in some cases to exploit the opportunities afforded by e-business to offer their products and services to new markets.

4.2.3.2 Price and Pricing Mechanisms

Electronic commerce technologies and business practices enable online stores and marketplaces to provide major innovations in pricing. Many are variations on pricing schemes that existed down through the history of commerce: barter, negotiated purchasing, bid-ask mechanisms, etc. Among the popular pricing mechanisms are fixed price, "name your price", and a variety of auction formats. Fixed price, sometimes based on terms and conditions, is standard in B2B. Auctions are very old market-making mechanisms that are now being used in B2B markets. Typically, auctions work by spatial matching, that is, either the buyer or seller bids against availability while conforming to a floor or ceiling price. Depending on the type of auction, prices can rise or fall from a designated point. Auctions enable efficient management of inventory and a means to secure revenue for unwanted or excess stock that cannot be easily sold through a fixed price mechanism. In a few commodity-like situations, dynamic pricing is beginning to play a role, adjudicating between demand and supply.

The ability to change prices and bring in different pricing mechanisms so support them is a significant innovation brought about by these new technologies. If there was ever any credence in using the term "new economy", it is in this area. Flexibility to adjust demand and supply to keep both in equilibrium are long sought after by economists. Flattening the value chain to allow vendors at the top-most end of the value chain to be closer to sources of demand, potentially adds enough visibility for each producer along the way to maintain inventories and adjust suppliers as required by those downstream.

4.2.3.3 Emergence of Services

One of the most interesting aspects of the Internet evolution is the proliferation of new and different services, so much so that the "service provider" label is now a standard part of the Internet vernacular. Starting with Internet Service Provider (ISP), we have seen the emergence of the Application Service Provider (ASP for networked application), Content Service Provider (distribute centralized content), Customer Service Provider (CSP), and so on. Fundamentally, the Internet allows merchants to expand value in modular and spatially distributed ways. Each module of service gives rise to a set of vendors specializing around that service. Thus, it is no longer necessary or even prudent to consolidate one's physical and human resources in company-owned and operated locations.

Growth of data centres mean that corporate servers can be located outside a company's IT centre, gaining several strategic advantages for both host and hosted. ERP software vendors foresaw the Web enabling wider use of their applications and expanding their

markets. Similar services are now available for desktop office applications, further reducing the burden of in-house IT staff. In addition, a variety of third-party marketing services are available, as well as services for customer satisfaction monitoring, sales contact management, affiliate recruitment, human resource management, etc.

Such services may be a very important to component of business models and enable the evolution of community and the automated handling of transactions and payments. Services touch on every aspect of electronic commerce, perhaps like in no other form of commerce. In many sectors of electronic commerce, the service providers may be analogous to those selling picks and shovels to miners.

4.2.3.4 Customer Acquisition

As with offline merchants, the holy grail of online commerce is to secure and retain customers. Any inability of online businesses to acquire paying customers successfully, and retain them, is at the root of instability and shakeout in the Internet space.

In B2C, the problem is simple: too many merchants for too few customers. Very few are good at brand differentiation. There are too many competitors in a small niche and this exacerbates low customer propensity to purchase, aggressive price reductions, and lack of organized shopping environments, all of which contribute to small revenue streams and low customer retention. Quite often company revenues barely meet customer acquisition costs, guaranteeing that increasing volume would not solve this problem.

Many B2B environments are linked to B2C, and they fare worse. In a sense, the B2B customer acquisition problem is opposite to that of B2C. Whereas in B2C a lack of stickiness is an issue, for B2B, established relationships often make customers *too* sticky. This leads to corporate reluctance to try new offerings, even if such offerings have higher value. It takes more effort to change established and time-proven corporate practices.

4.3 Market demand analysis

4.3.1 E-commerce Diffusion

The market scenarios for the commercial exploitation of LAURA outcomes will be determined accordingly to the factors that may affect the diffusion of e-commerce services. For this reason, a thorough research was conducted in order to identify the leading drivers identified by interviewing LAURA's probable users and by exploring the previous experience recorded in existing case studies and implementations. The goal is to ensure the LAURA final products and services will be in line with market expectations. The research activities have been focused mainly on business-to-business (B2B) e-commerce, especially electronic marketplaces.

In order to examine the drivers that influence the diffusion of e-commerce, we will classify them into two separate categories considering the type of assets that they may be associated to:

- Tangible Drivers (related to labour, capital, machines, etc.), and
- Intangible Drivers (related to business efficiency, enterprises' synergies, etc.)

4.3.1.1 Tangible Drivers

Generation of **additional revenues** is surely the most crucial factor for a small or medium enterprise to decide to enter into e-commerce business. The direct revenues could arise from:

- An expansion of the customer base: the company is able to reach new customers and establish presence in geographic areas and market segments that were previously unavailable. Using new marketing practices such as web-based marketing or by offering bundles of complementary products and services, a company can stimulate targeted trading partners promoting its products and services.

- Broader supplier base: the company has an opportunity to choose from a broader number of suppliers worldwide and consequently to increase its negotiation capabilities. Therefore, it could achieve larger discounts or search for the best possible offers.

- Cash flow improvement through electronic payment.

Briefly, e-business activities provide the opportunity for SME's to search for all possible revenue streams and identify the most optimal generating option.

An indirect way for increasing the company's revenue is through operational **cost reduction** achieved by applying emerging e-commerce technologies. In particular, e-commerce technologies allow companies to:

- Reduce the cost of processing orders because of processing time minimisation and the limited resource (mainly human resources) requirements.

- Reduce likelihood of mistakes (e.g. processing errors) through standardizing trading procedures and simplifying transactions

- Provide convenient methods for small transactions, with low overhands

In fact, as cost savings are considered a compelling motivation for enterprises to engage in e-business, the move from first generation applications, such as EDI, to second-generation Internet-based e-business applications is generally acknowledged to result in further cost savings [7].

4.3.1.2 Intangible Drivers

Efficiency gains: companies have an opportunity to exploit new and emerging synergies and channels and strengthen their position in the value chain. Until now it was difficult for them to find the right partners due to the lack of information, best practices and the ability to select the right business partners who will be flexible enough to market demand. Thus, SME's were reluctant to take advantage of the opportunities to collaborate with other SME's [9]. The trust building mechanisms that may be supported in a B2B e-commerce solution are a major issue for the future to overcome these obstacles.

Furthermore, the e-commerce solutions could optimise the supply chain performance via:

- Electronic transfer of information and transactions: e-commerce solutions are creating opportunities to improve all areas of trading services that are based on the transfer of information, by providing an increased speed and accuracy in the transmission of data (trading, engineering changes, etc.) throughout the value chain. They reduce information asymmetries between buyers and sellers through the supply of more up-to-date and comprehensive information.

- Streamlined inventory management.

- Streamlined supply chain structure by minimising intermediaries and enabling direct relationships with upstream manufacturers and suppliers.

Therefore, SME's could strengthen their core business and challenge their competitors. Of course, the truly optimised supply chain performance requires all the participants in the chain to possess the infrastructure to support these solutions.

Business model innovation: the unique characteristics of virtual markets (i.e., disappearance of geographical and physical constraints, possible reversal of information flows from customers to vendors, and other novel information bundling and channelling techniques) enable large-scale business model innovation. E-commerce offers firms the opportunity to uncover latent sources of valuable new complementary products and services into their business models in novel ways. [10]

Decrease of business risk: in a B2B e-commerce solution, a virtual trusted network of trading companies compliant to certain conditions and requirements could be established. Such a network will include only trustworthy business partners and their performance will be monitored on a regular basis. This kind of business environment could provide more security for trading transactions, minimizing related risks. There is also more security and predictability in inventory management, since supply comes from a broader supplier base.

Furthermore, a third party could undertake the task of providing quality-monitoring services, enhancing the quality control procedure in the whole value chain.

4.3.2 Companies Perspective

The above findings need to be compared with the perceptions of the European companies and with what they consider to be the actual benefits of e-business practices.

Based on Eurostat statistical data, companies in the European Union consider faster cycle time and simplicity of the trading procedures as the two major advantages of electronic WWW-based trading, while the cost savings come thereafter. However, cost savings could be achieved indirectly from the other benefits. This trend is common for most of the industrial sectors, suggesting that these benefits are not specific to any particular industrial branch. These results are summarised in Table 2.

Table 2 - Perception of benefits from e-purchases in the EU, first half 2001

Benefits	Percentage (%)
Faster processing	18
Simplification of tasks	16
Cost savings	13
Offers from a large number of suppliers available	9

Table 3 - Perception of benefits from e-sales in the EU, first half 2001

Benefits	Percentage (%)
Reaching new/more customers	14
Faster processing	11
Retaining market share	11
Expansion of market geographically	10
Simplification of tasks	10
Cost savings	9
Services quality improvement	9

Expansion of the customer base (reaching new customers and geographic expansion) is considered as the major benefit for the enterprises, while it is also considered as a reactive move to secure their existing market. Many enterprises consider faster cycle time of e-purchasing as one of the main e-commerce advantages.

4.3.3 Regional Information

In this section the following topics will be discussed:

- E-commerce status and perspectives in the LAURA participating countries (Bulgaria, Germany, Greece, United Kingdom) and regions
- General information about LAURA-related sectors - such as size, structure, main companies, etc.

This analysis was based on the results of surveys, conducted during the LAURA project or on information presented in third-party surveys.

4.3.4 E-commerce status in LAURA project countries

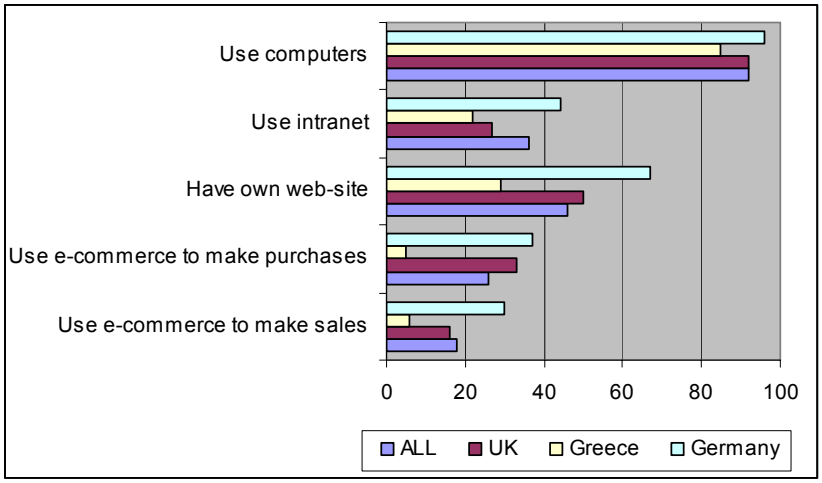


Figure 17 - Main Indicators for member states of EU, UK, Greece and Germany, Quarter 1 2001 (%), (e-commerce database, Eurostat)

Eurostat has published some important indicators and evidence of e-commerce adoption for all the European Union members and Norway. These indicators are presented for the three EU countries of the LAURA project in Figure 17. The sections below provide more details about e-commerce status in EU-member countries, participating in LAURA project.

4.3.4.1 Germany

B2B marketplaces attracted one in four enterprises selling on-line in Germany (7% of sales made), while only 17% of those are making e-purchases (6% of purchases made). The figures are lower compared to those in some other European countries.

Majority of these companies (30%) use e-purchases via the Internet only for placement of orders, while only a small percentage (6-8%) of them fully exploit the potential of e-purchasing via integrated payment and logistics-control procedures. Barriers for e-purchasing systems broad adaptation are considered to be:

- Uncertainty concerning contracts, terms of delivery and guarantees
- Limited stock of potential suppliers
- Uncertainty concerning payments
- Logistic problems (speed and timeliness of delivery)

There are similar trends for e-sales where enterprises are limiting their activities in publishing product and price information (26% - 21% accordingly) and receiving

customers' orders (22%) while only a small proportion expand their e-commerce practices any further.

4.3.4.2 Greece

Only 5% of Greek companies have implemented e-purchasing (this is the lowest rate in the surveyed countries) and 6% were selling on-line.

The numbers of purchases and sales that were conducted through e-marketplaces are 3% and 2% of the total purchases and sales, the lowest among the European Union countries participating in LAURA project. Based on a recent report (July 2002) issued by the e-Business Forum, a Greek governmental organization for e-commerce, there are six electronic marketplaces in the Greek region.

Companies themselves consider lack of trading partners (suppliers and customers) and security issues as the major obstacles to engage in e-commerce, while uncertainty about contracts, terms of delivery and guarantees are also considered as crucial issues.

4.3.4.3 United Kingdom

In general, e-commerce usage among enterprises in the UK is above the European Union average figures. Specifically, 33% of the companies have implemented e-procurement procedures and 16% were selling on-line. Similarly, quite popular is usage of e-marketplaces, as they attracted more than one-quarter of buyers and one-fifth of sellers.

As in most countries, uncertainties concerning contracts, terms of delivery and guarantees were seen as the most important barriers to e-purchasing, whilst costs of development and maintenance of e-commerce system was the main barrier to e-sales. However, in the latter case, it is interesting to note that a relatively high percent (39%) of enterprises in the United Kingdom were concerned about logistics, contrary to several other countries, where it was the least cited problem.

5 Technology

Technology support for e-business and e-commerce is complex and rather tricky – the field is new, the scope is vast, the pace of change is rapid, the variety of methodologies, techniques and tools is great. Luckily, there are some ongoing efforts, which can serve as reference points for building e-commerce systems. In this report, we will try to review the best practices, frameworks and systems patterns, in other words, we will try to chart a possible roadmap for e-commerce systems builders.

5.1 E-Commerce Frameworks, Architectures and Models

The use of electronic commerce - whether it is Business to Business, Business to Consumers or Business to Government - in an open environment is very much dependent on the correct application of common rules and standards. These rules and standards are often represented in Frameworks, Architectures and Models. The subsequent sections give an overview of e-commerce frameworks. For the most part, the CEN Workshop Agreement [96] is used as a reference point.

5.1.1 General Frameworks

5.1.1.1 The Biztalk™ framework

Microsoft's BizTalk initiative is aimed at facilitating and integrating XML-based business processes within and between organizations for supporting e-commerce. BizTalk technology consists of:

- BizTalk framework, which provides specifications for the XML-based messaging implementation – needed for the transmission of business documents.
- BizTalk.org web site, which hosts a library of BizTalk XML schemas (representing commonly used business documents), BizTalk framework specification and a forum for developer community.
- BizTalk Server 2000 for server side document transformation and routing.
- BizTalk Jumpstart Kit (JSK) for client side document execution and business logic application. The components of the JSK are anticipated to be included as part of final BizTalk product release.

5.1.1.2 CEN/ISSS Electronic Commerce Workshop 'Building Blocks'

The 'building blocks' of this model are specifically those required to build electronic commerce systems. The building blocks are technical functions in support of discrete business processes, which this model identifies. Therefore, this model covers the 'Trading' and 'Marketing & Sales' blocks of the Framework. It also addresses issues of interoperability for electronic commerce systems and certain aspects of the 'Legal' concerns, particularly Codes of Conduct.

Building blocks are derived from the sub-processes, which comprise the commercial activities of electronic commerce. They are defined as (electronic commerce specific) functions, which may be implemented as a discrete electronic commerce product or service. Three categories of building blocks are identified in relation to where the service or product 'belongs' (buyer, seller or the commercial/third party service) and its relationship with other building blocks.

Using the building blocks technology, two further basic concepts are defined - solutions, defined as the implementation of a building block (i.e. products and services), and solution sets, defined as a set of integrated products or services in which a number of implemented building blocks are being used together to provide a complete electronic commerce functionality.

5.1.1.3 ebXML Technical Architecture

The ebXML specification consists of a framework containing the following:

- Business Process Specification Schema (BPSS): This is an XML-based specification language that formally defines "public" business processes. It focuses on the collaboration of trading partners, and the business transaction activities they perform in the context of those collaborations. BPSS is strongly influenced by UMM, but does not require it.
- Core Components: Those provide the business information that is encoded in business documents that are exchanged between business partners.
- Registry/Repository: This is useful for more than merely conducting business searches. Some business scenarios depend heavily on registries to support setting up business relationships
- Collaboration Protocol Profiles (CPP) and Agreements (CPA): These are XML documents that encode a party's e-business capabilities or two parties' e-business agreements, respectively.
- Transport, Routing and Packaging: The ebXML messaging services provide an elegant general-purpose messaging mechanism. The ebXML messaging service is layered over SOAP (Simple Object Access Protocol) with Attachments, and can transport arbitrary types of business content.
- Security: This is a topic that is pervasive to all the components and is critical for a production e-business system.
- Architecture: The main concern here is e-business integration. This can be addressed at several application tiers in a multi-tier architecture model for software application, and can build on a variety of existing middleware technology. Practical B2B integration projects tend to cluster themselves around a limited number of patterns, or common solutions to common problems. These patterns show a progress towards increasingly capable middleware technology and are configured by declarative configuration languages rather than procedural programming interfaces.

The ebXML framework includes declarative, executable languages to express e-business collaborations (BPSS) and protocol profiles and agreements (CPP/CPA) in a non-proprietary, XML-based format. These specification documents can be shared and ported between compliant implementations. The ebXML messaging services complements these by offering a very capable standards-based e-business messaging system. Jointly, these can be used to configure and manage ebXML-based e-business message exchanges. The ebXML system overview is as follows:

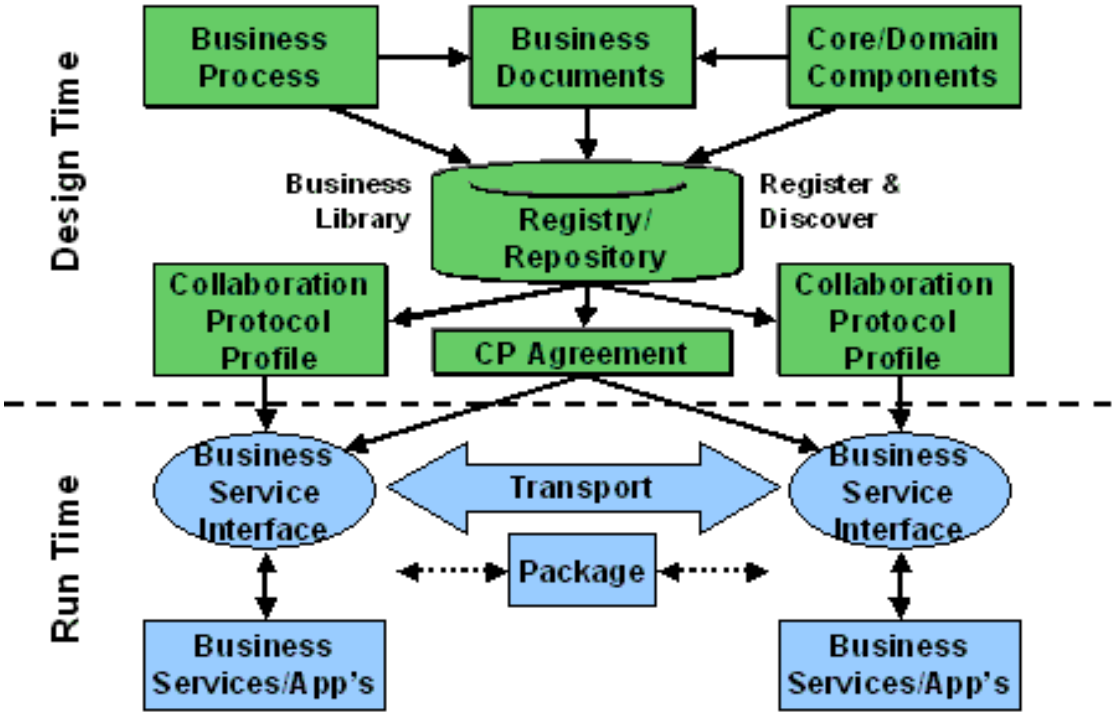


Figure 18 - ebXML Framework

As a collection of e-business infrastructure interoperability specifications, the ebXML framework allows horizontal or vertical standards bodies to focus on their specific needs, and obviates the need for them to develop proprietary solutions for generic e-business infrastructure issues.

In addition to offering a state-of-the-art framework for e-business, ebXML also incorporates some mechanisms that lower the cost of setting up and maintaining e-business relations, an issue that has restricted the use of e-business to large companies and stable, (semi-) permanent business relations. These mechanisms are:

- Facilitation of registering standard business scenarios and collaboration protocols of organizations.

- Facilitation of partially automating the process of negotiating and setting up trading partner agreements dynamically
- Separation of business aspects from implementation aspects of e-business, thus making it easier for business people to concentrate on defining (and refining) the business aspects of e-business collaboration.

5.1.1.4 The CommercNet eCo framework

CommerceNet have come up with the eCo Framework [11]. It is focused around discovery. It is used to discover businesses that provide particular products and services, and once these businesses are found, it discovers how to interact with their e-commerce system.

The main concept behind the eCo Framework is that e-commerce transactions consist of a series of exchanged messages or documents. The last four layers of the eCo Framework architectural model focus on the documents exchanged during an e-commerce transaction.

The eCo Framework uses a 7 Layer architectural model to describe e-commerce systems. Information at each of these layers is found by querying an associated type registry. A published interface exists for registries at each layer of the architectural model.

5.1.1.5 IMPRIMATUR Business Model

The IMPRIMATUR Business Model deals with intellectual property rights. It was developed by the EU supported IMPRIMATUR project, which concluded at the end of 1998. However, IMPRIMATUR Services Limited [http://www.imprimatur.co.uk] was established in 1999 to continue with the work of the IMPRIMATUR project. This new company owns and controls the entire inventory of intellectual property developed by the project, including the documentation and know-how contained in the Business Model, which covers the area of a conceptual framework for the development of an Electronic Copyright Management System (ECMS).

The IMPRIMATUR Business Model identifies the following active parties: creator, creation provider, rights holder, IPR database, unique number issuer, media distributor, and purchaser. It is not concerned with fraud, illegal copying, and so on, but assumes that the purchaser is good-willed and wants to acquire the work in a legal manner. In addition to the roles of the active parties, the roles of the certification authority, the monitoring service provider, and the bank are covered in the Business Model. Works may be composed into other works and the royalties tracked and split. The model only covers electronic cash or credit cards (e.g. SET) as means of payment.

5.1.1.6 Industrial Data Framework (STEP)

This 'framework' takes a wider view of electronic business. It is more concerned with the design phase of products and supply chain issues than trading. Industrial data is: product

definition data, component libraries, data warehousing, and manufacturing management data. ISO TC184 has produced the STEP standard (ISO 10303, which has many parts [14]). The standard specifies and uses the EXPRESS data definition language, which now has early and late bindings to XML.STEP gives different user views (called application protocols or APs) and extracts from them a common set of data, that can describe complex shapes for CAD systems, but also includes configuration data (etc.).

5.1.1.7 Java EC Framework

The Java Electronic Commerce Framework was developed by Sun Microsystems under the umbrella heading of Java Commerce. It aims to provide a complete infrastructure for Internet-based electronic commerce implemented in the Java programming language. A number of technical specifications, White Papers, tutorials, and guides are publicly available [15, 16, 18, 19, 20, 21, 22, 23 & 24]. The result is a set of Java tools and enabling technology. These include particularly a client-side wallet in Java and a set of Commerce JavaBeans.

The wallet is intended to be extensible to support different operations using a variety of value transfer instruments and protocols. Key to the Java Wallet is "cassettes", which are digitally signed containers (Java archive file) for Commerce JavaBeans components. JavaBeans are modular bodies of Java code. Commerce JavaBeans components are re-usable components which implement specific on-line transaction protocols (e.g. credit card payments, electronic cheques). The Java Wallet is designed to automatically download and install the assets that are specified by a particular transaction.

5.1.1.8 OMG Electronic Commerce Domain Specifications

This architecture and associated specifications are predicated on the use of objects to implement electronic commerce functions and whole systems [25 & 26]. There are several OMG specifications that apply to special area markets or domains. Each specialty area represents the needs of an important computing market. The CORBA Electronic Commerce Domain architecture is comprised of specifications that relate to the OMG compliant interfaces for distributed electronic commerce systems. Currently, there are four modules. These include the Document, Community, Collaboration, and DOM mapping modules. The specifications detail modules, interfaces, and types. For each interface, details of attributes, operations, events, and additional semantics are provided.

The specifications also cover specific business objects that relate to the OMG-compliant interfaces for business object systems. Currently, there are two formal specifications available: Task and Session, and Workflow. The Electronic Commerce Domain specifications build extensively on the Business Object Domain Task/Session specification. Task/Session defines business level notions of people places and things through the types User, Resource, Task, and Workspace.

5.1.1.9 Open-edi Reference Model (ISO 14662)

The Open-edi Reference Model, ISO 14662 [27], was conceived in order to lower the barriers of traditional EDI. These barriers are seen to stem from traditional EDI being based on detailed bilateral agreement, both business and technical, between the involved business partners. Open-edi is intended to alleviate these problems by the introduction of standard business scenarios and support services. The Open-edi Reference Model is a framework for the integration of existing and future standards that enable the inter-working of organisations without prior agreement among the trading partners. The framework is generic in that Open-edi applies to business transactions within and across sectors, involving one or more types of data or media. It is meant to be independent of specific implementations, business content, conventions, activities, and organisations. Open-edi emphasises the primacy of the business – rather than the system – aspects of transactions; it also puts emphasis on the autonomy, and flexibility, of organisations to engage in electronic transactions with one another. Two "views" are set out in the reference model to describe the relevant aspects of business transactions: Business Operational View (BOV) and Functional Service View (FSV). While the general requirements for standards and standardisation are set out in the framework, no individual standards are specified.

5.1.2 Trading Models

5.1.2.1 Ad Hoc Functional and Process Models

These models are generally presented as simple diagrams and in use supported by descriptive text. Such models are relatively easy for humans to understand and are adequate for identifying interfaces and where they apply as they map easily onto real hardware and software systems. The ones summarized here are either functional block diagrams representing logical functions to be performed and the logical interfaces between them or blocks representing a process with arrows on the lines between them showing the flow of information and control from process to process. The simplest is a four-function block model [28] representing the four main functions of current business-to-business electronic commerce. In order, these blocks are Sourcing, Order Processing, Supply Chain Management and Settlement. The same blocks apply to business to consumer, but with settlement generally being required before the order is processed. Each of these blocks could be broken down into blocks that are more detailed.

5.1.2.2 OTP - Internet Open Trading Protocol (IETF)

The Internet Open Trading Protocol [31] covers the area of specification of a 'unifying' framework for trading over the Internet. It is now maintained by the IETF Internet Open Trading Protocol ("Trade") Working Group of the IETF. The objectives of IOTP are to:

- Enable development of interoperable products to support electronic commerce (any IOTP enabled)
- Consumer can "trade" with any IOTP enabled merchant).

- Replicate consumer's real world experiences in the virtual world (e.g. provide invoices and receipts)
- Link delivery to the offer and the payment.
- Provide a "universal shopping experience" (a consistent interface for all trading steps, irrespective of the identity of the trading parties).
- Encapsulate any Internet payment method ("complements" but does not replace available and emerging payment methods).

IOTP is based on a two party operation (the low cost trade model). Its architecture describes the various roles of the parties that are involved in trade on the Internet -- consumer, merchant, value acquirer, deliverer, customer care provider -- and the different types of transactions that can occur between these parties. The IOTP specification, which is based on XML, sets out the content, format and sequence of messages that pass among the trading parties.

5.1.2.3 Open Applications Group XML Framework

The Open Applications Group (OAG) [39 & 40] focuses on defining a framework, which allows communication of heterogeneous business applications. Their integration model addresses the needs of traditional ERP integration, as well as supply chain management and electronic commerce. This specification provides the structure of business documents and additional meta-data that is required as a part of application processing. The base processes are defined (purchases, invoices, catalogue consultation, etc.) and scenarios are proposed to use those base processes. The messages are built with XML but few as possible constraints are put on the values that those messages transfer.

5.1.2.4 OBI (The Open Buying on the Internet (OBI) Consortium)

The objective of Open Buying on the Internet (OBI) [41 & 42] is to provide a standard framework for secure and interoperable business-to-business Internet commerce with an initial focus on automating high-volume, low-value transactions between trading partners. The OBI architecture comprises four entities: Requisitioner, Buying Organisation, Selling Organisation, and Payment Authority. It involves the following interactions: Product selection, order placing and approval, order fulfilment, and payment. The OBI technical specifications focus on interoperability among trading partner systems, and particularly secure transmission of OBI objects to OBI-compliant trading partners over the Internet. OBI uses the X12 850 EDI standard for order formats. Transport is based on the Hypertext Transfer Protocol (HTTP). Security service is provided by the Secure Sockets Layer (SSL) protocol. Electronic signature syntax is provided by the PKCS #7 cryptography standard. Digital certificates are based on the X.509 V3 certificate syntax standard. It is now being updated to allow the use of XML formatted data as an alternative to the American EDI format.

5.1.2.5 RosettaNet

RosettaNet is a not for profit private consortium created by the Leading Companies of the Computer Industry (IT), Electronic Component (EC), and Semiconductor Manufacturing (SM) Supply Chains. The mission of RosettaNet is to develop a complete set of **Standard e-Business processes** for these Supply Chains, and to promote and support their adoption and their widest deployment [43].

RosettaNet develops and produces 3 elements, which allow the trading Partners to run their B2B processes.

1. The **"Partner Interface Process" : PIPs ™** define the B2B processes agreed upon by all the Trading Partners
2. The **"RosettaNet Implementation Framework (RNIF ™)**
3. The **Dictionaries** (Business and technical)

A major part of RosettaNet's standardisation effort is alignment of business processes between trading partners in a given supply chain. Trading partners agree on the PIPs™ to use, and they define a "Trading Partner Agreement" (TPA). They are now ready to start the business scenario (a collection of PIPs™), and let their "Systems" run it. RosettaNet divides the entire e-business supply chain domain for which PIPs™ are specified into broad classifications called "clusters". Each cluster is further sub-divided into two or more "segments". Each segment comprises several PIPs™. PIPs™ contain one or more Activities, and Activities in turn specify Actions. The PIPs™ are described according to the **UML** Specifications produced by the partners. The PIPs™ include:

- The specification of partner business roles (Buyer, Seller etc.);
- The business activities involved between the roles; type, content and sequence of business documents exchanged by the role-interactions while performing these activities.
- The specification of the time, security, authentication and performance constraints of these interactions.
- The Structure and content of the business documents exchanged is specified through **XML Document Type Definitions (DTDs)** and associated **Message Guidelines**.

The framework specifies a message envelope for packaging the XML business messages, which includes MIME encapsulated preamble, delivery and service headers plus the payload. It also recommends a protocol stack based on HTTP(S) or SMTP or other over TCP/IP (or other). Application of a digital signature is possible, but optional.

5.1.2.6 Secure Electronic Market Place for Europe (SEMPER)

Secure Electronic Market Place for Europe (SEMPER) was produced by an EU-supported project under the ACTS programme, undertaken by a 20-partner consortium led by IBM. It is a definition of an open and system independent architecture for

electronic commerce. The project concluded in 1999. The project outputs included an architecture specification 'Basic Services: Architecture and Design' [44], API specifications [48], Architecture of Payment Gateway [45], New Payment Instruments Prototype [46], and Advanced Services, Architecture and Design (http://www.semper.org/deliver/d10/d10.pdf [47]. Based on access via a browser, the architecture specifies common functions to be supported by applications which include Exchange of certificates, Exchange of signed offer/order, Fair contract signing, Fair payment for receipt, and Provision of delivery information. It takes a layered approach and specifies layers for 'Supporting services', 'Transfer & fair exchanges', 'Commerce', and 'Business applications'. The SEMPER architecture also includes standard buyer/seller scenarios. The conclusions of the SEMPER project include:

- There is no trust-worthy computer base for e-commerce
- There is no sufficiently secure legal basis for using digital signatures now, across borders, using insecure software and hardware
- There are many secure steps (payment, signatures), but only few secure processes
- Users and developers don't understand security well enough. The need for multi-party security in e-commerce is often ignored.

It should be noted that though these conclusions may have applied in 1999 the situation is slowly improving over time.

5.1.3 Payment Models

5.1.3.1 Electronic Payment Technologies

There are several key technologies for electronic payment. The following categories can be identified:

- Smart Cards
- Tokens
- Micropayment
- Home Banking
- Payment Method Negotiation
- Electronic Fund Transfer.

5.1.3.2 SET - Secure Electronic Transaction

The Secure Electronic Transaction specification, developed jointly by MasterCard and the Visa International Service Association, is a definition of a protocol for secure transfer of credit card transactions over the Internet [49]. The transaction begins with the cardholder. Once the cardholder finishes shopping at a web site the SET protocol provides the mechanisms for the cardholder to securely transmit payment instructions, as well as for the merchant to obtain authorisation and receive payment for the order. Message data is encrypted for confidentiality using a symmetric algorithm with the key generated on the cardholder's side. This key is sent with the message encrypted with the recipient's public key using a public key algorithm. SET uses a distinct public/private key

pair to create a "digital signature". Authentication is further strengthened by the use of certificates issued by a trusted third party "Certificate Authority". Within SET, dual signatures are used to link an order message sent to the merchant with the payment instructions containing purchaser account information sent to the Acquirer.

5.1.3.3 Trading and Payment model in TC 224 Report on 'Card-related secure commercial and financial transactions on open networks'

This report [53] was commissioned by CEN/ISSS TC 224 and its international counterpart ISO/TC 68/SC 6. Part 2 provides a framework and architectural model for the identification, trading, and payment processes with an emphasis on the card related financial aspects. Part 1 provides an Executive summary (of the whole report). Part 3 summarises existing standards and specifications and provides brief summaries of the Open-edi reference model, Internet Open Trading Protocol (IOTP), SEMPER, and parts of SET. It also provides summaries of many other standards and specifications that have some relevance for electronic commerce that are not covered in this document. Part 4 suggests requirements for further standardisation (both new standards relating to electronic commerce and enhancements to existing ones. Part 5 provides various annexes. Although the title of the report suggests a restriction to card related commerce it actually covers a broader sweep. Unfortunately there is no intent to revise the current report to keep it up to date, which is a pity given its breadth.

The framework in Part 2 of the report is used to elucidate and position a comprehensive set of requirements. It presents a set of basic concepts, requirements on the overall electronic commerce transaction, then requirements by stage. These are identified as 'ordering', 'delivery', and 'payment'. This is followed by a description of a security framework and the concepts of interoperability, in particular payment system and communication protocol interoperability, each with their own sets of requirements.

5.1.4 Security Models

5.1.4.1 PKIX

The PKIX working group of the Internet Engineering Task Force (IETF) is producing Internet drafts and RFCs (the Internet equivalent of recommendations) concerned with the management, distribution, and usage of keys for public key cryptographic functions. An Internet draft provides an overview or "roadmap" of the work done by the IETF PKIX working group and describes some of the terminology used in the working group's documents, and the theory behind an X.509-based Public Key Infrastructure, Privilege Management Infrastructure (PMI), and Time Stamping and Data Certification Infrastructures [54]. It identifies each document developed by the PKIX working group, and describes the relationships among the various documents. It also provides advice to would-be PKIX implementers about some of the issues discussed at length during PKIX development, in hopes of making it easier to build implementations that will actually interoperate.

It should be noted that the models included are all concerned with aspects of public - private key management, distribution, and use. There are other forms of cryptography and many other aspects of security that are not covered by these models. Currently, the EESSI work in CEN and ETSI is developing a technologically neutral environment for electronic signatures in line with PKIX.

5.1.4.2 Security model in TC 224 Report on 'Card-related secure commercial and financial transactions on open networks'

As mentioned earlier in this report [53] was commissioned by CEN/ISSS TC 224 and its international counterpart ISO/TC 68/SC 6. Part 2 provides a framework and architectural model for the identification, trading, and payment processes with an emphasis on the card related financial aspects. It also includes a security model, which has a broad scope and deals with security requirements and the corresponding ways to achieve them independently of the stage of the transaction. Its aim is to increase confidence in the Business to Consumer area with regard to privacy protection, security, refunds, and dispute resolution. These factors were seen as impediments to electronic commerce in 1999/2000, at the time the report was prepared. The report covers the areas of Security Policy, Security Mechanism (two types elementary and combined are defined), Security services and related interaction models (authentication, access control, data confidentiality, data integrity, and non-repudiation), security management (key and certificate management, and supporting facilities), security supporting components, and security evaluation.

5.1.5 Mobile Models

Mobile commerce is developing rapidly and other architectures are expected to emerge, indeed are already doing so.

5.1.5.1 MeT

Ericsson, Motorola, and Nokia have clubbed together to form the MeT Initiative. Mobile commerce is developing rapidly and the Met Framework is likewise expected to evolve rapidly [55].

The approach is to regard the mobile phone as a user centred Personal Trusted Device (PTD). The Framework defines logical and physical devices and systems and the functions they perform. This highlights critical interfaces for interoperability. Apart from the PTD itself the MeT Framework focuses on the service registration interface, the service execution interface and the user interface.

5.1.5.2 Mobey

Mobey Forum (http://www.mobeyforum.org) was founded in May 2000 by a number of the world's leading financial institutions and mobile terminal manufacturers with the mission of encouraging the use of mobile technology in financial services. Ever since its

establishment, Mobey Forum has consistently worked towards this goal. One of the major achievements has been the announcement of the Preferred Payment Architecture, including extensive documentation defining both the business and technical aspects of providing user-friendly and secure mobile banking and payment services. This was the first time that financial institutions formed an agreed opinion on the way forward for mobile financial services. Mobey Forum also cooperates with other industry forums and consortiums, such as MeT and OMA (Open Mobile Alliance).

5.2 Enabling Technologies

An e-commerce system, in a sense, is yet another software system, which needs the same methodical approach as any other system, despite all the hype about "silver bullets" – "magic technologies" like Java, XML, .NET, J2EE and, of course, ebXML. Due to all the novelties in the field and rapid pace of technology change, an e-commerce system needs even more careful and better-managed software engineering process, than those "old" software systems. The main question, which all software architects face is the right choice of enabling technologies for the particular project: software engineering and business modelling tools, EAI technologies, middleware, etc., etc. The answer is far from trivial in each case – there is vast number of tools to choose from, long lists of acronyms to know, buzzwords to note and tradeoffs to make. The goal of this section is to shed some light on these technologies – both general-purpose software development tools and those specific to e-business systems.

5.2.1 Software Engineering Methodologies

Let us start with the basics – methodologies and techniques, which support the life cycle of a software system or product. Luckily, there are pretty well established and standards, which leverage the best practices of software engineering and embrace the latest and most innovative approaches as well. We will briefly touch general-purpose methodologies and focus on those specific to e-business.

5.2.1.1 The Unified Software Development Process and the Rational Unified Process (RUP)

The starting point of modern software development methodology is Unified Software Development Process (USDP), which, together with UML, defines basic principles, notation and artefacts for software development. UML and USDP are generic, which means they can be customised for specific software projects. The basic principles, inherited by all modifications of USDP are:

- Iterative development
- Use-case driven
- Requirements and change management
- Model-based
- Component-based

The first main specialization of USDP is Rational Unified Process (RUP), a software engineering framework, originally developed by Rational Corporation, www.rational.com. RUP extends USDP by introducing business modelling activities, inherited, in turn by the UMM. UMM has been developed as a specialization of a modified subset of the RUP. UMM covers the first two phases of this subset and four workflows, relevant to these phases. The section below presents UMM in greater degree of detail.

5.2.1.2 The UMM

UMM stands for UN/CEFACT (United Nations Centre for Trade Facilitation and Electronic Business) Modelling Methodology. It is a framework to structure e-business projects in terms of workflows, phases and iterations. UMM is a method to capture business process knowledge, independent of the underlying implemented technology. However, there is a direct mapping from UMM artefacts to ebXML constructs. UMM is based on the Unified Modelling Language (UML) from the Open Management Group (OMG, link: www.omg.org).

UMM is based on configuring the Unified Process methodology developed by the Rational Corporation to meet UN/CEFACT needs for modelling business processes in addition to objects. This requires extensions of the UML meta-model through business domain specific stereotyping to support a complete business process and information definition, resulting objects and interface-specific object behaviour descriptions.

UMM workflows include:

- Business Modelling Workflows: Those are used to create models for business processes. These workflows produce the Business Operations Map (BOM) in the form of a model architecture expressed as UML packages and initial business *use cases* with descriptions.
- Requirements Workflows: Those are used to create models for e-business collaborations. In these workflows, it is the first time that stakeholder needs are elicited. Typically, the use cases expressed in Business Modelling workflows are reviewed, and more are discovered.
- Analysis Workflows: Those are used to create models for e-business transactions. In these workflows one looks at the collaborations between business roles, assigns business information transaction patterns, and begins to understand the information bundles (business documents) that flow between roles.
- Design Workflows: Those deal with the data exchange between business partners. This primarily involves detailing the information model, applying *business information objects* across all class models, detailing service protocol syntax and semantics (comparable to EDIFACT, XML message design), and applying Business Service Interaction Patterns.
- Implementation Workflows: This deals with the message translation and software development. The patterns here are the Message Design rules and the UML to XML mapping.

UMM Phases include the:

- Inception Phase: This deals with the requirements specification and determines the scope and vision of the overall project.
- Elaboration Phase: In this case the requirements are analysed and an "architectural prototype" is delivered.
- Construction Phase: This deals with the Implementation and Testing of the project.
- Transition and Testing Phase: This deals with the deployment and final testing of the project.

UMM Iterations deal with the breakage of (long, complex) projects up into a series of mini-projects, each going through a series of analysis, design, coding, integration and testing activities.

UMM is primarily concerned with the Business Operations View (BOV) and not the Functional Service View (FSV) of a company. The BOV is defined as "a perspective of business transactions limited to those aspects regarding the making of business decisions and commitments among organizations", while the FSV is focused on implementation-specific, technological aspects. Hence, UMM provides a procedure for specifying (modelling), in a technology-neutral, implementation-independent manner, business processes involving information exchange.

Many projects have contributed to the UMM. In particular:

- Open-edi reference model. This provides ISO/IEC 14662, a recognized international standard for the specification of a class of business transactions (i.e. business collaborations) having the same business goal.
- UML. This provides a formal descriptive technique, as required by open-edi, for a syntactic representation of a business process and information model.
- Unified Process. This provides a top-down business analysis approach that utilizes the basic workflows that are recognized in the IT industry for application software development: business modelling, requirements, analysis and design.
- Business Collaboration Framework. This provides an e-business industry recognized methodology and UML profile for specifying an incremental construction of a business process and information model.

UML, on which part of UMM is based, requires the use of a lexicon. This contains information and process definitions including relationships and cross-references as expressed in business terminology and organized by industry domain. The lexicon evolves over time and is a bridge between the specific business or industry language and the UML models through the application of UMM.

While the UMM is used by business domain experts and business process analysts to describe individual business processes, the UMM meta-model is used to describe the UMM components the domain experts and analysts have at their disposal as they describe

and analyse individual processes. Additionally, a set of reusable process and information descriptions, or patterns, help the business domain experts and analysts be more effective and help enforce consistent, reproducible results from the UMM across business domains. The UMM *meta-model* is defined as a UML profile by extending the UML syntax and semantics with stereotype syntax and semantics of the business process domain. The UMM meta-model is organized into the following views:

- Business Operations Map (BOM): The partitioning of business processes into business areas and business categories.
- Business Requirements View (BRV): The view of a business process model that captures the Use Case scenarios, inputs, outputs, constraints and system boundaries for business transactions and their interrelationships.
- Business Transaction View (BTV): The view of a business process model that captures the semantics of business information entities and their flow of exchange between roles as they perform business activities.
- Business Service View (BSV): The view of a business process model that specifies the network component services and agents and their message (information exchange) as interactions necessary to execute and validate a business process.

UMM provides patterns, which are reusable, generalized business process abstractions that can be applied to many domains. The business transaction patterns are:

- Commercial Transaction: This is used to model the "offer and acceptance" business transaction process that results in a residual obligation between both parties to fulfil the terms of the contract.
- Query/Response: This is used to query for information that a responding partner already has, e.g. against a fixed data set that resides in a database.
- Request/Response: This is used for business contracts when initiating partner requests information that a responding partner already has and when the request for business information requires a complex interdependent set of results.
- Request/Confirm: This is used for business contracts where an initiating partner requests confirmation about the status with respect to previously established contracts or with respect to a responding partner's business rules.
- Information Distribution: This is used to model an *informal* information exchange business transaction that does not have non-repudiation requirements.
- Notification: This is used to model a *formal* information exchange business transaction that therefore has non-repudiation requirements.

5.2.2 General Purpose Software Systems Architectures

The foundation of any decent software system is sound architecture. There are dozens of architectures that focus on different aspects of systems and serve very different purposes. In this report, we will briefly discuss a couple of important architectures and their principles. The first one – OMG Model Driven Architecture is an attempt to focus on platform-neutral application model first and only then map the model to the platforms of

choice. This is very important in order to build the right model and preserve the investment of building it. Service Oriented Architecture (SOA), on the other hand, is important because it fits the nature of e-commerce systems – it is all about services, after all. Therefore, when we think about collaboration of business parties and, if we get more technical, of interoperability of heterogeneous software systems, SOA may provide the roadmap for building the solution. Of course, there are other aspects to take into consideration, therefore let us lay down the main requirements for e-commerce solution architecture in a greater degree of detail.

5.2.2.1 Requirements for E-business System Architecture

In particular, a sound foundation for business integration must deliver the following characteristics (according to [101]):

- The architecture must support a business process management approach to integration. Emerging e-business models are becoming more ambitious and the ability to support a rapidly changing business environment is imperative. Companies want to automate and manage complete business processes, not just specific steps of a business process. They also want to tailor e-business interactions for specific partner or internal business needs –on a whim and without application re-engineering. Emerging deep and broad integrated business processes will involve the use of multiple B2B standards and internal applications all within a single managed business process. Long-lived business processes – processes that can span weeks, months, or years – are also being considered for formal management. Such processes are characterized by start n' stop processing, multiple states, compensating flows, human interactions, and multiple B2B and EAI interactions. Finally, many business processes today involving predominately human interaction can benefit from business process management and subsequent incremental automation. A business process approach to integration enables the seamless integration of human interactions within the same process engine that delivers automated EAI and B2B interactions.
- The architecture must support enterprise scalability, manageability, and security. Organizations deploy many types of integration scenarios. Throughput and security requirements vary widely, depending on the integration scenario. The architecture must therefore accommodate potentially rapid growth and deliver repeatable performance for a wide range of responsiveness expectations. It must support 24x7 operations and large-scale production management, via capabilities such as cross CPU scaling, recoverability, fail over, live individual component upgrades, and versioning of integration objects.
- The architecture must be capable of delivering non-invasive integration with legacy systems. Large enterprises have huge legacy systems investments and must deploy an integration platform as an evolutionary vehicle in most cases. At the same time, an explosion of XML-based technologies is occurring. Organizations want to exploit these new technologies yet cannot disrupt mission critical operations. Legacy systems, by definition, form the operational backbone of any

organization. Therefore, a next generation integration broker architecture must deliver peaceful co-existence of the old, the new, and the to-be-determined.

- The architecture must support the emerging notion of e-business frameworks, which specify the coordinated use of low-level standards and technologies. Individual standards-based technologies today solve problems at specific layers of the integration "stack." In and of themselves, they have very limited value. For example, SOAP (Simple Object Access Protocol) is not by itself a business quality application interface standard. It must be combined with functionality for cryptographic services, access control, quality of service, exception handling, and flow management. The true value of SOAP emerges therefore when it is deployed within a framework, to coordinate its use with other low-level standards and technologies and higher-level business protocols. Strategic integration solution architecture must provide such a framework. Its primary goal is thus the efficient delivery of emerging visions for collaboration, real-time visibility, and managed complete business processes – in short, the coordinated use of low-level technology and business processing standards.
- The architecture must support rapid deployment and change management. The pace of e-business standards work today is accelerating. XML-based standards development is faster, and the sheer number of standards is overwhelming. While firms have an urgent need to get their feet wet in these technologies, they aren't sure which ones are real. Moreover, they do not want to "bet the farm" on a single standard that might fail. To minimize the risk of experimentation, the architecture must therefore support a layered architecture that is highly extensible. It must be able to insulate relatively static parts of an integration scenario – for example, a well-understood abstract business process model – from underlying technologies that actually execute the integrated process. This promotes the concept of reuse, an important feature in helping firms leverage scarce IT staff, deploy integration scenarios rapidly, and respond to change. The architecture must support multiple interaction "styles." Integration is not a single problem, but rather a large set of problems. There are numerous "styles" of integration, including file-based, store-and-forward, mailbox with secure repository, point-to-point messaging, publish/subscribe and emerging B2B response-request protocols (such as the ebXML Messaging Service). Most firms cannot dictate an external partner's or packaged application's transport vehicle. Similar to the problem of highly fluid emerging XML-standards, support for multiple integration styles requires a layered architecture that abstracts low-level infrastructure technologies from a business process view of integration.
- The architecture must support a rich, open-ended functionality set, with plug n' play extensibility. In particular, it should support extensibility to a wide range of integration "targets" including legacy applications, large-scale packaged applications, middleware technologies, first generation EAI products and B2B gateways, file transfer, mobile devices, and humans (via forms support). The architecture must support rapid extension to currently unsupported targets through an adapter development kit, and should include a range of generic technology adapters.

- The architecture should support a component-based packaging and deployment model. Organizations today want a sound integration infrastructure solution, but they want to deploy it incrementally in order to gain repeatable tactical ROI. The architecture should support a systematic approach to integration through a basic foundation and a range of optional components that support a "start small, grow as needed" strategy.
- The architecture must support sophisticated use without software development. First generation integration broker offerings typically require software development for production business use. Users are expected to be experts in a programming language, such as Java or C++, or a vendor's proprietary development language. Next generation integration brokers will include a rich feature set to enable sophisticated use with the need to code a solution. GUI-based tools for visually modelling business processes and defining data transformation maps, as well as wizards for configuring adapters, must be provided.
- The architecture must facilitate integration software interoperability, in order to promote the widespread adoption of key industry standards. For interoperability standards that it supports, the architecture should support those standards faithfully. While it is important to leverage point-to-point optimisations to deliver such features as premium levels of ease-of-use and advanced monitoring, those optimisations should not be required for basic interoperability. The architecture must support platform independence so that large organizations can protect and extend their heterogeneous systems portfolio.

If we will take a closer look into MDA and SOA, we will find that most of the requirements are addressed in these architectures.

5.2.2.2 Model Driven Architecture (MDA)

Good system architecture should transcend limits of specific technologies and focus on the application domain or business model. OMG white paper [100] serves as a good introduction into MDA.

MDA is about integration and interoperability. As the pace of technology continues to quicken, and the demands of integrating existing legacy systems, new intranet, and e-business continue, there is a need for an architecture that makes interoperability central to the infrastructure. There will never be a single operating system, single programming language, or single network architecture that replaces all that has passed, however there is a way to manage this situation based on the core modelling standards from OMG. Figure 19 lays out the **Model Driven Architecture** (MDA), which is language-, vendor- and middleware-neutral.

Whether the ultimate target is CCM, EJB, MTS, or some other component or transaction-based platform, the first step when constructing an MDA-based application will be to create a platform-independent application model expressed via UML in terms of the appropriate core model. Platform specialists will convert this general application model into one targeted to a specific platform such as CCM, EJB, or MTS. Standard *mappings*

will allow tools to automate some of the conversion. In Figure 19, these target platforms occupy the thin ring surrounding the core.

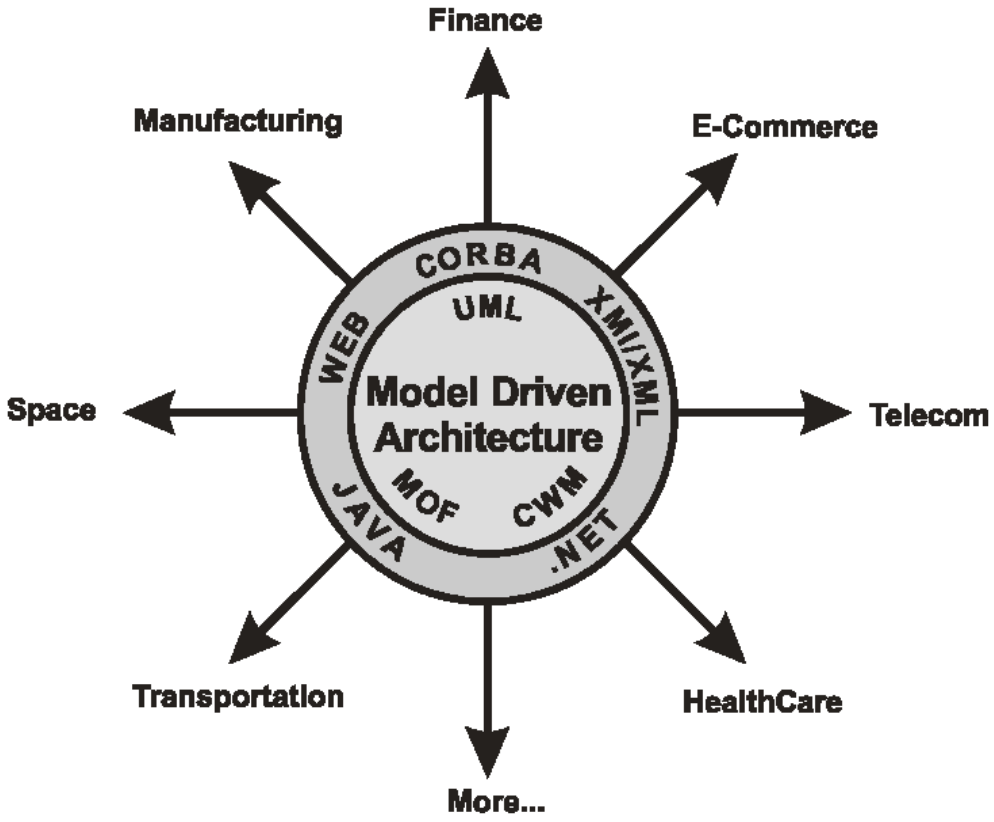


Figure 19 - OMG's Model Driven Architecture (from [100])

The platform-specific model faithfully represents both the business and technical run-time semantics of the application. It's still a UML model, but is expressed (because of the conversion step) in a dialect (i.e. a profile) of UML that precisely mirrors technical run-time elements of the target platform. The semantics of the platform-independent original model are carried through into the platform-specific model.

5.2.2.3 Service Oriented Architecture (SOA)

Service Oriented Architecture is being explored and exploited in many contexts, including the e-commerce systems field. A recent Rational Software white paper provides an excellent overview of SOA [97].

In recent years, much of the attention in the software engineering community has focused on design approaches, processes, and tools supporting the concept that large software systems can be assembled from independent, reusable collections of functionality. Some of the functionality may already be available and implemented in-house or acquired from a third party, while the remaining functionality may need to be created. In these cases, the whole system must be conceived and designed to bring together all these elements into a

single, coherent whole. Today this is exemplified in *component-based development (CBD)*, a concept that is realized in technological approaches such as the Microsoft .NET platform and the Java 2 Enterprise Edition (J2EE) standards supported by products such as IBM's WebSphere and Sun's iPlanet.

An additional consideration is that operational systems will typically be distributed across many machines to improve performance, availability, and scalability. An enterprise solution has to coordinate functionality executing on a collection of hardware. One way to conceive of such a system is to consider it as composed of a collection of interacting *services*. Each service provides access to a well-defined collection of functionality. The system as a whole is designed and implemented as a set of interactions among these services. Exposing functionality as services is the key to flexibility. This allows other pieces of functionality (perhaps themselves implemented as services) to make use of other services in a natural way regardless of their physical location. A system evolves through the addition of new services. The resulting *service-oriented architecture (SOA)* defines the services of which the system is composed, describes the interactions that occur among the services to realize certain behaviour, and maps the services into one or more implementations in specific technologies.

Service-oriented architecture is not a new notion; it is important at this time because of the emerging Web services technology. For example, here is a quote from a book published in 2000 describing the value of a service-oriented architecture:

> *Service-Oriented Solutions… Applications must be developed as independent sets of interacting services offering well-defined interfaces to their potential users. Similarly, supporting technology must be available to allow application developers to browse collections of services, select those of interest, and assemble them to create the desired functionality. [97]*

For the purposes of this document, we shall consider the following definition of a service:

> *A service is generally implemented as a course-grained, discoverable software entity that exists as a single instance and interacts with applications and other services through a loosely coupled (often asynchronous), message-based communication model. [97]*

In many ways, the terminology for services is much the same as the terminology used to describe component-based development; however, there are specific terms used to define elements within Web services, as shown in Figure 20 below.

- **Service** – A logical entity; the contract defined by one or more published interfaces.
- **Service provider** – The software entity that implements a service specification.
- **Service requestor** – The software entity that calls a service provider. Traditionally, this is termed a "client"; however, a service requestor can be an end-user application or another service.
- **Service locator** – A specific kind of service provider that acts as a registry and allows for the lookup of service provider interfaces and service locations.
- **Service broker** – A specific kind of service provider that can pass on service requests to one or more additional service providers.

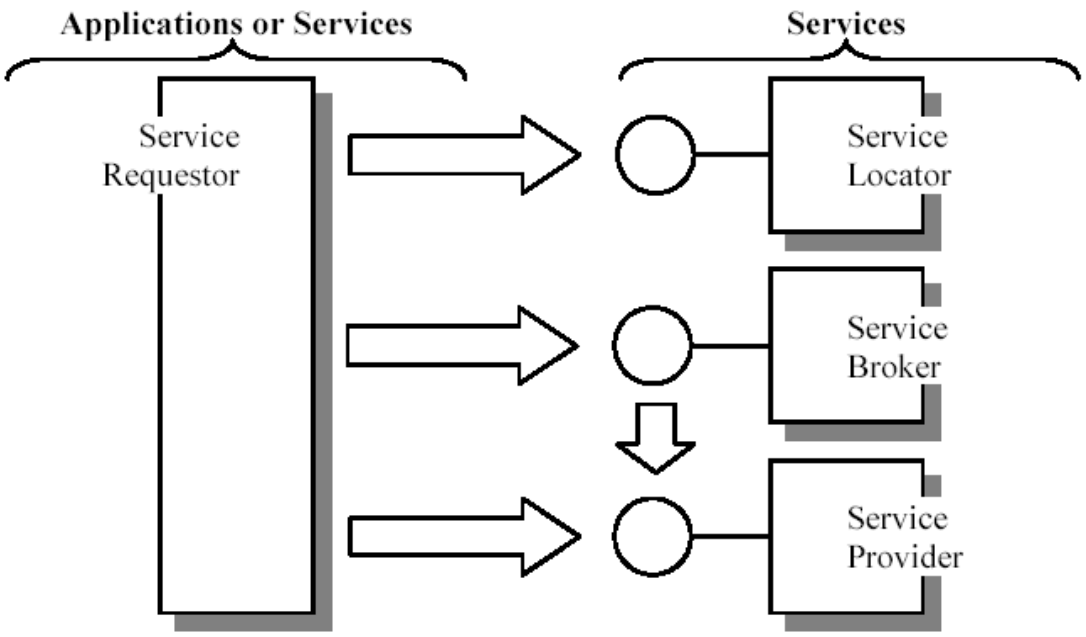


Figure 20 - Service Terminology (from [97])

This description of services, and the context of their use, imposes a series of constraints. Furthermore, efficient use of services suggests a few high-level best practices. Here are some key characteristics for effective use of services:

- **Coarse-grained** – Operations on services are frequently implemented to encompass more functionality and operate on larger data sets, compared with component-interface design.
- **Interface-based design** – Services implement separately defined interfaces. The benefit of this is that multiple services can implement a common interface and a service can implement multiple interfaces.
- **Discoverable** – Services need to be found at both design time and run time, not only by unique identity but also by interface identity and by service kind.
- **Single instance** – Unlike component-based development, which instantiates components as needed, each service is a single, always running instance that a number of clients communicate with.
- **Loosely coupled** – Services are connected to other services and clients using standard, dependency-reducing, decoupled message-based methods such as XML document exchanges.
- **Asynchronous** – In general, services use an asynchronous message passing approach; however, this is not required. In fact, many services will use synchronous message passing at times.

Some of these criteria, such as interface-based design and discoverability, are also used in component-based development; however, it is the sum total of these attributes that

differentiate a service-based application from an application developed using component architectures such as a J2EE or .NET.

However, businesses are moving more and more to service-oriented systems in the hope that they can be more easily integrated and choreographed to realize business processes through collaborations of services. As a result, the notion of defining the behaviour of an interface and, more importantly, the behaviour of sets of related interfaces is receiving increasing industry attention. Unfortunately, there are currently few standard approaches to this.

One approach might be to use design models such as those introduced through this paper, defined in a standardized language such as the UML to document the interdependencies between service interfaces. Such models can be shared, socialized, and used to drive specific standards when they emerge.

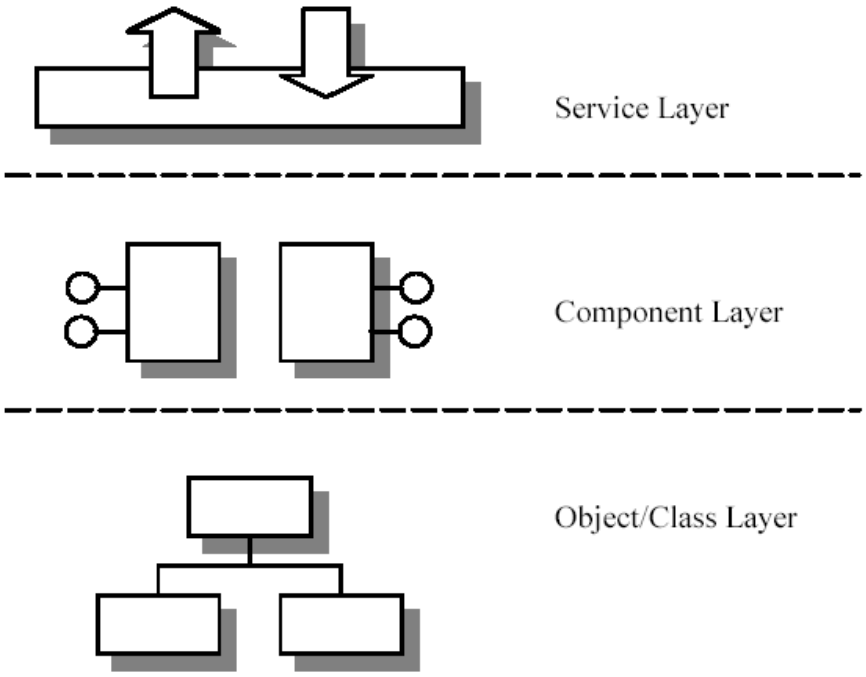


Figure 21 - Application implementation layers (from [97])

Additionally, Rational has sponsored the Reusable Asset Specification (RAS), which provides a mechanism for packaging and sharing assets that could be applied to this problem. For example, when using the RAS mechanism to distribute the details for a service, one could package the model describing its behaviour as well. Within such a model, a sequence diagram may then be used to show the required interaction between the calls on the interface.

Components can be seen as the best way to implement services, though one has to understand that an exemplary component-based application does not necessarily make an exemplary service-oriented application. There is a great opportunity to leverage company's component developers and existing components, once the role played by

services in application architecture is understood. The key to making this transition is to realize that a service-oriented approach implies an additional application architecture layer. Figure 21 demonstrates how technology layers can be applied to application architecture to provide more coarse-grained implementations, as one gets closer to the consumers of the application. The term coined to refer to this part of the system is "the application edge," reflecting the fact that a service is a good way to expose an external view of a system, with internal reuse and composition using traditional component design.

5.2.3 Integrated Enterprise Modelling Architectures

E-business and E-commerce is about business and enterprise, therefore methodologies and architectures for modelling, designing and integrating enterprises or networks of enterprises for their entire life cycle. The sections below present a couple of the methodologies of this kind.

5.2.3.1 REA

REA stands for Resources, Events and Agents: It can serve as a model for creating a semantic Web for Internet supply chain collaboration [164]. A semantic model describes the content of the semantic Web. It is a computer software model of real-world supply chain activities. Another term for semantic model from the field of knowledge representation is "ontology": the set of classes, relationships and functions in a universe of discourse. REA is best used for the modelling of the economic elements of a transaction. Parts of REA are included in ebXML.

The REA model provides domain-specific guidance in determining the information structure (static data model) of an enterprise. An REA semantic model can be expressed in many formats: XML, UML, relational database, and/or an object oriented programming language. REA works by give and take. For example, in an economic Event, an economic Agent gives one economic Resource (i.e. a product) and takes in return a different economic Resource (i.e. cash).

An REA model can be seen to comprise of two infrastructures:

- Knowledge infrastructure: contains the abstract concepts, called "type images", captured by a process called "typification". Type images are connected together with type image relationships.
- Operational infrastructure: This contains "instantiations" of the elements in the knowledge infrastructure.

The three-layer architecture of the REA Enterprise Information Systems contains:

- In the Knowledge Infrastructure: Exchange Types, Process Types, and Task & Recipe Types.

- In the Operational Infrastructure: Exchanges, Tasks, and Enterprise Scripts & Processes. It also includes commitment entities, and association, custody & linkage relationships.

The REA model can split into two parts:

a. **Basic REA Model**:

- This is based on the premise that the economic exchanges or conversions of an enterprise all follow a particular object pattern. There is a transaction (an economic event) where an internal agent (an economic unit or agent) gives something of value (an economic resource) to an outside person (an economic agent); this decrement event is always paired with a mirror-image increment event where the internal agent receives in kind another type of economic resource which has more value to the enterprise in its pursuit of entrepreneurial goals [164].
- The basic REA model has three primitive components: Resources, Events and Agents. It also has 4 types of relationships defined: stockflow (between resources and events), duality (between "give" and "take" events), control (between events and agents) and responsibility (to model the static hierarchical reporting and assignment structures within business enterprises, which is often omitted in complex REA models with dynamic firm behaviour). Taken as a whole, duality relationships are the glue that binds a firm's separate economic events together into rational economic processes, while stock-flow relationships weave these processes together into an enterprise value chain or scenario.

b. **Extended REA model:** There are 2 infrastructures here:

- REA Accountability Infrastructure: It conceptualises what is or has been in the firm with an emphasis on resource tracking. The Accountability Infrastructure contains the REA Business Process Specifications (BPS), which are based on the basic REA model, with an extra *Commitment* entry added. The BPS is part of REA Value-Chain Specification, and decomposes into REA Workflow Specifications.
- REA Policy Infrastructure: It conceptualises what "could be" or "should be" within the context of a defined portfolio of firm resources and capabilities. This infrastructure consists of *Type Images*, whose instantiations are contained in the Accountability Infrastructure. It contains REA Business Process Configurations (BPC), which are part of REA Value Chain Configurations. BPC also decompose into REA workflow configurations.

Value chain processes can be decomposed into subprocesses multiple times before an enterprise modeller finds the level at which it is appropriate to explode into a full set of

matched REA patterns. Full REA decomposition leads to a process structure of the firm shaped like a tree, with only the leaf nodes fully exploded to object patterns.

One can view REA information architectures at various level of abstraction, and concomitantly, one can envision how these architectures are designed:

- First, a corporate chain of value-added processes is specified in very general terms. These high-level processes are then divided into subprocesses until the lowest level at which management needs to plan, control and evaluate, is reached.
- Second, each process at the lowest level is exploded to illustrate in object fashion its decrement and increment events (duality relationships) along with their flow of resources and their internal/external agents.
- Third, if necessitated by implementation and measurement considerations, some economic events are subdivided into tasks which are economic occurrences in time that do not have to adhere to the full pattern of REA exchanges.
- Lastly, in an augmentation process, other object data types are added to the accountability infrastructure. Such additional objects might include those of a non-economic nature or those dealing more with hypothetical data types or opportunity costs.

5.2.3.2 GERAM

GERAM stands for Generalized Enterprise Reference Architecture and Methodology [162]. It is about the methods, models and tools, which are needed to build and maintain the integrated enterprise, be it, a part of an enterprise, a single enterprise or a network of enterprises (*virtual enterprise* or extended enterprise).

GERAM defines a tool-kit of concepts for designing and maintaining enterprises for their entire life history. GERAM is not yet another proposal for enterprise reference architecture, but is meant to organize existing enterprise integration knowledge. The framework has the potential for application to all types of enterprises. Previously published reference architectures can keep their own identity, while identifying through GERAM their overlaps and complementing benefits compared to others.

The scope of GERAM encompasses all knowledge needed for enterprise engineering / integration. Thus GERAM is defined through a pragmatic approach providing a generalized framework for describing the components needed in all types of enterprise engineering / enterprise integration processes, such as:

- Major enterprise engineering / enterprise integration efforts (green field installation, complete re-engineering, merger, reorganization, *formation of virtual enterprise or consortium*, value chain or supply chain integration, etc)
- Incremental changes of various sorts for continuous improvement and adaptation.

GERAM is intended to facilitate the unification of methods of several disciplines used in the change process, such as methods of industrial engineering, management science,

control engineering, communication and information technology, i.e. to allow their combined use, as opposed to segregated application.

One aspect of the GERAM framework is that it unifies the two distinct approaches of enterprise integration, those based on product models and those based on business process design. It also offers new insights into the project management of enterprise integration and the relationship of integration with other strategic activities in an enterprise.

An important aspect of enterprise engineering is the recognition and identification of feedback loops on various levels of enterprise performance as they relate to its products, mission and meaning. To achieve such feedback with respect to both the internal and the external environment, performance indicators and evaluation criteria of the corresponding impact of change on process and organization are required. The continuous use of those feedback loops will be the prerequisite for the continuous improvement process of the enterprise operation and its adaptation to the changes in the relevant market, technology and society.

GERAM provides a description of all the elements recommended in enterprise engineering and integration and thereby sets the standard for the collection of tools and methods from which any enterprise would benefit to more successfully tackle initial integration design, and the change processes which may occur during the enterprise operational lifetime. It does not impose any particular set of tools or methods, but defines the criteria to be satisfied by any set of selected tools and methods.

The GERAM framework consists of the following components:

- GERA (Generalized Enterprise Reference Architecture). This is the most important component of GERAM and in it are identified the basic concepts to be used in enterprise engineering and integration (for example, enterprise entities, life cycles and life histories of enterprise entities). These concepts can be categorized as:
  (1) Human Oriented concepts
    (a) to describe the role of humans as an integral part of the organization and operation of an enterprise and
    (b) to support humans during enterprise design, construction and change.
  (2) Process oriented concepts for the description of the business processes of the enterprise
  (3) Technology oriented concepts for the description of the business process supporting technology involved in both enterprise operation and enterprise engineering efforts (modelling and model use support).
- EEM (Enterprise Engineering Methodologies): Those describe the process of enterprise engineering and integration. An enterprise engineering methodology may be expressed in the form of a process model or structured procedure with detailed instructions for each enterprise engineering and integration activity.
- EML (Enterprise Modelling Languages): Those define the generic modelling constructs for enterprise modelling adapted to the needs of people creating and

using enterprise models. In particular, enterprise-modelling languages will provide constructs to describe and model human roles, operational processes and their functional contents as well as the supporting information, office and production technologies.

- GEMC (Generic Enterprise Modelling Concepts): Those define and formalize the most generic concepts of enterprise modelling. GEMC may be defined in various ways. In increasing order of formality generic enterprise modelling concepts may be defined as:
  - Natural language explanation of the meaning of modelling concepts (glossaries)
  - Some form of meta model (e.g. entity relationship meta schema) describing the relationship among modelling concepts available in enterprise modelling languages
  - Ontological Theories defining the meaning (semantics) of enterprise modelling languages, to improve the analytic capability of engineering tools, and through them the usefulness of enterprise models. Typically, these theories would be built inside the engineering tools.
- PEM (Partial Enterprise Models): Those capture characteristics common to many enterprises, within or across one or more industrial sectors. Thereby these models capitalize on previous knowledge by allowing model libraries to be developed and reused in a "plug-and-play" manner rather than developing the models from scratch. Partial models make the modelling process more efficient.
- EET (Enterprise Engineering Tools): Those support the process of enterprise engineering and integration by implementing an enterprise engineering methodology and supporting modelling languages. Engineering tools should provide for analysis, design and use of enterprise models.
- EM (Enterprise Models): These represent the particular enterprise. Enterprise models can be expressed using enterprise-modelling languages. EMs include various designs, models prepared for analysis, executable models to support the operation of the enterprise, etc. They may consist of several models describing various aspects (or views) of the enterprise.
- EMO (Enterprise Modules) – products, which can be used in implementation of an enterprise. Examples of enterprise modules are human resources with given skill (specific professions), types of manufacturing resources, common business equipment or IT infrastructure (software and hardware) intended to support the operational use of enterprise models. Special emphasis is on the IT infrastructure, which will support enterprise operations as well as enterprise engineering. The services of the IT infrastructure will provide two main functions:
  1. Model portability and interoperability by providing an integrating infrastructure across heterogeneous enterprise environments
  2. Model driven operational support (decision support and operation monitoring and control) by providing real-time access to the enterprise environment.
- EOS (Enterprise Operational Systems): Those support the operation of a particular enterprise. Their implementation is guided by the particular enterprise

model, which provides the system specification and identifies the enterprise modules used in the implementation of the particular enterprise system.

5.2.4 Layered Standards-Based Architectural Stack

Having discussed e-commerce system architectures from different perspectives we need to layer existing standard-based technologies according to the principles outlined above. In the context of practical e-commerce, there are three major layers of interest, which, of course, can be subdivided further. These layers in particular are: Business Modelling, Integration and Infrastructure. We will try to discuss the most relevant aspects of them in subsequent sections.

5.2.4.1 Business Modelling Layer

This is a very important layer, since the interaction between business and technical communities occurs using tools and standards of this layer. According to [63], many corporations put their BPM initiatives on-hold as they wait to see how standards play out.

One organization that is taking a lead in driving standards for BPM is BPMI.org (the Business Process Management Initiative). BMPi.org is a non-profit corporation whose goal is to empower companies of all sizes, across all industries, to develop and operate business processes that span multiple applications and business partners, behind the firewall and over the Internet.

The Initiative's mission is to promote and develop the use of Business Process Management (BPM) through the establishment of standards for process design, deployment, execution, maintenance, and optimisation. BPMI.org develops open specifications, assists IT vendors with marketing their implementations, and supports businesses with using Business Process Management technologies.

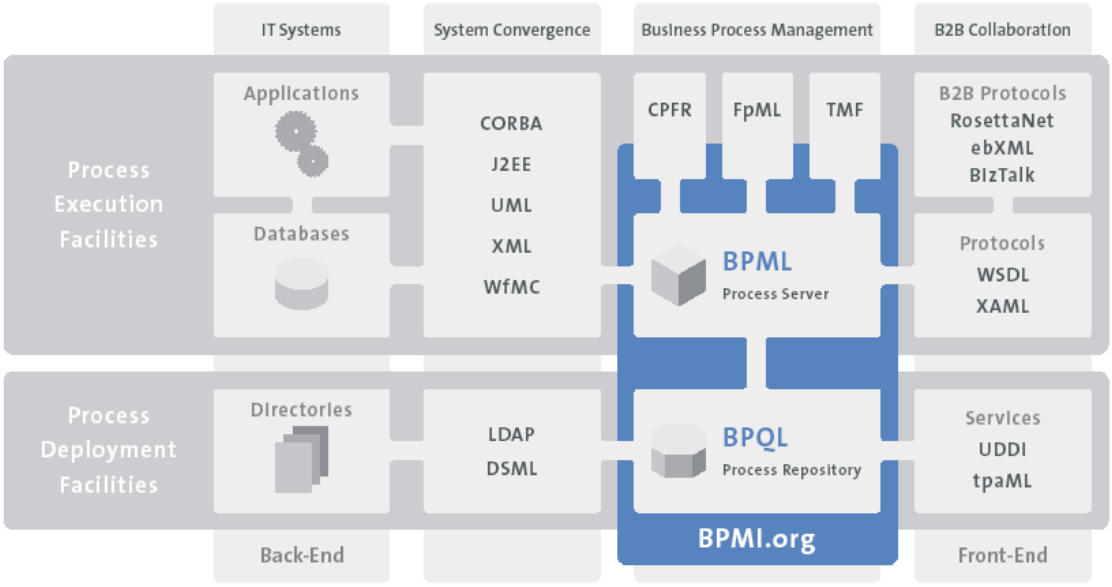


Figure 22 - Scope of BPMI.org (from www.bpmi.org)

On the back-end, technology integration standards such as XML Schema, SOAP, and J2EE enable the convergence of legacy infrastructures toward process-oriented enterprise computing. On the front-end, emerging protocols such as ebXML, RosettaNet, and BizTalk support the process-level collaboration among business partners. BPMI.org leverages those converging trends by driving the development of technologies that help companies to develop and operate business processes that span multiple applications and business partners, behind the firewall and over the Internet.

BPMI.org defines open specifications, such as the Business Process Modelling Language (BPML), Business Process Query Language (BPQL), and Business Process Modelling Notation (BPMN) that will enable the standards-based management of e-business processes. BPMI.org and ebXML are addressing complementary aspects of e-business process management. While ebXML provides a standard way to describe the Public Interface of e-business processes, BPMI.org provides a standard way to describe their Private Implementation. BPMI.org is driving the creation of BPML for the private implementation part (proprietary to each business partner) of a process. The Business Process Modelling Language (BPML) is a meta-language for the modelling of business processes, as XML is a meta-language for the modelling of business data. BPML provides an abstracted execution model for collaborative & transactional business processes based on the concept of a transactional finite-state machine. BPML is supported by BEA, IBM, Microsoft, Sterling Commerce and others.

Defined as a medium for the convergence of existing applications toward process-oriented enterprise computing, BPML offers explicit support for synchronous and asynchronous distributed transactions. Therefore, it can be used as an execution model for embedding existing applications within e-business processes as process components.

BPMN will be a notation for the development of BPML processes at the business level. Where BPML is used to carry process semantics among computer systems and software applications, BPMN will assist the communication of business processes among business and technical users, working to bridge the gap that exists today.

5.2.4.1.1 BPML

BPML considers e-business processes as made of a common public interface and as many private implementations as process participants [154]. This enables the public interface of BPML processes to be described as ebXML business processes or RosettaNet Partners Interface processes, independently of their private implementations.

In much the same way XML documents are usually described in a specific XML Schema layered on top of the XML, BPML processes can be described in a specific business process modelling language layered on top of the extensible BPML XML Schema. BPML represents business processes as the interleaving of control flow, data flow, and event flow, while adding orthogonal design capabilities for business rules, security roles and transaction contexts.

Defined as a medium for the convergence of existing applications toward process oriented enterprise computing, BPML offers explicit support for synchronous and asynchronous distributed transactions, and therefore can be used as an execution model for embedding existing applications within e-business processes as process components.

The BPML terminology consists of the following notions:

- **Constructs**: Those are the base parts that comprise the BPML abstract model.
- **Definitions**: Those are named constructs that can be referenced.
- **Abstract Model:** This defines the information that is used to express BPML definitions and explains their semantics.
- **BPML Schema:** This is an XML grammar for representing BPML constructs in the form of an XML document.
- **BPML package:** This is a collection of definitions, including both BPML definitions and other definitions that are referenced by or necessary for the purpose of interpreting the BPML definitions.
- **BPML document:** This is the XML representation of a BPML package based on the syntax given in the BPML schema.
- **BPML processor**: This is responsible to process XML documents that conform to the BPML schema.
- **BPML implementation**: This is responsible to perform one or more duties based on the semantics conveyed by BPML definitions.
- **Process**: This is a continuing procedure consisting of a series of controlled activities that are systematically directed toward a particular result or end.
- **Activity**: This is a component that performs a specific function within the process, such as invoking a service or another process. Activities can be as simple as sending or receiving a message or as complex as coordinating the execution of other processes and activities. Activities are related to each other by means of composition and context. Activities are divided into:
  - **Atomic activity**: This is an elementary unit of work that cannot be further decomposed. Atomic activities can be used to start other processes, perform calculations, or perform operations.
  - **Complex activity**: This is composed of other activities, and directs the execution of these activities. The complex activity instructs these activities to execute in sequential order or in parallel, to execute once or repeatedly, or even whether to execute or not conditionally. A process is a type of complex activity
- **Operation:** This directs work done by a service by establishing communication with that service. The atomic activity that performs an operation is called an **action**.
- **Context**: Activities always execute within a context. The context retains an association between the activities and information and services they utilize during execution, for example, properties that they can access, security credentials, transaction, exception handling, etc.
- **Activity set:** This is a collection of one or more activities that execute in the same context. A complex activity, then, is an activity that comprises of one or

more activity sets. Activity sets are used in other places as well, such as exception event handlers and transaction compensation.

- **Flow:** This is the series of executing activities resulting from the execution of an activity set.
- **Property:** This is a named value. Activities can access a property's value or establish a new value. Properties are accessed as part of the context in which an activity is executed, also known as its **current context**. Properties are communicated between loosely coupled processes by performing operations and mapping properties to the messages exchanged in these operations.
- **Transaction:** This is a logical unit of work that must be executed in an all-or-nothing manner. Once the transaction completes, its effects can be reverted by performing **compensation**.
- **Exception handling:** This defines activities that correspond to an unexpected event. An exception could be the receipt of a message, a time-out, or a fault.
- **Fault**: This is an error that occurs while executing an activity. Specifically, it is an error that occurs while executing an operation.
- **Process definition:** This is used to define a process within a particular context. The context can be part of a larger process, in which case the definition is known as a **nested process**. The context can be that of a package, in which case the definition is known as a **top-level process**.
- **Property definition:** This is used to define a property within a particular context. The context can be part of a process, or that of a package.
- **Instantiation:** This is the act of creating a new instance of a definition. For example, instantiating a process definition creates a new process instance.
- **Selector:** This is used to instantiate a property from part of an input message.
- **Independent Services:** Those are processes that are loosely coupled but interact with each other.
- **Locator:** This is used by an action for the purpose of identifying a particular service against which the operation is performed.
- **Connector:** This establishes communication between two operations performed by different services.
- **Global model:** This is a composition of interacting processes and shows the linkage between these processes through the exchange of messages.

5.2.4.1.2 BPQL

BPMI.org is driving the creation of BPQL to be a standard management interface for the deployment and execution of e-business processes [154]. The Business Process Query Language (BPQL) is a management interface to a business process management infrastructure that includes a process execution facility (Process Server) and a process deployment facility (Process Repository).

The BPQL interface to a Process Server enables business analysts to query the state and control the execution of process instances managed by the Process Server. This interface is based on the Simple Object Access Protocol (SOAP). The BPQL interface to a Process Repository enables business analysts to manage the deployment of process models

managed by the Process Repository. This interface is based on the Distributed Authoring and Versioning Protocol (WebDAV). Process models managed by the Process Repository through the BPQL interface can be exposed as UDDI services for process registration, advertising, and discovery purposes.

5.2.4.1.3 TpaML

The tpaML (trading Partner Agreement Mark-up Language) is an IBM specification focused on specifying inter-organizational agreements, in terms of messages exchanged, message sequences and the underlying transport and security infrastructure. These agreements are expressed using XML. To support agreement-related inter-party interactions, tpaML provides a number of tools and runtime services. The TPA tools include those to edit TPAs, register of the user application logic bound to the business's interfaces, and to facilitate code generation, essentially generating interfaces for each party's side of the business processes. The run-time services include the ability to monitor a TPA's execution. The system is open enough that the specific interaction style and formats can be based upon standards such as OBI or RosettaNet.

5.2.4.1.4 UBL

International agreement on a concrete XML syntax for business documents is the key to bringing the majority of the world's businesses into electronic commerce.

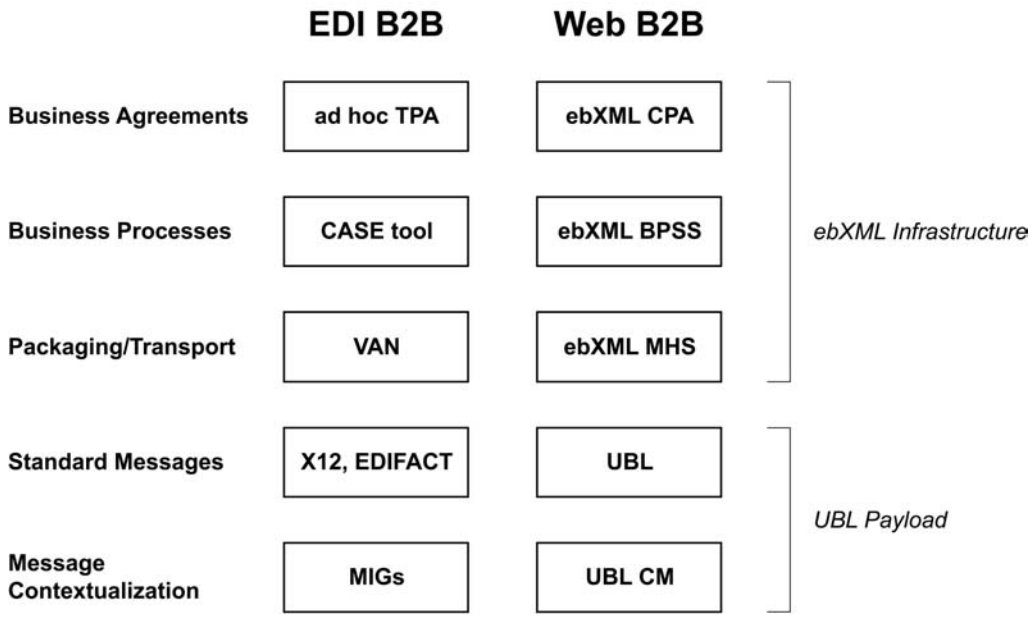


Figure 23 - Positioning of UBL (from [107])

XML mark-up (the "tags") transforms documents into hierarchical sets of information objects with logical "handles" that can easily be manipulated by simple pattern matching and text processing tools like perl, Python, and emacs. In addition, free lightweight parsers can apply rigorous structural and semantic validation to XML documents to ensure interoperability. These two characteristics of XML documents mean that when

UBL arrives, any reasonably computer literate person with a PC and some free software tools will be able to interact with the UBL-compliant purchasing system of a Fortune 500 company. Custom programming with expensive data extraction and mapping software typical of EDI implementations will still be possible but no longer required. And taming the problem of context-driven data requirements – met in EDI with implementation guides – should greatly reduce the cost of adapting applications to the requirements of particular trading relationships.

International agreement on a single vocabulary for electronic business will create an environment where businesses of every size can automate their processes to exactly the degree that they can afford – from manually programmed text-hacking systems at the low end to off-the shelf software in the midrange to completely automated and integrated purchasing systems at the high end. In addition, it will allow all of these businesses to interoperate as if they were technologically at the same level.

The growth of the World Wide Web demonstrated the inherent power of a standardized tag set running over a ubiquitous transport layer. UBL plus ebXML messaging services will allow businesses of every kind access to electronic commerce just as HTML plus HTTP allowed publishers of every kind access to the Internet. Like HTML, UBL will someday be seen as a transitional technology. Like HTML, its effect could be revolutionary.

5.2.4.1.5 BPSS

The Business Process Specification Schema (BPSS) is part of the ebXML specification and provides a standard framework by which business systems may be configured to support execution of business collaborations consisting of business transactions. It is based upon prior UN/CEFACT work, specifically the Metamodel behind the UN/CEFACT Modelling Methodology (UMM).

The ebXML BPSS provides a standard framework for business process specifications. As such, it works with the ebXML Collaboration Protocol Profile (CPP) and Collaboration Protocol Agreement (CPA) specifications to bridge the gap between Business Process Modelling and the configuration of ebXML compliant e-commerce software.

The BPSS specification is designed to specify the runtime aspects of business collaboration. It is not intended to incorporate a methodology, and does not directly prescribe the use of a methodology. However, if a methodology is to be used, it is recommended that it be the UN/CEFACT Modelling Methodology (UMM).

Business process models describe interoperable business processes that allow business partners to collaborate. Business process models for e-business must be turned into software components that collaborate on behalf of the business partners. BPSS provides for the nominal set of specification elements necessary to specify a collaboration between business partners, and to provide configuration parameters for the partners' runtime systems in order to execute that collaboration between a set of e-business software

components. The relationship between UMM, BPSS and other elements of ebXML is depicted in Figure 24.

Using Business Process Modelling (for example UMM), a user may create a complete Business Process and Information Model. Based on this Business Process and Information Model and using the ebXML BPSS the user will then extract and format the nominal set of elements necessary to configure an ebXML runtime system in order to execute a set of ebXML business transactions. The result is an ebXML Business Process Specification. Alternatively, the ebXML Business Process Specification may be created directly, without prior explicit business process modelling.

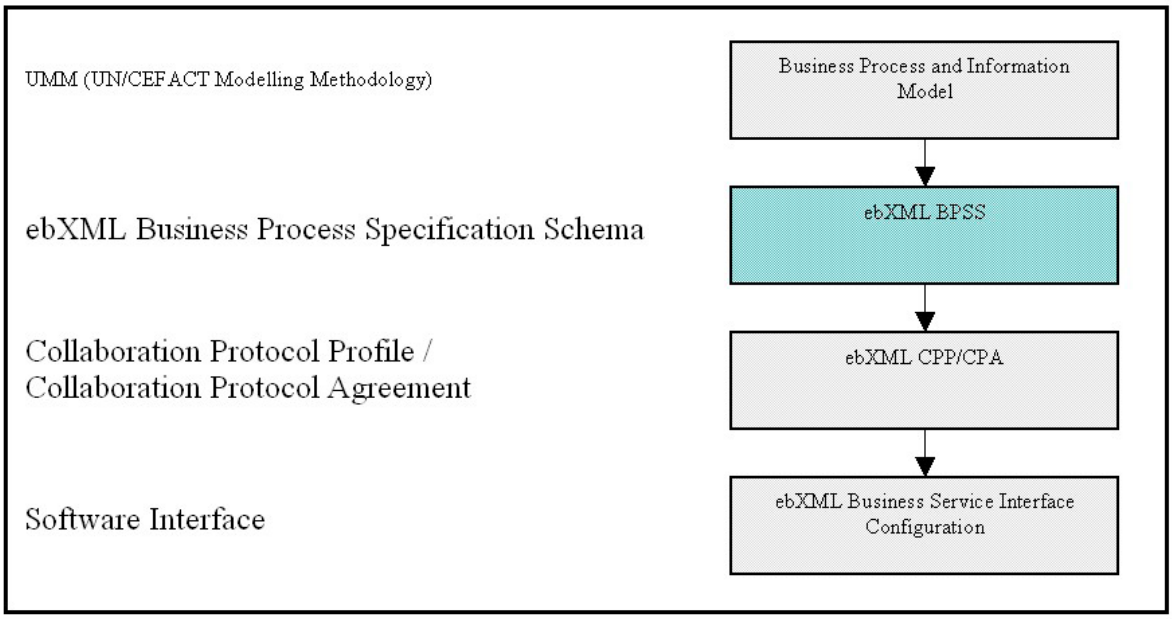


Figure 24 - Relationship between UMM, BPSS and other elements of ebXML

An ebXML Business Process Specification contains the specification of Business Transactions and the choreography of Business Transactions into Business Collaborations. This ebXML Business Process Specification is then input to the formation of ebXML trading partner Collaboration Protocol Profiles and Agreements. These ebXML profiles and agreements in turn serve as configuration files for ebXML Business Service Interface software.

In BPSS each Business Transaction can be implemented using one of many available standard patterns. These patterns determine the actual exchange of Business Documents and business signals between the partners to achieve the required electronic commerce transactions.

The ebXML BPSS is available in two stand-alone representations, a UML version and an XML version. The UML version of the BPSS is merely a UML Class Diagram. It is not intended for the direct creation of ebXML Business Process Specifications. Rather, it is a self-contained statement of all the specification elements and relationships required to be

able to create an ebXML compliant Business Process Specification. Any methodologies and/or metamodels used for the creation of ebXML compliant Business Process Specifications must at a minimum support these elements and relationships.

The XML version of the BPSS provides for the specification of XML based instances of ebXML Business Process Specifications, and is a target for production rules from other representations. The UML and XML based versions of the ebXML BPSS are unambiguously mapped to each other.

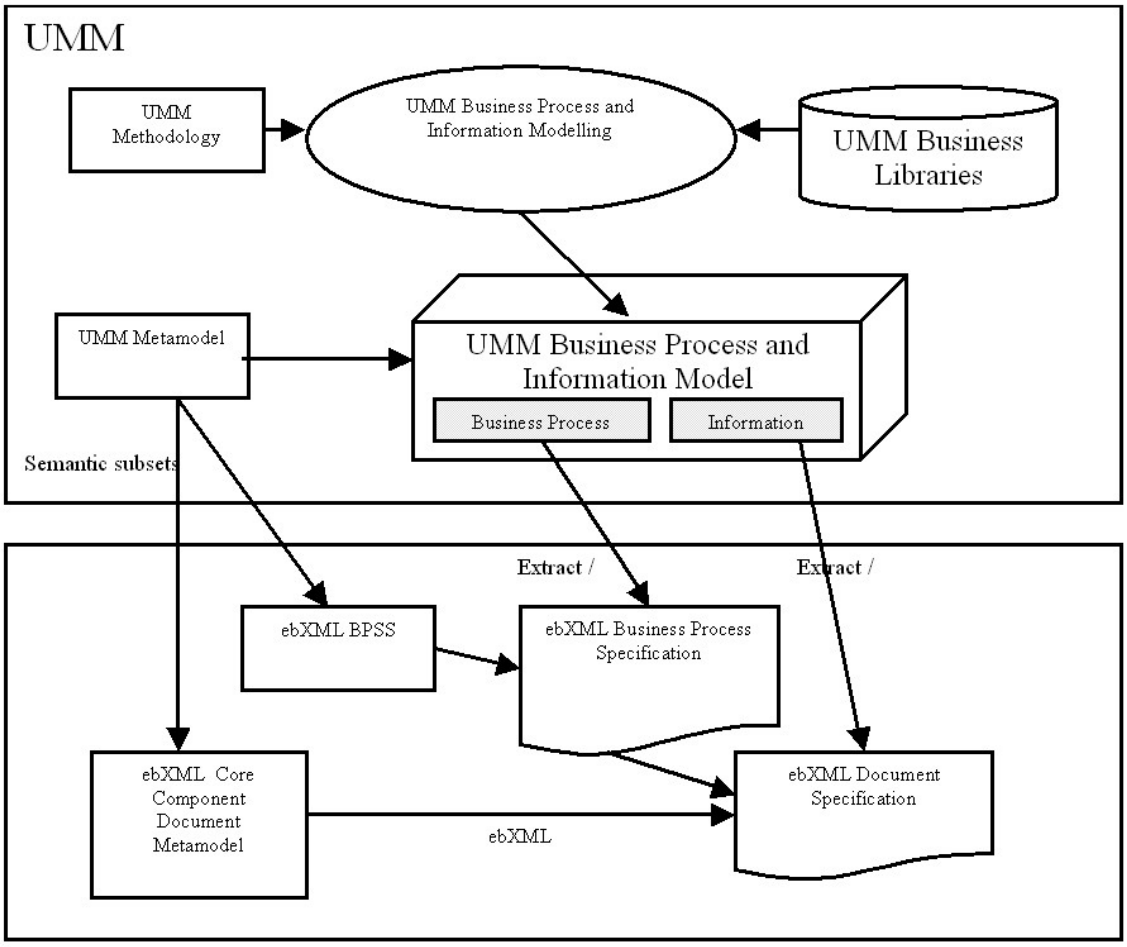


Figure 25 - Relationship between the UMM Meta Model and the ebXML BPSS

BPSS extends the UMM Metamodel by providing an additional view of it. This subset is provided to support the direct specification of the nominal set of elements necessary to configure a runtime system in order to execute a set of ebXML business transactions. By drawing out modelling elements from several of the other views, BPSS forms a semantic subset of the UMM Meta Model. Using the BPSS the user may thus create a Business Process Specification that contains only the information required to configure ebXML compliant software.

5.2.4.2 Integration Layer

Integration occurs at different levels – business, application, middleware, transport, etc. We will distinguish these layers in the following sections.

5.2.4.2.1 Business Integration Layer

Most of the technologies and frameworks discussed in section 5.1 facilitate business integration from one or another perspective. Usage of particular framework(s) depends mostly on system context. We will revisit ebXML later in this chapter, section 5.2.4.2.3 in extended enterprise application integration context.

5.2.4.2.2 Service Integration Layer

5.2.4.2.2.1 Web Services

The most basic Web Services connect computers and devices with each other using the Internet to exchange data and combine data in new ways. Web Services can be defined as software objects that can be assembled over the Internet using standard protocols to perform functions or execute business processes [185]. The key to Web Services is on-the-fly service creation using loosely coupled, reusable software components. This has fundamental implications in both technical and business terms:

- Software can be delivered and paid for as fluid streams of services as opposed to packaged products
- It is possible to achieve automatic, ad hoc interoperability between systems to accomplish business tasks
- Business services can be completely decentralized and distributed over the Internet and accessed by a wide variety of communications devices
- Businesses can be released from the burden of complex, slow and expensive software integration and focus instead on the value of their offerings and mission critical tasks.

Web Services can be roughly classified into simple and complex [185]. Simple Web services provide basic "request/response" functionality, and are not transactional in nature or provide sophisticated security. These simple Web services are generally how most people define Web services today. Complex Web services are services that will transform the way industries conduct business. Such services, largely unaddressed to date by most e-business software vendors, will provide the framework for collaboration among trading partners over the Internet. They can be characterized as multi-party, long running transactions (or business "conversations") that involve sophisticated security, such as non-repudiation and digital signatures, as well as business-to-business collaboration and business process management. These can be illustrated through different examples [185].

Scenario 1: Simple Web Services in a credit check.

Consider a bank or agency that provides businesses with up-to-the-instant credit standings. A business may need to check a potential trading partner's credit standing before completing a business transaction. In this scenario, a request would be sent to the bank's Web Service, processed, and a response returned in real-time. A simple Web Service would streamline this transaction process and reduce the business' exposure to risk.

Figure 26 - A request from a business going to the bank's Web Service and back (from [185])

To complete this process, the business application requiring credit information on a potential trading partner would:

1. Use XML, SOAP, WSDL, and UDDI to locate the credit check Web Service via the Web
2. Discover how to invoke the service
3. Submit the request
4. Accept the result
5. Return it to the user

This is a simple Web Service because it has no real security or transactional requirements, and follows a simple "request/response" pattern.

Scenario 2: Complex Web services in a long-running transaction involving many companies.

Consider a manufacturer with multiple suppliers developing an application that not only integrates internal applications and systems, such as forecast and inventory, but also loosely integrates with its suppliers through complex Web services. A motivating factor for this application development might be the multiple calls, long lead times, and cumbersome manual processes involved in interacting with numerous suppliers.

For example, when inventories reach certain thresholds, an application would automatically send a Request For Quote (RFQ) to multiple suppliers who also have exposed complex Web services. The applications of these suppliers (which are connected to their internal systems) receive the request and respond automatically based on predefined constraints — inventory, supplier status, discount levels, margins, etc. The manufacturer's originating application receives these responses and makes supplier selections for this unique order based, likewise, on predefined criteria. A confirmation is sent back to the selected suppliers with binding agreement information that may include a purchase order, fulfilment, and desired logistics information. Supplier applications respond with acknowledgement and appropriate logistical information, such as tracking

numbers and export/import documentation, that complete the transaction. This long-running transaction is characteristic of a complex Web Service and demonstrates the loosely coupled, collaborative relationship between suppliers, partners, and customers.

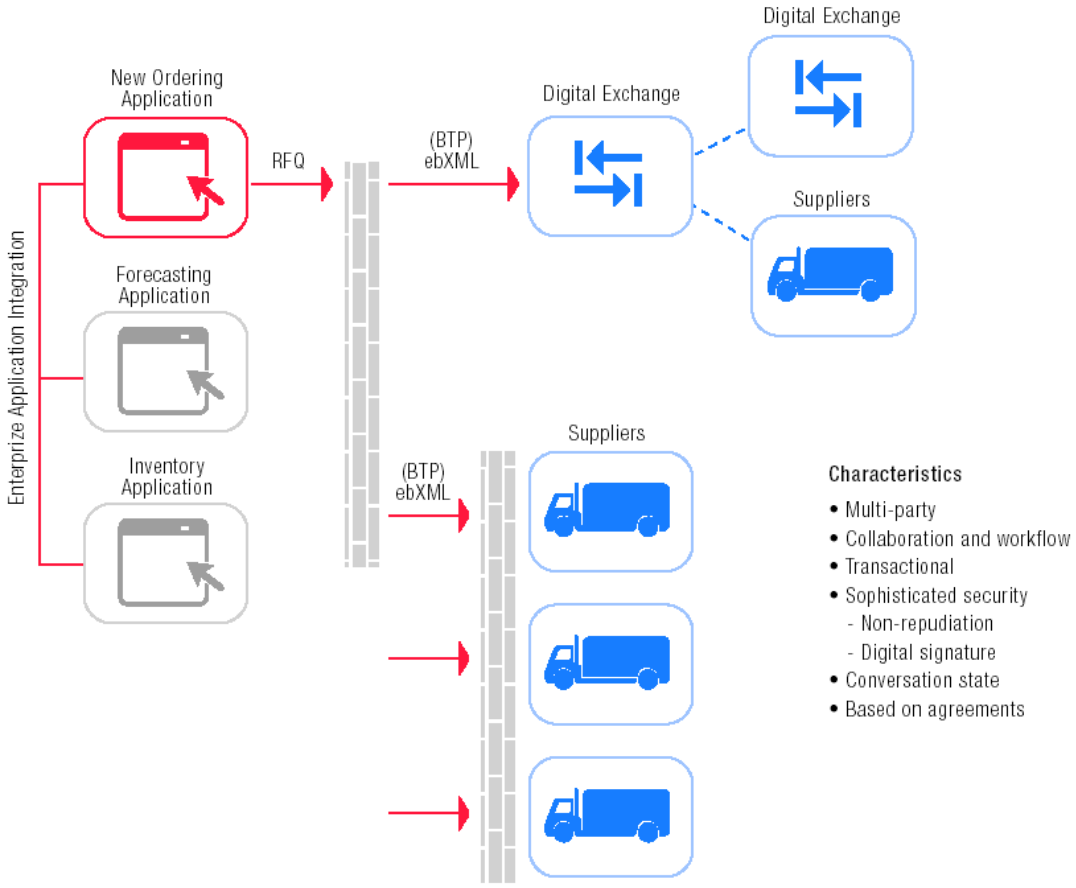


Figure 27 - An enterprise connecting to different types of suppliers. (from [185])

This example could be extended to include independent trading exchanges and Logistics Service Providers (LSPs). Exchanges could provide an additional set of suppliers through a Web Service. Furthermore, LSPs could provide detailed and up-to-the-minute information for the movement of goods through a Web Service. The manufacturer would then be able to make transactions contingent on additional criteria, such as estimated time of arrival, and actual quantities shipped. This allows for context-sensitive transactions that ensure that the actual goods arrive at the appointed place, as scheduled.

This example is a complex Web Service because it exemplifies the higher value characteristics of any business transaction:

- Multi-party, long-running transaction support
- Collaboration and business process management
- Transactional integrity
- Security
    - ♦ Non-repudiation

    - Digital signatures
- Context sensitivity
    - Ordering of steps
    - Described conversations

Like simple Web services, UDDI, WSDL, and SOAP are used to seek and invoke the service. However, higher-level protocols, such as ebXML and BTP are necessary to facilitate the conversation with multiple parties, requiring high security, non-repudiation, and transactional guaranteed delivery. These additional requirements — characteristics not typically included in the Web services discussion by other companies — make this a complex Web Service.

Although simple Web services are an important part of an e-business platform, by themselves they do not have the necessary qualities to provide the enterprise-class communication and integration required for high-value B2B applications. Collaboration, business process automation, transactional integrity, guaranteed delivery, sophisticated security, and multiparty, long-running transaction support are essential characteristics of complex Web services.

5.2.4.2.2.2 Open Grid Services Architecture

OGSA is being developed to address the need to integrate services across distributed, heterogeneous, dynamic "virtual organizations" formed from the disparate resources within a single enterprise and/or from external resource sharing and service provider relationships. Although the work arose from initiatives from the high performance computing and other scientific communities, it is now being broadened in particular to meet the needs of e-business.

Based on initial proposed technical specifications developed by the Globus Project and IBM, the need for an open Grid architecture is first identified and defined in *The Anatomy of the Grid*, which reviews the "Grid problem" and associated unique challenges. In *The Physiology of the Grid,* OGSA is elaborated and defined, based on concepts and technologies from the Grid and Web Services communities, in terms of [187]:

- A uniform exposed service semantics (the "Grid Service")
- Standard mechanisms for creating, naming and discovering transient Grid Service instances
- Mechanisms required for creating and composing sophisticated distributed systems, using Web Services Description Language (WSDL) interfaces and associated conventions.

In *Grid Service Specification* Grid Services are further defined in terms of a number of technical interfaces expressed in WSDL (WSDL portTypes). Though routed in Web Services concepts and technologies, OGSA is not a Web Services architecture in that it does not place requirements on what a service does or how a service is performed. OGSA

does not address issues of implementation programming model, programming language, implementation tools or execution environment

5.2.4.2.3 Integration Patterns

Again, to put all these technologies to work is a tough challenge even for an experienced systems architect, therefore leveraging of shared wisdom in the form of software patterns is important. Bloor Research [104] goes directly to the point in the following paragraphs, as far as the practical side of e-business systems is concerned.

"Throughout its history, the computer industry has devoted an inordinate amount of effort to reinventing the wheel". Patterns for e-business is a methodology developed by IBM with the aim of helping senior executives plan e-business system architectures. The need for such a methodology is considerable because e-businesses have evolved to such a point of complexity it is almost impossible for a chief executive to keep up to date with all the essential features. While IBM patterns for e-business cover quite many aspects from business patterns to runtime ones and product mappings, we will mention only integration patterns in this section.

5.2.4.2.3.1 Document Exchange Pattern

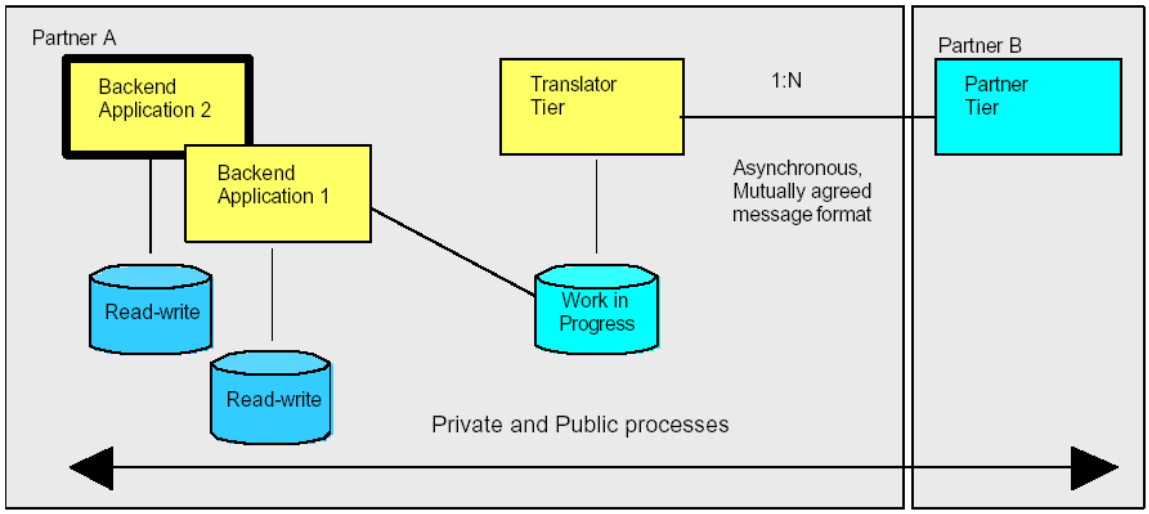


Figure 28 – Document Exchange Integration Pattern (from [102])

The Document Exchange Pattern is suited for business partners, who replace paper document-based communication by electronic batched data interchange. Actually, EDI is an example of this pattern. Direct association of external and internal processes limits flexibility of a solution, built using pattern.

5.2.4.2.3.2 Exposed Application Pattern

The exposed application pattern is one where the application tier is exposed directly to the outside world via message queuing or component based middleware. Communication can be synchronous or asynchronous in this case. Direct exposure of business API greatly

limits flexibility of this solution and increases maintenance and modification costs. In addition, partners must standardise on middleware, which is always an issue.

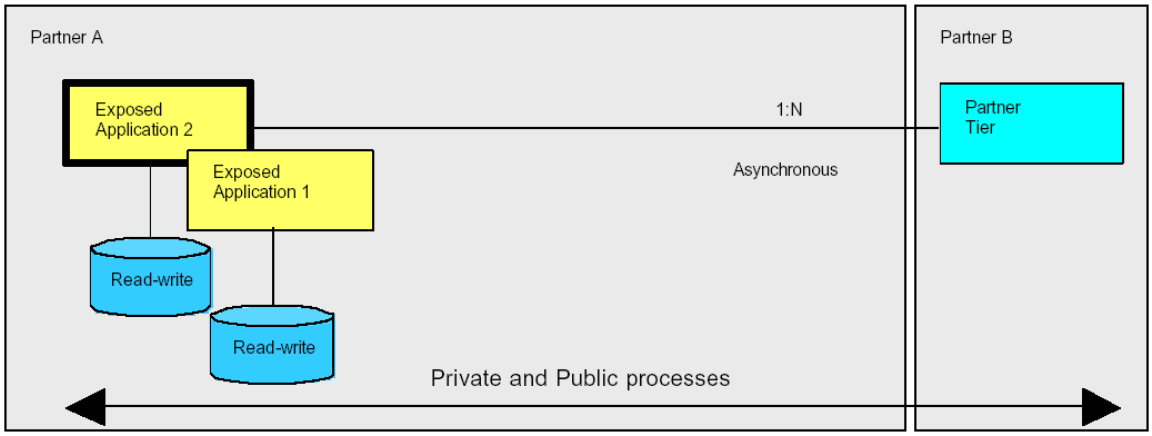


Figure 29 - Exposed Application Integration Pattern (from [102])

5.2.4.2.3.3 Exposed Business Services Pattern

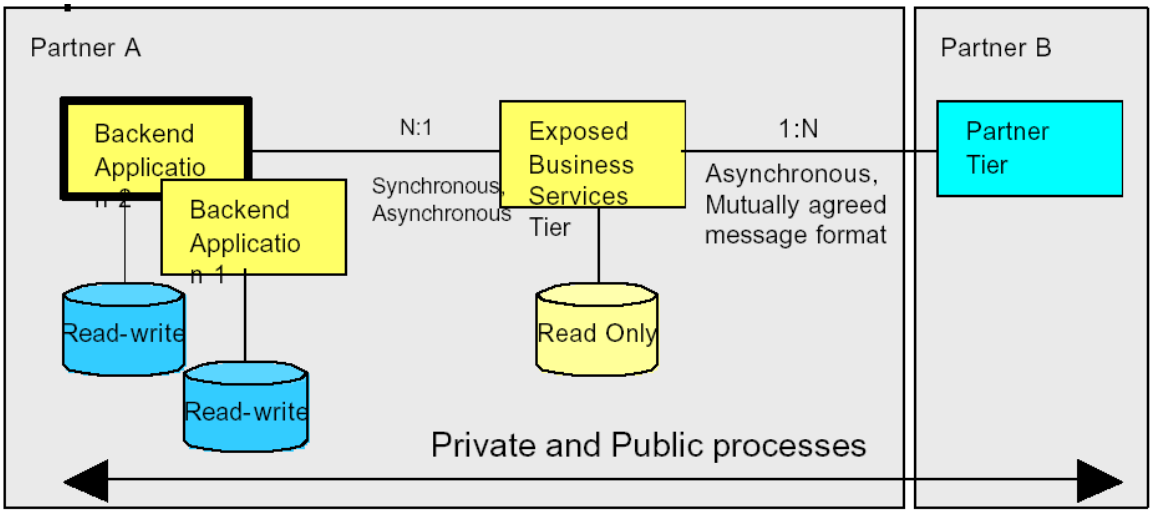


Figure 30 - Exposed Business Services Integration Pattern (from [102])

It is possible to optimise the above pattern by putting an intermediate tier between the outside world and internal business application. This tier would encapsulate internal interactions and expose e-business oriented business services. Web Services technology (or Grid in more sophisticate cases) is a good candidate to play such a role. However, when the number of collaboration participants reaches a certain level, the diversity of business services interfaces becomes unmanageable and one more step towards standardisation is needed.

5.2.4.2.3.4 Managed Public Processes Pattern

This step towards easier collaboration is a detailed definition of public collaboration processes and the separation of them from internal partner processes. This changes

logical integration topology from point-to-point dialects to common procedures and language for all the partners. Collaboration between parties is governed by trading partner agreements (TPA). The ebXML framework is designed to support development of this pattern.

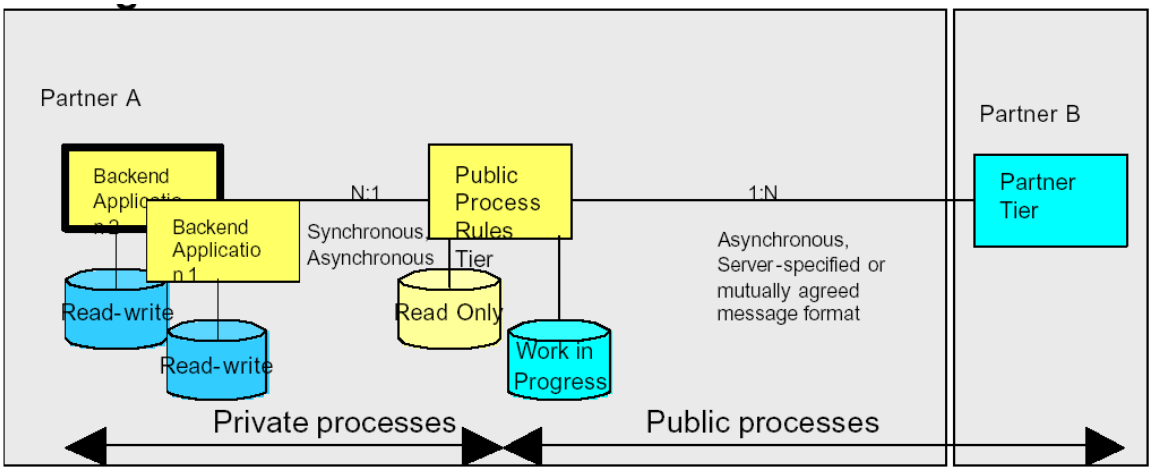


Figure 31 - Managed Public Process Integration Pattern (from [102])

5.2.4.3 Infrastructure Layer

This layer is pretty well understood and most of the technologies are commodities these days – component-based architectures such as J2EE and .NET, Message-Oriented Middleware, Internet protocols, database management systems, core XML, etc. The complexity lies in finding the right combination of these technologies. In many cases this is dictated by other layers, however, independence of infrastructure layer is one of the most important features of the above layers.

6 European E-Business Policies For SMEs

6.1 European Union Initiatives

European Union has already identified key opportunities and challenges that e-commerce will provide for individuals, industry and governments. It has set as an objective for the next decade at the Lisbon European council in March 2000, *"To become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion".* The Lisbon strategy reinforced the response to the knowledge-based society within existing processes and launched the eEurope 2002 Action Plan in June 2000.

One of the major priorities of the eEurope Action Plan was the acceleration of e-commerce growth, especially for SME's, so that they could consider the whole European Market as their market. Based on the eEurope initiative this effort requires:

- A reliable internal Market Framework, which could provide legal security, removes barriers to cross-border services, encourages on-line innovation and consumer trust.
- Public administrations to lead by example by facilitating and using electronic procurement, including the use of open and compatible systems and to ensure efficient physical distribution channels (e.g. postal and delivery services) to support online trade.

As a follow up to the eEurope 2002 Action Plan and for further contribution to the implementation of the Lisbon strategy, the European Union has launched, in May 2002, the eEurope 2005 Action Plan. The Council endorsed the objectives of the Commission's Action Plan for eEurope 2005 as "an important contribution to the EU's efforts towards a competitive, knowledge-based economy, calling upon all institutions to ensure that it will be fully implemented by the end of 2005", where e-commerce acceleration remains one of the priority areas of European Union e-business initiatives.

6.2 European Policies

As it is mentioned in the previous section, European SMEs need to become fully committed to using e-business solutions and the Internet, supported by information technology as leading-edge business tools. In order to stimulate usage of the Internet by SMEs, European Union has deployed a wide range of policies and instruments and has launched many different actions and initiatives based on them.

The general scope is to adapt European policies to the needs and requirements of SMEs across the EU, thus improving their efficiency. In the field of e-business the specific SME policies could be quite diverse, given the differing policy needs and challenges in the different member states and regions and the changing over time business environment. However, in general terms they aim in the generation of new ideas, adapted to the

specific context of each country or region. These policies could concern the following areas:

- Firstly, policies to raise the awareness of SMEs of the potential for profitable opportunities in the digital economy and to train them in how to make them real,
- Secondly, policies to help to establish support networks for SMEs, to ensure that good ideas and working business models are shared,
- Third, policies to help SMEs to take part in the digital economy, such as those which promote Internet platforms for SMEs.

The eEurope Go Digital initiative constituted a first policy response at EU-level for helping SMEs to make use of information and communication technologies (ICT) and seize the opportunities of the e-economy. GoDigital's overall purpose is to put together and adapt where appropriate support activities to help SMEs to use ICT with best possible efficiency.

In any case, SME policies should be based on clear, rational, realistic, and measurable targets. Only with this factors built in from the start, this should ultimately improve their effectiveness in measurable terms as the policies mature.

The European Union broader approach to policy development will comprise the following five main steps:

- The first step is to obtain a clear picture about the adoption of ICT and e-business by SMEs. Thorough regions' analysis and statistical work will be undertaken in order to identify the size and scope of the problems and issues to be addressed by specific policy initiatives in support of ICT and e-business by SMEs.
- The second step is to benchmark existing policy initiatives in favour of helping SMEs to go digital against pre-defined criteria. The objective here is to identify examples of "good" public sector practice in selected areas. The issue in this instance is not to prescribe which policies should be adopted, but to set out the process by which this should be done, by learning from experience.
- The third step is to present the results of this benchmarking initiative, including examples of good practice in policy making in this area to a broader audience of policy makers.
- The fourth step is to identify a number of quantitative targets to be achieved through a combination of national and/or European policies, for example in the areas of awareness and training, and SMEs support services. Such targets should be adapted to the differing needs of SMEs, possibly resulting in a range of priorities and policies.
- The final step will be to monitor the implementation of the policy targets, on the basis of agreed indicators. This should result in an "e-business scoreboard" which should be integrated into the Enterprise Scoreboard, thus measuring the efficiency of SMEs' policies in support of e-business and ICT.

For the better co-ordination of EU policies, framework policies would be established that will set clear and ambitious targets and will establish policy co-ordination mechanisms to

ensure that the various component initiatives are serving common goals. Framework policies are typified by being both horizontal and vertical in concept, with a strong central strategy and message addressing a variety of needs.

The LAURA project goes along with the three major categories of interest in European e-business policies:

- *E-business awareness raising and training policies,*
- *E-business support networks for SMEs,* and
- *Helping SMEs to use Internet platforms.*

In the following paragraphs, the way that LAURA project responds to European policies initiatives will be analysed in detail for each category of interest.

6.3 LAURA Project Compliance With E.U. Policies

6.3.1 E-business awareness raising and training policies

Most European companies are not fully convinced about the applicability of e-business to their type of practices and the related commercial benefits. The main reason for this negative attitude towards e-commerce is that SMEs have difficulty finding appropriate independent sources of business advice and information. In addition, SMEs face particular difficulties with regards to e-business skill shortages, which are considered to be one of the major inhibitors to the adoption of e-business.

LAURA project recognise these problems and for this purpose have introduced an appropriate local support unit called "Support Centre" in participating LAURA's European regions. Support Centre's role is to launch awareness raising schemes, to introduce better models and simulations to the SMEs, and to help the whole process of setting up the local e-commerce among SMEs in a region. The starting point is to inform and engage potential participants about the challenges and opportunities offered ny information technology and e-business.

Furthermore, Support Centres will address the training needs of companies in the area of e-commerce, by organising seminars and external training events or providing consulting services to the co-operative companies. The education and training support services will provide regional SMEs with the knowledge to access new technologies, to move beyond traditional business models and to take advantage of e-commerce technology.

Moreover, LAURA support centres will be flexible enough to correspond to the changing needs of SMEs as they become more mature in their awareness and training needs and market conditions. This will be achieved by on going surveys that look to the users of the project and identify how effective it is and what new types of services would be appropriate. For this purpose a set of metrics and indicators (quantitative and qualitative) are developed to support measuring of innovative performance of the project's participating companies. So once they have their capture audience, the schemes have the

opportunity to adapt to the changing needs of the SMEs as they become more sophisticated users.

The Support Centres will be organized and run by the independent local or regional organizations that participate in the LAURA project, safeguarding a smoother integration environment within the European Union.

6.3.2 E-business support networks for SMEs

The LAURA project will fully explore the role of local or regional business organisations by establishing interconnected SME business support networks in the less favoured European regions that face extra barriers to the adoption of e-business practices. The business support networks are a classic way of providing assistance at regional and local level. More specific, these networks aim to provide targeted knowledge and practical assistance to regional SMEs in the various stages of their effort to adopt e-commerce.

These business support networks are mentioning in LAURA project as *"regional electronic commerce zones"*. The conceptual modelling of regional electronic commerce zones will be based on the concept of Request-Based Virtual Organizations, which launch the development of clusters of partnering organisations.

As long as there is still great potential for SMEs networks in less favoured region for information exchange, in LAURA project the electronic commerce zones will also communicate tailored for SMEs information via the Web.

The development of electronic commerce zones will be based on useful mechanisms, involving surveys and on-going dialogue with SMEs and the contribution of other stakeholders including universities, research institutes and industrial partners.

Afterwards, the electronic commerce zones will be run by the local / regional business organisations in each region. In this way, the role of existing organisations such as Chambers of Commerce or public/private partnerships will be extended as intermediaries in the introduction of new technologies and innovative business management solutions.

Finally, electronic commerce zones will have the required flexibility to respond to SMEs' evolving needs and requirements, by adapting the type of provided content and services to that were made available.

6.3.3 Helping SMEs to use Internet platforms

Internet platforms are cited as one of the principal means for e-business introduction in SMEs. They could support existing methods of company operation and enhance the capabilities of those who participate. However the opportunities for SMEs to participate in private Internet platforms created by large market players are often limited, because of the cost of participation, the difficulty of accessing the software used and lack of transparency about the rules for trading within a marketplace.

The LAURA project follows an alternative approach where a business organization (regional or local) supports these e-marketplaces (so called B2A e-marketplaces) as a practical way of demonstrating the potential value and opportunities of e-commerce adoption. Nevertheless, the proposed Internet platform will support trading procedures not only on a local or regional level but also to an inter-regional level, using the Internet for more sophisticated business purposes than used to be.

Specifically, local or regional business organizations will undertake to:

- steer the local SMEs community in e-business and e-commerce practices,
- promote the implemented platform to local SMEs community,
- help them get started with LAURA Internet platform, and
- absorb and evaluate SMEs demand and feedback regarding the platform's functionality.

For the provided services, there will be a custom pricing policy that will facilitate the different regions and the different categories of customers and sales volumes. In any case, the profitability of this platform will be secured and monitoring in a regular base.

The platform performance will be evaluated under quantifiable and measurable targets that will be defined during the project. The participating SMEs will have a crucial role during the evaluation phase providing their point of view for possible improvements or further extensions.
The Internet platform development will be based on state-of-the-art methodologies and technologies frameworks that could secure the required systems flexibility and sustainability in order to be able to easily adapt functionality to new markets and service requirements.

7 Other Non Technical Considerations

7.1 Funding / Government support

7.1.1 Funding

Information and Communication Technologies (ICTs) provide the trigger for change, but many important other conditions must also be met. For instance, adequate means of financing is so important that many analysts tend to identify it as one of the key factors behind the spectacular performance of the US economy over the last decade.

Equity capital has proved to be more appropriate and more efficient as a way of financing new ventures than traditional bank lending which remains the main source of finance for many SMEs, particularly outside the core e-Economy sector. Very often, the new ventures that are made possible by ICTs tend to be based on an idea, a concept, a software application as well as the skills and energy of an entrepreneur. Enterprises based on so-called "intangible" values have often had difficulty raising finance from traditional sources. However, the relative weakness and fragmentation of the risk capital in Europe constitutes a barrier to the development of the e-Economy. Although the situation is improving, the EU venture capital market remains only a fraction of that of the US, where pension funds play a major role. Early stage investments in 2000 were five times higher in the US than in Europe. The financial environment in Europe is still insufficiently favourable to innovation, both technological and organizational. Such handicaps have to be overcome in Europe so that the structural changes will take place swiftly and on a larger scale. The European Investment Bank with its "Innovation 2000" initiative and the Commission under the Action Plan on financial services and the multi-annual programme for enterprise and entrepreneurship (2001-2005) have taken initiatives to contribute to the supply of risk capital for innovative businesses.

7.1.2 Government Support

Digital interactions between administrations and business are important components of the e-Economy. By offering online access to public services, administrations can add concrete, direct incentives for enterprises to go digital themselves. In particular, public authorities should offer on-line services aimed at lowering administrative costs for citizens and enterprises. To do this it is necessary to try to ensure that e-government solutions are not developed at a different pace and using different technical strategies than those adopted by commercial enterprises. This applies, for example, to payment mechanisms and authentication procedures. In parallel with the removal of discrimination against electronic signatures and electronic contracts in the business environment, discrimination against electronic filing of official documents should be progressively abolished. In this respect, the use of open standards and off the shelf applications is the key to ensure interoperability.

Similar openness should be achieved across borders, especially where there is an impact on internal market objectives, i.e. e-government applications should as far as possible be open not only to enterprises within an individual Member State, but to all European enterprises. In this respect, there is a need to:

- Foster online availability and exchange of information. This should happen at all levels, between manufacturers and public authorities, between different administrations and with certification and standardisation bodies.
- Promote interoperability, both in terms of infrastructure like electronic signatures, cross certification and smart cards, as well as in terms of service standards. The aim is to ensure broad interoperability both across borders and between administrations and business.
- Benchmark online services of public administrations.

7.2 Data Management

Business-to-Business electronic commerce (B2B EC) opens up new possibilities of trade. For example, new business partners from around the globe can be found, their offers can be compared, even complex negotiations can be conducted electronically, and a contract can be drawn up and fulfilled via an electronic marketplace. However, a sophisticated data management is required to provide such facilities.

During a commerce process, the involved participants usually go through three phases: Firstly, a party looks for potential business partners. A buyer wants to find relevant suppliers of the product he is looking for; a seller might want to find potential customers for the products he can supply. After locating potential (new) partners, the second step is to come to an agreement that is acceptable to all partners. If the negotiation is successful then a business deal is struck and the outcome is a contract, which will then have to be processed by the partners in the third phase, e.g. concerning logistics, payment, etc. In each of these phases, efficient business data management is required.

A business data management system for B2B e-commerce should fulfil the following requirements:

- Maintain business ontologies that are multilingual to support enhanced search techniques
- Integrate data from external sources and classify it according to the ontologies of the marketplace
- Retain the ownership of data and leave the information providers in complete control of their data
- Manage messages and documents of a negotiation process in an integrated way
- Use extensible data structures for all types of business data

As the LAURA project will deal with B2B e-commerce transactions between trading partners, it is very important to examine data management issues during the design and implementation phases of the project.

7.3 Trading Partner Trust in E-Commerce Participation

Growth of business-to-business e-commerce has highlighted the role of computer and communications technologies as well as inter-organizational trust in developing and maintaining business-to-business relationships. Despite the acknowledged importance of trust, only a limited amount of research exists that examines the role of trusts in these relationships.

There seems to be a perception by businesses that e-commerce transactions may be both insecure and unreliable. Despite the assurances of technological security mechanisms, trading partners in business-to-business e-commerce do not seem to trust the *people side* of the transactions. Some research suggests that a perceived lack of trust in e-commerce transactions sent by trading parties using the Internet could be a possible reason for the relatively slow adoption rate of e-commerce.

Lack of trust and consequently barriers to participation in e-commerce activities arise due to uncertainties inherent in the current e-commerce environment. These uncertainties, in turn, create a perception of increased risk, thereby inhibiting the tendency to participate in e-commerce. Uncertainties reduce confidence both in the reliability of B2B transactions transmitted electronically, and more importantly, in the trading parties themselves. Furthermore, lack of universally accepted business standards and policies to guide global B2B e-commerce has left trading partners, especially smaller suppliers, with lack of awareness, knowledge and expertise in using e-commerce technologies to their fullest potential.

One aspect of the LAURA project therefore, could be to examine ways to enhance trading partner trust for e-commerce activities, and reduce the uncertainties related to the introduction of e-commerce. An important aspect of the LAURA project will also be the setting up of (technological and business) security policies, in order to reduce trading partner uncertainties relating to the participation in e-commerce activities.

7.4 Service Level Management

Service Level Management (SLM) is the disciplined, proactive methodology and procedures used to ensure that adequate levels of service are delivered to all users in accordance with business priorities and at acceptable cost. The instrument for enforcing SLM is the Service Level Agreement (SLA).

Recently, Service Level Management (SLM) has become as much a business pull as a technology push, thanks to the trend towards e-business. This is helping not only to remove some of the longstanding barriers between IT and business unit managers, but also to reposition IT as a strategic component of the business (rather than as a cost to be minimized).

As the movement toward more comprehensive service management evolves within IT, there is renewed emphasis on Service Level Agreements (SLAs), executed between organizations – which spell out specific cost and performance targets. Unlike earlier

versions of SLAs, which were written in purely technical terms, the challenge to today's management is to define service levels in terms that are meaningful to the business stakeholders.

As a large part of the LAURA project will be the setting of efficient SLAs and the management of those, Service Level Management issues must be taken into consideration, in order to ensure that trading partners gain the maximum possible benefit from their trading activities.

7.5 Virtual Enterprises for E-Business

Dynamic e-business, as envisioned by several industry analysts and corporate leaders, involves the rapid teaming of companies with both familiar and new business partners in pursuit of specific market opportunities. For realizing this new generation business model, the ability to form, operate, and disband virtual enterprises will be the single-most important requirement. These short-lived, opportunity-based organizations leverage the individual capabilities of several member companies to form virtual enterprises that have resources equivalent to a traditional vertically integrated corporation. Before successfully applying this business model, however, several issues need to be resolved, such as building trust and a collaborative attitude amongst member companies, developing the e-commerce infrastructure for handling engineered-to-order products and services, building optimal coalitions for the job, etc.

As the LAURA project will be largely based on the formation of Request-Based Virtual Organizations, one needs to examine optimal ways in which those organizations will be formed, and the laws that will govern these partnerships.

8 Conclusions

The main purpose of this report is to serve as the reference point for the LAURA project and it is intended to inform business and technology decisions related to the project. Both general e-commerce developments and regional/sector specific details were analysed during the initial phase of the LAURA project. Actual data relating to the most viable sectors from the participating regions was gathered and analysed in order to assess the implications of participation in the LAURA project. The analysis shows that there is good potential for the introduction of innovative e-commerce concepts, such as Request-Based Virtual Organisations. However, it is important to differentiate the requirements for each region and sector to make the most of the proposed services. There are also already good examples of e-business initiatives that can inform the LAURA project.

The literature suggests that the emergence of Internet / Web based communities of common interest accelerates a shift towards the concept of the virtual organisation by enabling enterprises to align within a series of 'value networks' against other groups of enterprises. The literature presents a common theme of increasing competitive pressures on companies exacerbating the need for greater flexibility, efficiency, responsiveness and innovation. Firms may therefore seek to collaborate in order to compete more effectively in their chosen markets. Using e-commerce provides a potential enabler to allow firms to react to the strong pressures, emanating from an ever more complex environment, by transcending organisational boundaries and creating privileged relationships with trading partners.

The discussion of the concept of organisational networks in the literature lacks consistent terminology with terms such as virtual networks, strategic networks, dynamic networks, extended networks and value networks. These different terms are often used as synonyms but sometimes also indicate different characteristics related to longevity, purpose and culture. However, the common theme is one of traditional external boundaries of organisations beginning to blur, often with e-commerce as a key enabler of such change. The separation between internal and external processes becomes less clear as the innovative use of e-commerce technologies facilitate more co-ordinated exchange and sharing of information enabling flexible organisational arrangements, value acceleration and new value added processes.

The technology aspects of e-business continue to undergo rapid change. However, there is considerable synergy between activities carried out by non-profit organisations, standards bodies and the corporate world. These efforts have gained momentum and have resulted in a significant number of important standards developed by the wide-participation of consortia and are also supported by key players in the e-business software market. The most important of these standards for the LAURA project are: ebXML, BPML, UML, UMM, SOAP, UDDI etc. They are backed by IBM, Oracle, SAP AG, BEA Systems, Microsoft and other key players. There are already (or emerging) viable standards at almost every level of systems engineering, ranging from business process management to middleware. The two competing camps, .Net of Microsoft and J2EE led by Sun Microsystems and others, seem to be able to coexist and interoperate using Web

Services. This is a major breakthrough in EAI, since these two camps have always had integration issues to solve. Of course, the task of choosing the right technology toolset is very far from trivial, but based on existing experience there are guidelines to follow as well as space for innovation.

The report also highlights a number of interdependent factors that are key in implementing B2B e-commerce. Foremost among these are the redesign of processes and practices, common information interchange standards, technical support, a consultative approach based on mutual trust and a willingness to learn and to adopt a 'network' perspective. The role of a regulatory and legal framework is key to the development and diffusion of e-commerce services and the LAURA project will be concerned with the setting and management of efficient SLAs, in order to ensure that trading partners gain the maximum possible benefit from their trading activities. An important aspect of the LAURA project will also be concerned with addressing the issues of trust and reducing trading partner uncertainties relating to their participation in e-commerce activities.

It would appear that now it is a good time for a project such as LAURA. E-commerce awareness among the business community has reached critical mass and technology developments in terms of standards and interoperability are making good progress. Although the Internet dotcom bubble has burst, the upside is that valuation of e-commerce services is much more realistic and pragmatic. Therefore, a carefully planned and innovative approach may open the doors to e-business for many more companies than previously and the LAURA project will facilitate this process for small and medium sized enterprises.

9 References

9.1 Chapter 3 References

[1.] Arnold, J., Cooper, C. L., Robertson, I. T., (1998), Work Psychology: Understanding Human behaviour In The Workplace, 3rd Ed., London, Financial Times – Prentice Hall

[2.] Aubin, M., Simplifying the Integration Market: BPI Is Here To Stay, 2nd Apr 2002, URL: http://eai.ebizq.net/bpm/aubin_1.html (4th Apr 2002)

[3.] Ayed, H. K. B., Chihi, S. K., Kamoun, F., Electronic Negotiation: Characteristics And Requirements, (2001), in Developing a Dynamic, Integrative, Multi-Disciplinary Research Agenda in E-Commerce/E-Business, pp57-71, Steve Elliot, Kim Andersen, Paula Swatman, and Siegfried Reich (eds.), Salzburg, Austria

[4.] Bass, C., Lee, M.L., Building a Business Case for EAI, EAI Journal, 21st Jan 2002, pp18-20

[5.] Bingi, P., Mir, A., Khamalah, J., The Challenges Facing Global E-Commerce, Information Systems Management, Fall 2000 Vol. 17 No. 4 pp26-34, Auerbach Publishing, USA, ISSN 1058-0530

[6.] Bingi, P., Sharma, M.K., Godla, J.K., Critical Issues Affecting An ERP Implementation, Information Systems Management, Summer 1999 Vol. 16 No. 3 pp7-14, Auerbach Publishing, USA, ISSN 1058-0530

[7.] BizTalk, Initiative for Automating Business Process Integration – White Paper, URL: http://www.ecomnz.co.nz/Whitepaper_Registration/Whitepapers/Biztalk_White_Paper.doc (4th Feb 2002)

[8.] BizTalk.org, The BizTalk Framework, URL: www.biztalk.org/home/framework.asp (4th Feb 2002)

[9.] Brown, T.M., Web Services – EAI Killer? , EAI Journal, April 2002, pp48

[10.] Butler, M., Will Web Services Kill EAI? , EAI Journal, May 2002, pp26

[11.] Byrne, J. A., (1993), The Virtual Corporation, Business Week, Feb 8, pp36-41

[12.] Caldeira, M. M., Ward, J. M., Understanding The Successful Adoption And Use Of IS/IT In SMEs: An Explanation From Portuguese Manufacturing Industries, Information Systems Journal, Vol. 12 No2, Apr 2002, pp121-152, Blackwell Science (UK), ISSN 1350-1917

[13.] Davidow., D. H., Malone, M. S., (1993), The Virtual Corporation: Structuring And Revitalising The Corporation For The 21st Century, New York, Harper-Collins

[14.] Erbschloe, M., Forces of Change: Ten Trends That Will Impact The Internet Over The Next Five Years, Information Systems Management, Summer 2001 Vol. 18 No. 3 pp25-29, Auerbach Publishing, USA, ISSN 1058-0530

[15.] Ferguson, B.R., Implementing supply chain management, Production and Inventory Management Journal, Vol 41 Issue 2, Alexandria, 2nd Qtr 2002, ISSN 08978336

[16.] Garrimella, K., Integration Challenges in Mergers and Acquisitions, EAI Journal, August 2001, pp36-39

[17.] Gartner (Furlonger, D.), How Financial Firms Should Collaborate, Research Note TG-14-5020, 10th Oct 2001

[18.] Gartner (Sinha, D., Eisenfeld, B.), CRM Services Market Size and Forecast, 2001-2006, Gartner Dataquest Alert ITSV-WW-DA-0126, 13th Mar 2002

[19.] Ghosh, A.K., 2001, Security & Privacy for E-Business, Wiley, Chichester, 240pp, ISBN 0-471-38421-6

[20.] Giussani, B., 2001, Roam – Making Sense of the Wireless Internet, Random House Business Books, London, 320pp, ISBN 0 7126 8153 1

[21.] Goldman, S. L., Nagel, R. N., Preiss, K., (1995), Agile Competitors And Virtual Organizations: Strategies For Enriching The Customer, New York: Van Nostrand Reinhold, International Thomson Publishing

[22.] Gottschalk, K., Graham, S., Kreger, H., Snell, J., Introduction to Web services architecture, IBM Systems Journal, Vol 41 Issue 2, Armonk, 2002, ISSN 00188670

[23.] Hammer, K., Web Services and Enterprise Integration, EAI Journal, November 2001, pp12-15

[24.] Henriksen, H. Z., Andersen, K. V., Pedersen, T., IS Innovation: Adoption Of B2B E-Commerce, (2002), in Towards the Knowledge Society: eCommerce, eBusiness, and eGovernment, pp569-581, Monteiro, J., Swatman, P. M. C., L. Valadares Tavares (eds.), The Second IFIP Conference on E-Commerce, E-Business, E-Government (I3E 2002), October 7-9, 2002, Lisbon, Portugal. IFIP Conference Proceedings 233 Kluwer 2002, 766pp, ISBN 1-4020-7239-2

[25.] Holder, C., and Bailey, G. (Shaw Pittman), Legal Issues Surrounding Web Content, MSc Information Systems - E-Commerce Lecture Notes, Kingston University, May 2001

[26.] Horak, C., Web Services: What Lies Beneath, EAI Journal, February 2002, pp17-19

[27.] Ishaya, T., Macaulay, L., (1999), The Role Of Trust In Virtual Teams, Organizational Virtualness And E-Commerce, 2nd International VoNet Workshop, Zurich

[28.] Karpinski, R., It's All About The Process, 19th Oct 2001, URL: www.internetweek.com/transtoday01/ttoday101901.htm (4th Feb 2002)

[29.] Khan, R., A Perfect Marriage Workflow and EAI, EAI Journal, February 2002, pp20-21

[30.] Klutke, O., Integrated Supply: A Free Lunch?, Tooling & Production, Vol. 67 Issue 7, Solon, Oct 2001, ISSN 00409243

[31.] Lawton, G., Achieving B2B Business Process Integration, 4th Sep 2001, URL: http://b2b.ebizq.net/ebiz_integration/lawton_2.html (4th Feb 2002)

[32.] Linthicum, D.S., Binding Companies, EAI Journal, June 2001, pp47-48

[33.] Lublinsky, B., Farrell Jr., M., Web Services The Implementation Iceberg, EAI Journal, June 2002, pp26-30

[34.] Manthou, V., Vlachopoulou, M., Folinas, D., The Supply Chain Perspective Of E-Business Evolution, (2002), in Towards the Knowledge Society: eCommerce, eBusiness, and eGovernment, pp229-242, Monteiro, J., Swatman, P. M. C., L. Valadares Tavares (eds.), The Second IFIP Conference on E-Commerce, E-Business, E-Government (I3E 2002), October 7-9, 2002, Lisbon, Portugal. IFIP Conference Proceedings 233 Kluwer 2002, 766pp, ISBN 1-4020-7239-2

[35.] McKnight, D. H., Chervany, N. L., What Trust Means In E-Commerce Customer Relationships: An Interdisciplinary Conceptual Typology, International Journal of Electronic Commerce, Winter 2001-2002, Vol. 6 No. 2, pp35-59, M.E. Sharpe Inc., ISSN 1086-4415

[36.] Milopoulos, G., Pouloudi, N., Lytras, G., CEBOS: Transforming SME Needs To Successful E-Marketplaces, Challenges And Achievements In E-Business And E-Work, B. Stanford-Smith et al (eds.), IOS Press, 2002

[37.] Pinkston, J., The Ins and Outs of Integration – How EAI Differs from B2B Integration, EAI Journal, August 2001, pp48-51

[38.] Rabin, S., Automating Trading Partner Collaboration Across The Order Management Life Cycle, Information Systems Management, Summer 2002, Vol. 19 No. 3, pp70-73, Auerbach Publishing, USA, ISSN 1058-0530

[39.] Rao, H.R., Pegels, C.C., Salam, A.F., Hwang, K.T., Seth, V., The impact of EDI implementation commitment and implementation success on competitive advantage and firm performance, Information Systems Journal, Vol 5 No3, July 1995, pp185-202, Blackwell Science (UK), ISSN 0959-2954

[40.] Roch, E., Application Integration Business Case and Technology Trends, TIBCO 2002, URL: http://eai.ebizq.net/str/roch_1a.html (10th Jul 2002)

[41.] Rowley, J., The Role of BPI in e-Commerce, 26th Mar 2001, URL: http://eai.ebizq.net/bpm/rowley_1.html (4th Feb 2002)

[42.] Saabeel, W., Verduijn, T. M., Hagdorn, L., Kumar, K., (2002), A Model Of Virtual Orgasnization: A Structure And Process Perspective, Electronic Journal Of Organizational Virtualness, Vol. 4, No. 1

[43.] Saunders, C., No Integration, No CRM, EAI Journal, 24th Sep 2001, URL: http://www.eaijournal.com/ArticlePrint.asp?ArticleID=422 (10th Jul 2002)

[44.] Scannell, E. and Sullivan, T. IBM connects its software layers, InfoWorld, 17th Dec 2001 Framingham, Vol 23, Issue 51, pp15-16, ISSN 01996649

[45.] Schuette, D., Turning E-business Barriers Into Strengths, Information Systems Management, Fall 2000 Vol. 17 No. 4 pp20-25, Auerbach Publishing, USA, ISSN 1058-0530

[46.] Schultz, R., Business Process Integration, EAI Journal, 18th Sep 2001, pp34-36

[47.] Sharpe, R., Why public sector IT is so important, Computing, Week 18 - dated 2nd May 2002, pp31, VNU Business Publications

[48.] Sieber, P., Griese, J., (1999), Virtual Organizations As Power Assymetrical Networks, Organizational Virtualness And E-Commerce, 2nd International VoNet Workshop, Zurich

[49.] Singer, T., Portals lower cost and increase productivity, Plant Engineering, Jan 2002, Vol 56 Issue 1, pp24-28, Barrington, ISSN 0032082X, URL: http://proquest.umi.com/pdqweb? (10th Jul 2002)

[50.] Skinstad, R., Business process integration through XML, White Paper, URL: www.gca.org/paperds/xmleurope2000/papers/s10-03.html (4th Feb 2002)

[51.] Strader, T. J., Lin, F., Shaw, M. J., (1998) Information Structure For Electronic Virtual Organization Management, Decision Support Systems, 23, pp75-94

[52.] Timmers, P., 1999, Electronic Commerce – Strategies And Models For Business To Business Trading, Wiley, UK, 268pp, ISBN 0-471-49840-8

[53.] Tumulo, M., Business-To-Business Exchanges, Information Systems Management, Spring 2001 Vol. 18 No. 2, pp54-62, Auerbach Publishing, USA, ISSN 1058-0530

[54.] Ulrich, W., Critical Success Factors in a Business Process Integration Initiative, 17th Dec 2001, URL: http://eai.ebizq.net/bpm/ulrich_1.html (4th Feb 2002)

[55.] Virtual Organization – A whatis Definition http://whatis.techtarget.com/definition/0,,sid9_gci213301,00.html (4th Nov 2002)

[56.] Vitria BusinessWare® at URL: http://www.vitria.com (21st Jan 2002)

[57.] Vollmer, K., Evolution Of B2B Integration Continues Despite Slower Growth, InternetWeek, 24th Sep 2001, pp27

[58.] Vollmer, K., The Growth Of The Internet Means Business Needs More EDI Not Less, InternetWeek, 9th Apr 2001, pp25

[59.] White, A. G., 'The Rise And Fall Of The Trading Exchange', Logility Inc 2000 – White Paper, URL: http://www.logility.com/news/logility_library.html (25th Nov 2002)

[60.] White, A., 'The Value Equation: Value Chain Management, Collaboration And The Internet', Logility Inc 1999 – White Paper, URL: http://www.logility.com/news/logility_library.html (25th Nov 2002)

[61.] Wilkins, L., Swatman, P. M. C., Castleman, T., More Than Just A Transaction: Conceptualising Industry-Based Networks For Virtual Trading Communities (2002), in Towards the Knowledge Society: eCommerce, eBusiness, and eGovernment, pp539-552, Monteiro, J., Swatman, P. M. C., L. Valadares Tavares (eds.), The Second IFIP Conference on E-Commerce, E-Business, E-Government (I3E 2002), October 7-9, 2002, Lisbon, Portugal. IFIP Conference Proceedings 233 Kluwer 2002, 766pp, ISBN 1-4020-7239-2

[62.] Yee, A., Demystifying Business Process Integration, URL: http://eai.ebizq.net/workflow/yee_1.html (4th Feb 2002)

[63.] BPM2002 Market Milestone Report - A Delphi Group White Paper, http://www.delphigroup.com

[64.] Schubert, P., Ginsburg, M., Virtual Communities of Transaction: The Role of Personalization in Electronic Commerce

[65.] Carr, Jim (2001), "Service Level Agreements", NetworkMagazine.com

[66.] Engel Fred (1999), "The role of Service Level Agreements in the Internet Service Provider Industry", International Journal of Network Management, 9

[67.] Hathaway Joy (1995), ”Service Level Agreements: Keeping a Rein on Expectations”, Paper (Computing Services Department, Fermi National Accelerator Laboratory)

[68.] Hawryszkiewycz I.T. (2001), “A Metamodel for Virtual Enterprises”, Faculty of Information Technology, University of Technology, Sydney

[69.] Khim-Yong Goh, Hock-Hai Teo, Haixin Wu and Kwok-Kee Wei (2000), “Computer-Supported Negotiations: An experimental study of bargaining in electronic Commerce”

[70.] LAURA- Adaptive Zones for Interregional Electronic Commerce based on the concepts of Request-Based Virtual Organizations and sector-specific Service Level Agreements (2001)

[71.] Lee John L., Ben-Natan Ron (2002), “Integrating Service Level Agreements: Optimizing your OSS for SLA delivery”, Wiley

[72.] Liu Zen, Squillante Mark S. & Wolf Joel L. (2001), “On Maximizing Service-Level-Agreements Profits”, IBM T.J. Watson Research Center

[73.] Muller Nathan J. (1999), “Managing service Level Agreements”, International Journal of Network Management, 9

[74.] Nayak Nitin, Bhaskaran Kumar and Das Raja (2001), “Virtual Enterprises – Building Blocks for Dynamic e-Business”, IEEE

[75.] Nextslm.org, “The Heart of the Matter: Service Level Agreements”

[76.] Nicoll Chris (1999), “A closer look at Service Level Metrics”, International Journal of Network Management, 9

[77.] Shally Bansal Stanley, (2002) **“**Strengthen service-level agreements”, Network World

[78.] Sturm Rick, Morris Wayne and Jander Mary (2000), “Foundations of Service Level Management”, Sams

[79.] ebXML & OASIS (2000), “ebXML Business Process Methodology Guidelines”

9.2 Chapter 4 References

[1.] The development of e-commerce in the European Union: A general assessment, The European e-Business Market Watch, May 2002

[2.] Digital Economy 2002 report, US Department of Commerce, Economics and Statistics.

[3.] The Unexpected eEurope, Accenture (2001)

[4.] ECO – Verband der Deutschen Internetwirtschaft e.V., News, 13 March 2002 (www.eco.de)

[5.] e-Marketplace Perspective: State Attitude, e-business Forum, July 2002

[6.] The impact of the e-economy on European enterprises: economic analysis and policy implications, Communication from the Commission to the Council and the European Parliament, COM (2001) 711 final.

[7.] Introduction to EMarkets and why export companies should care about them, e-Market Services, July 2002

[8.] Peter WEISS (2002), E-business and Small Businesses, Challenges and Achievements in E-business and E-work, IOS Press, November 2002, p. 173-178.

[9.] Raphael AMIT, Christoph Zott, Value Drivers of e-Commerce Business Models, July 2000

[10.] Robyn Lawson, Carole Alcock, Joan Cooper (2001), Diffusion of Electronic Commerce in Small and Medium Enterprises, CollECTeR 2001 Conference Proceedings.

[11.] M. A. Emmelhainz, EDI - A Total Management Guide, Van Nostrand Reinhold Publishing, 1993.

[12.] M. Hendry, Implementing EDI, Boston, Artech Boston & London, 1993

[13.] Europa Newsletter. Available from: http://europa.eu.int/information_society/topics/ebusiness/ecommerce/9ebusiness/b2b/index_en.html

[14.] T. Forester, (1985) The Information Technology Revolution, Oxford: Blackwell.

[15.] Empirica / BMWi, Status Quo and Development Perspectives of Electronic Commerce in Germany, Europe and the USA in 1999 and 2001, November 2001.

[16.] G. Roos (2001), RosettaNet for the masses, ebn. http://www.ebnews.com/story/OEG20010928S0071

[17.] Dale Waldt, Rik Drummond, ebXML – The global standard for electronic business, ebXML, http://www.ebxml.org/presentations/global_standard.htm

[18.] David S. Linthicum (2001), Don't Discount BizTalk!, eAI Journal, April 2001.

[19.] George Lawton (2000), BizTalk, RosettaNet and the Holy Grail of e-Commerce Integration, ebiz, November 2000, http://b2b.ebizq.net/ebiz_integration/lawton_1.html

[20.] Eric Knorr (2002), ebXML: A B2B standard on hold, ZDnet Tech Update, May 2002, http://techupdate.zdnet.com/techupdate/stories/main/0,14179,2865508,00.html

[21.] Europa Newsletter, http://europa.eu.int/information_society/topics/ebusiness/ecommerce/2research/institutes/index_en.htm

[22.] Columbus Louis, "Generating Higher Levels of Responsiveness with Sell-Side E-Commerce Applications", www.nextslm.org

[23.] Commission of the European Communities (2001), "Communication from the Commission to the Council and the European Parliament: The Impact of the E-Economy on European Enterprises: Economic Analysis and Policy Implications"

[24.] European Commission (2001), "The e-Economy in Europe: Its potential impact on EU enterprises and policies", e-Economy conference, 1 and 2 March 2001, Brussels

[25.] Grover Varun and Teng James T.C. (2001), "E-Commerce and the Information Market", Communications of the ACM, April 2001/Vol. 44, No. 4

[26.] Hahn Jungpil (2001), "The Dynamics of Mass Online Marketplaces: A Case Study of an Online Auction", SIGCHI

[27.] Poulimenakou Aggeliki, Dimitrakopoulos George and Limpereas Takis (2002), "e-Marketplaces: prospects, the state's position (in Greek)", Ministry of Finance, Ministry of Interiors, Program Information Society

[28.] Bakos Yannis (1998), "The Emerging Role of Electronic Marketplaces on the Internet", Communications of the ACM-August 1998/Vol 41, No 8

9.3 Chapters 5, 6 and 7 References

[80.] 'Business-to-Business E-Commerce Frameworks', Simon S Y Shim, Vishnu S Pendyala, Meera Sundaram & Jerry Z Gao, IEEE Computer, Vol No, October 2000

[81.] Extensible Markup Language (XML) 1.0: http://www.w3.org/TR/1998/REC-xml-19980210

[82.] Biztalk™ initiative: http://www.biztalk.org/biztalk/default.asp

[83.] Biztalk™ Framework version 2.0: http://www.microsoft.com/biztalk/techinfo/BiztalkFramework20.doc

[84.] ebXML Technical Architecture Specification (refer to http://www.ebxml.org for latest version)

[85.] Basic Semantic Register: http://www.ubsr.org (Key document is ISO/TS16668 'BSR rules and guidelines')

[86.] Hypertext Transfer Protocol—HTTP/1.1: http://www.ietf.org/rfc/rfc2616.txt

[87.] The MIME Multipart/Related Content-type: http://www.ietf.org/rfc/rfc2387.txt

[88.] Simple Object Access Protocol (SOAP) Version 1.1: http://www.w3.org/TR/SOAP.

[89.] Final Report on Building Blocks for Electronic Commerce, http://www.cenorm.be/isss/Workshop/ec/Prb.zip

[90.] "eCo Architecture for Electronic Commerce Interoperability", CommerceNet eCo Framework group, 1999 (http://eco.commerce.net)

[91.] IMPRIMATUR Business Model, Version 2.1, June 1999, http://www.imprimatur.net/IMP_FTP/BMv2.pdf

[92.] Synthesis of the IMPRIMATUR Business Model, October 1998, http://www.imprimatur.net/IMP_FTP/model_synthesis.pdf

[93.] ISO 10303 Industrial automation systems and integration -- Product data representation and exchange (many parts - STEP is derived from STandard for the Exchange of Product Model Data)

[94.] Java Wallet User Interface Components: Design Methodology, http://java.sun.com/products/commerce/docs/whitepapers/uidesign/uidesign.html

[95.] White Paper on The Gateway Security Model in the Java Commerce Client, http://java.sun.com/products/commerce/docs/whitepapers/security/gateway.pdf

[96.] Java Wallet Security API Usage, http://java.sun.com/products/commerce/docs/security/security_api.html

[97.] Java Wallet User Interface Functionality, http://java.sun.com/products/commerce/docs/user_interface/new_JWUI_Func_1.1.html

[98.] The Commerce JavaBeans Specification, http://java.sun.com/products/commerce/docs/specifications/commerce_javabeans/beans.pdf

[99.] White Paper on The Java Wallet Architecture, http://java.sun.com/products/commerce/docs/whitepapers/arch/architecture.pdf

[100.] White Paper on Java Commerce Messages, http://java.sun.com/products/commerce/docs/whitepapers/jcm_whitepaper/jcm.pdf

[101.] Java Commerce Business Perspective, http://java.sun.com/products/commerce/docs/business/business.html

[102.] Java Wallet documentation, http://java.sun.com/products/commerce/docs/api/API_users_guide.html

[103.] Java Smart Card API, http://java.sun.com/products/commerce/docs/smartcard_api/api_users_guide.html

[104.] OMG Electronic Commerce Domain Specifications, version 1.1, 14 February 2000, http://cgi.omg.org/pub/docs/dtc/00-02-06.pdf

[105.] OMG Business Object Domain Specifications, Version 2, 2 August 1999, http://cgi.omg.org/pub/docs/dtc/99-08-03.pdf

[106.] Open-edi reference model, ISO 14662

[107.] An introduction to eCommerce, S G E Garrett and P J Skevington, BTTJ vol. 17 No. 3, July 1999, p11

[108.] Trading environments, I D E Videlo and A M Fletcher, BTTJ vol. 17 No. 3, July 1999, p24

[109.] Implementing electronic commerce in SMEs - three case studies, A J Davies and A J Garcia-Sierra, BTTJ vol. 17 No. 3, July 1999, p97

[110.] Internet Open Trading Protocol - IOTP Version 1.0 (RFC 2801), April 2000 http://www.ietf.org/rfc/rfc2801.txt

[111.] Digital Signatures for the 1.0 Internet Open Trading Protocol (IOTP) (RFC 2802), April 2000 http://www.ietf.org/rfc/rfc2802.txt

[112.] Digest Values for DOM (DOMHASH) (RFC 2803), April 2000 http://www.ietf.org/rfc/rfc2803.txt

[113.] Internet Open Trading Protocol (IOTP) HTTP Supplement (RFC 2935), September 2000 http://www.ietf.org/rfc/rfc2935.txt

[114.] HTTP MIME Type Handler Detection (RFC 2936), September 2000 http://www.ietf.org/rfc/rfc2936.txt

[115.] Requirements for Digital-Right Trading, December 2000 (Expires: June 2001) http://www.ietf.org/internet-drafts/draft-ietf-trade-drt-requirements-01.txt

[116.] SET Supplement for the v1.0 Internet Open Trading Protocol (IOTP), November 2000 (Expires: May 2001) http://www.ietf.org/internet-drafts/draft-ietf-trade-iotp-v1.0-set-02.txt

[117.] Electronic Commerce Modelling Language (ECML) Version 2 Requirements, November 2000 (Expires: May 2001) http://www.ietf.org/internet-drafts/draft-ietf-trade-ecmlv2-req-00.txt

[118.] White Paper - Plug and Play Business Software Integration - The Compelling Value of the Open Applications Group, 1999 (http://www.openapplications.org)

[119.] Open Applications Group Integration Specification (OAGIS), Release 7.0.2 Document Number 20001124, 2000 (http://www.openapplications.org)

[120.] OBI specification, Version 1.0, May 1997, http://www.openbuy.org/obi/specs/obi-v1.rtf

[121.] OBI specification, Version 2.0, June 1999, http://www.openbuy.org/obi/specs/obiv2.doc

[122.] RosettaNet Implementation Framework: Core Specification, Version: Release 2.00.00, 3 January 2001, http://www.rosettanet.org

[123.] SEMPER: Basic Services: Architecture and Design', http://www.semper.org/deliver/d03/D03.ps

[124.] SEMPER: Architecture of Payment Gateway, 1996 - http://www.semper.org/deliver/d14/D14final.ps

[125.] SEMPER: New Payment Instruments Prototype, 1997 - http://www.semper.org/deliver/d15/D15.ps

[126.] SEMPER: Advanced Services, Architecture and Design, 1999 - http://www.semper.org/deliver/d10/d10.pdf

[127.] SEMPER: APIs, 1999 – http://www.semper.org/deliver/d10/javadoc/index.html

[128.] Secure Electronic Transaction (SET) specifications. 'The Business Description' - gives a general overview of the process; 'The Programmer's Guide' - describes fields and messages and outlines appropriate processing; and 'The Formal Protocol Definition' provides the most rigorous description of SET messages and fields, http://www.setco.org/set_specifications.html

[129.] An overview of the role of SET, The Information Interchange Report, January 1997, http://www.diffuse.org/oii/en/Set.html

[130.] Extensions to SET, http://www.setco.org/extensions.html

[131.] SET Vendor Matrix, http://www.setco.org/cgi-bin/vsm.cgi

[132.] TC 224 Report on card-related secure commercial and financial transactions on open networks (1999), http://forum.afnor.fr/afnor/WORK/AFNOR/GPN2/Z15Y/PUBLIC/WEB/ENGLISH/commerce.htm

[133.] Internet X.509 Public Key Infrastructure, November 2000 (expires May 2001), http://www.ietf.org/internet-drafts/draft-ietf-pkix-roadmap-06.txt

[134.] Met Overview White Paper, Version 2.0, 29 January 2001 www.mobiletransaction.org

[135.] Namespaces in XML: http://www.w3.org/TR/1999/REC-xml-names-19990114

[136.] Uniform Resource Identifiers (URI): Generic Syntax: http://www.ietf.org/rfc/rfc2396.txt

[137.] S/MIME Version 3 Message Specification: http://www.ietf.org/rfc/rfc2633.txt

[138.] Library of Biztalk™ Schemas: http://www.biztalk.org/library/schema_search.asp

[139.] Biztalk™ Schema Guidelines : http://www.biztalk.org/resources/schemasguide.asp

[140.] ISO 13584 Industrial automation systems and integration -- Parts library (Draft - Multiple parts)

[141.] ISO 15531 Industrial automation systems and integration -- Industrial manufacturing management data (Draft - Multiple parts)

[142.] ISO 18629 Industrial automation systems and integration – Process Specification Language (Draft - Multiple parts)

[143.] ISO 18876 Integration of industrial data for exchange, access, and sharing (Draft - Multiple parts)

[144.] ISO 15704, "Requirements for Enterprise Reference Architecture and Methodologies" ISO TC 184/SC5/WG1, 2000

[145.] ISO/CEN WD, "Enterprise Integration - Framework for Enterprise Modelling" CEN TC 310/WG1 and ISO TC 184/SC5/WG1 Document N167

[146.] CEN ENV 13550, "Advanced Manufacturing Technology - Systems Architecture -Enterprise Model Execution and Integration Services" CEN TC 310/WG1, 1999.

[147.] Biztalk™ and the Open Applications Group – Implementing OAGIS within the Microsoft Biztalk™ Framework, 14 June 2000, Christopher Kurt (ckurt@microsoft.com) (http://www.openapplications.org)

[148.] Security in a Web Services World: A Proposed Architecture and Roadmap. A joint whitepaper from IBM Corporation and Microsoft Corporation. http://www.verisign.com/wss/architectureRoadmap.pdf

[149.] Mobey Forum / LK Preferred Payment Architecture Executive Summary Document. http://www.mobeyforum.org/public/material/PPAExecutive_Summary.pdf

[150.] Mobey Forum / LK Preferred Payment Architecture Technical Document. http://www.mobeyforum.org/public/material/PPATechnical.pdf

[151.] Mobey Forum / LK Preferred Payment Architecture Business Document ???. http://www.mobeyforum.org/public/material/PPABusiness.pdf

[152.] Arkin Assaf (2002), "Business Process Modelling Language", BPMI.org

[153.] BPMI.org (2001), "BPML|BPEL4WS: A Convergence Path toward a Standard BPM Stack", Position Paper

[154.] BPMI.org (2001), Business Process Management Initiative", BPMI.org

[155.] Business Process Project Team (2001), "ebXML Business Process Specification Schema Version 1.01", UN/CEFACT and OASIS

[156.] Business Process Team (2001), "ebXML E-Commerce Patterns v1.0"

[157.] Chappell, David A. et al (2001), "Professional ebXML Foundations", Wrox

[158.] Clark, C.J. (2000), "The UN/CEFACT Unified Modeling Methodology: An Overview".

[159.] Cole James and Milosevic Zoran (2001), "Extending Support for Contracts in ebXML", IEEE

[160.] ebXML & OASIS (2000), "ebXML Business Process Methodology Guidelines"

[161.] Grudin Jonathan (1991), "CSCW: The convergence of two development contexts", ACM

[162.] IFIP (1999), "GERAM: Generalized Enterprise Reference Architecture and Methodology, Version 1.6.3", IFIP-IFAC Task Force on Architectures for Enterprise Integration

[163.] Koch, Christopher (1998), "Put IT in Writing", CIO Magazine, Nov 15 1998 Issue

[164.] McCarthy, William & Geerts, Guido, "REA Ontology Use in ebXML and the UN/CEFACT Modeling Methodology (N90)", Semantic Web Workshop Position Paper.

[165.] McCarthy, William E. & Haugen, William (2000), "REA, a semantic model for Internet supply chain collaboration", Business Object Workshop VI: Enterprise Application Integration.

[166.] McCarthy, William E. & Geerts, Guido L. (2000), "The Ontological Foundations of Enterprise Information Systems"

[167.] McCarthy, William E. & Geerts, Guido L., "An ontological analysis of the economic primitives of the extended-REA enterprise information architecture".

[168.] McCarthy, William E. & Geerts, Guido L., "Modeling Business Enterprises as Value-Added Process Hierarchies with Resource-Event-Agent Object Templates"

[169.] Quix Chrostoph, Schoop Mareike and Jeusfeld Manfred (2002), "Business Data Management for Business-to-Business Electronic Commerce", SIGMOD Record, Vol. 31, No. 1, March 2002

[170.] Ratnasingham Pauline and Kumar Kuldeep, "Trading Partner Trust in Electronic Commerce Participation"

[171.] Romano Simon Pietro and D'Antonio Salvatore, "ebXML: electronic business XML"

[172.] TMWG (2001) "UN/CEFACT's Modeling Methodology (Draft)"

[173.] Waldt Dale and Drummond Rik, "EBXML The Global Standard for Electronic Business"

[174.] Whitman Larry, Ramachandran Kartik & Ketkar Vikram (2001), "A taxonomy of a living model of the enterprise", in Proceedings of the 2001 Winter Simulation Conference, B.A. Peters, J.S. Smith, D.J. Medeiros, and M.W. Rohrer, eds

[175.] Summaries of some Frameworks, Architectures and Models for Electronic Commerce. EUROPEAN COMMITTEE FOR STANDARDIZATION (COMITÉ EUROPÉEN DE NORMALISATION – CEN) Workshop Agreement. June, 2001.

[176.] Brown Alan, Johnston Simon, Kelly Kevin, "Using Service-Oriented Architecture and Component-Based Development to Build Web Service Applications". Rational Software White Paper. TP032, Oct. 2002.

[177.] Maresca Massimo et al., "Deployment Experience of a Service Oriented Architecture in the Business Community of the Port of Genoa: Lessons Learned."

[178.] Agrawal Rakesh, et al., "Architecture for Rapid Development of Web Applications", IBM Almaden Research Center, 2001.

[179.] Soley Richard and the OMG Staff Strategy Group, "Model Driven Architecture" by Object Management Group, White Paper Draft 3.2 - November 27, 2000

[180.] Sterling Integrator v1.2 Technical Overview. Sterling Commerce, Inc., 2002

[181.] Patterns for E-business, IBM Corp, 2001, www.ibm.com/developerworks/patterns/library/index.html

[182.] "Patterns: Connecting Self-Service Applications to the Enterprise", IBM Red Book, September 2002

[183.] "Patterns of Experience. A Review of IBM's Patterns for e-business Initiative", Bloor Research, 2001

[184.] Guide to Web Services, The Diffuse Project, www.diffuse.org/WebServices.html

[185.] Web Services and the BEA WebLogic® E-Business Platform. BEA Systems White Paper. http://www.bea.com/products/weblogic/server/paper_webservices.pdf

[186.] Bosak, Jon, Sun Microsystems, Chair, OASIS UBL Technical Committee, "UBL: The Universal Business Language", Web Services Edge East 2002 New York City 25 June 2002

[187.] Electronic Commerce Architectures, The Diffuse Project, http://www.diffuse.org/architectures.html#OGSA

[188.] E-Commerce in Europe: Results of the pilot surveys carried out in 2001, Eurostat, THEME 4 – Industry, trade and services, Edition 2002

[189.] eEurope, An Information Society for All, Communication on a Commission Initiative for the Special European Council of Lisbon, 23 and 24 March 2000.

[190.] eEurope Go Digital, Benchmarking national and regional e-business policies for SMEs, Final report of the "E-business Policy Group", 28 June 2002.

10 Annex A – Regional Analysis

10.1 Regional Profile - Saxony-Anhalt Region, Germany

10.1.1 Size structure of the sector in the region

Between 1994 and 2001, the gross earnings per hour increased from 8,46 Euro to 10,46 Euro in the manufacturing industry and from 8,01 Euro to 10,42 Euro in the processing industry and 8,92 Euro to 10,21 Euro in the construction industry.

Table 4- Average gross earnings per hour of the employees by sectors – Saxony-Anhalt

Area / Sector	1994	1995	1996	1997	1998	1999	2000	2001
Name	EUR / worked hour							
male and female employees								
Manufacturing industry	**8,46**	**9,15**	**9,5**	**9,64**	**9,78**	**9,99**	**10,2**	**10,46**
Processing industry	8,01	8,84	9,26	9,47	9,64	9,89	10,17	10,42
Construction industry	**8,92**	**9,53**	**9,76**	**9,81**	**9,81**	**9,93**	**9,95**	**10,21**
female employees								
Manufacturing industry	**6,92**	**7,49**	**7,71**	**7,84**	**8,02**	**8,24**	**8,49**	**8,7**
Processing industry	6,76	7,38	7,62	7,75	7,94	8,15	8,4	8,62
Construction industry	**7,82**	**8,55**	**8,57**	**.**	**.**	**.**	**8,14**	**8,99**
male employees								
Manufacturing industry	**8,61**	**9,31**	**9,65**	**9,81**	**9,95**	**10,17**	**10,38**	**10,67**
Processing industry	8,28	9,14	9,58	9,81	10,01	10,25	10,54	10,79
Construction industry	**8,93**	**9,54**	**9,77**	**9,82**	**9,82**	**9,94**	**9,96**	**10,21**

The number of employees increased from 1998 to 2001 in the agriculture, forestry, fish and food industry from 40.100 to 41.000, fell in the manufacturing sector from 356.300 to 319.300 and in the trade, tourism and traffic sector from 247.400 to 243.400.

Table 5 - Employees by economic sectors in Saxony-Anhalt since 1998

Year	Employees at all	Sector			
		Agriculture, forestry-, fish and food industry	**Manufacturing sector**	**Trade, tourism and traffic**	other services
	1000				
1998	1 098,2	**40,1**	**356,3**	**247,4**	454,4
1999	1 088,7	**45,0**	**348,2**	**255,3**	440,1
2000	1 064,1	**43,7**	**338,8**	**249,6**	432,0
2001	1 059,5	**41,0**	**319,3**	**243,4**	455,8

The monthly net income for one person households amounts to 31,1 percent under 716 Euro, 20.2 percent between 716 Euro till 920 Euro, 36.1 percent between 920 and 1278 Euro, 6.9 percent between 1278 and 1534 Euro, 3.6 percent between 1534 and 2045 Euro and 2.1 percent over 2045 Euro.

Table 6 - One person households by monthly household net income in Saxony-Anhalt since 1991

Year	One person households	with a monthly household net income from ... till under ... EUR					
		under 716	716 - 920	920 -1278	1278 -1534	1534 - 2045	2045 and more
	1000	Share in %					
1998	352,4	31,8	23,5	34,0	6,1	3,3	/
1999	370,1	32,4	21,5	34,2	7,1	3,2	(1,6)
2000	390,1	31,9	20,9	35,1	6,7	3,4	(2,0)
2001	**396,1**	**31,1**	**20,2**	**36,1**	**6,9**	**3,6**	**(2,1)**

The numbers of employees fell in the construction sector to 18,5 percent and the turnover fell to 13,8 percent since the base measure at 30.09 in1998.

The number of the employees increased in the food industry to 0.2 percent and the turnover increased to 3.4 percent since the base measure of 30.09.1998.

Table 7 - Data for the handicraft sector in Saxony-Anhalt for the 3rd quarter of 2002

Sector group	Employees		Turnover	
	Base measure 30.09.98=100	Alteration to preceding quarter in %	Base measure 1998=100	Alteration to preceding quarter in %
Construction sector	**65,5**	**-18,5**	**79,7**	**-13,8**
Electro- and metal sector	84,1	-6,5	95,2	-6,9
Wood sector	74,6	-11,4	76,3	-11,3
Clothing, textile and leather sector	65,6	-3,4	51,2	-24,6
Food industry	**76,7**	**0,2**	**82,8**	**3,4**
Sanitary, healthy, hygiene, chemical and cleaning sector	108,8	1,8	116,8	3,6
Glass, paper-, ceramic and other sectors	73,9	-9	68,5	-10,5
handicraft at all	79,3	-8,8	88,6	-8,4

Table 8 - Employees and turnover for the retail trade sector (Monthly data)

Month	Employees	Turnover	
		Respective price	Bases price 2000
	Base 2000 = 100		
Jan 01	99,1	89,8	89,5
Feb 01	98,5	87,0	86,3
Mar 01	99,0	102,3	101,1
Apr 01	99,1	101,6	100,0
May 01	99,6	104,5	102,2
Jun 01	99,7	98,0	95,5
Jul 01	99,2	95,3	93,0
Aug 01	99,5	100,8	98,5
Sep 01	99,5	94,9	92,8
Oct 01	99,9	100,4	98,4
Nov 01	99,8	110,3	108,6
Dec 01	100,2	120,7	119,3
Jan 02	100,1	85,7	83,8
Feb 02	99,1	84,2	82,4
Mar 02	98,3	101,9	99,6
Apr 02	98,2	96,4	94,1
May 02	97,7	100,2	97,9

Jun 02	96,0	90,5	88,7
Jul 02	96,3	97,1	95,4
Aug 02	96,5	97,0	95,3
Sep 02	**96,8**	**93,9**	**92,1**
Oct 02	...	...	...
Nov 02	...	...	...
Dec 02	...	...	...

Table 9 - Total elevations at the construction sector for 30.06.2002

Government district	Enterprises at 30.6.02	Employees at 30.6.02	Work in hours at June	Gross pay and wages at June	Turnover at June	Turnover in the preceding year
	Number		1000 Hours	1000 Euro		
Dessau, Stadt	99	1 359	148	2 395	8 344	109 161
Anhalt-Zerbst	95	1 054	126	1 967	7 996	75 785
Bernburg	84	1 097	114	1 822	8 524	96 821
Bitterfeld	160	2 008	221	3 097	12 775	141 682
Köthen	83	949	111	1 387	4 886	54 688
Wittenberg	190	2 017	218	3 292	12 010	133 095
RB Dessau	711	8 484	939	13 958	54 535	611 232
Halle (Saale), Stadt	153	2 535	225	5 235	21 504	264 835
Burgenlandkreis	185	2 254	249	3 815	15 168	192 590
Mansfelder Land	126	1 675	187	2 557	7 930	94 755
Merseburg-Querfurt	177	2 038	227	3 592	15 157	160 791
Saalkreis	132	1 918	199	3 852	15 313	193 771
Sangerhausen	73	1 152	132	1 942	6 928	80 136
Weißenfels	79	847	88	1 430	3 947	56 252
RB Halle	925	12 419	1 308	22 424	85 947	1 043 130
Magdeburg, Stadt	237	4 621	478	9 321	44 572	485 729
Aschersleben-Staßfurt	115	1 580	161	2 488	12 169	143 324
Bördekreis	92	1 005	107	1 618	6 039	73 184
Halberstadt	93	1 279	139	2 215	9 382	110 760
Jerichower Land	157	2 550	287	4 687	19 780	167 740
Ohrekreis	162	1 800	197	3 100	13 024	154 605
Stendal	229	3 043	342	4 866	19 695	231 187
Quedlinburg	96	1 125	114	1 806	7 120	74 539
Schönebeck	83	1 254	127	2 060	7 816	103 792
Wernigerode	128	1 450	158	2 577	9 825	106 463
Altmarkkreis Salzwedel	179	1 910	216	3 127	11 961	135 589
RB Magdeburg	1 571	21 617	2 326	37 865	161 383	1 786 913
Saxony-Anhalt	**3 207**	**42 520**	**4 573**	**74 247**	**301 865**	**3 441 274**

Table 10 - Additional elevations at the construction sector for 30.06.2002

Government district	Enterprises at 30.6.02	Employees at 30.6.02	Work in hours at June	Gross pays and wages at June	Turnover at June	Turnover in the preceding year
	Number		1000 hours	1000 Euro		
Dessau, Stadt	27	804	245	3 997	11 768	57 024
Anhalt-Zerbst	23	418	125	1 905	6 315	27 052
Bernburg	15	310	99	1 391	3 638	16 561
Bitterfeld	28	493	155	2 069	7 111	30 151
Köthen	13	302	106	1 855	4 769	18 619
Wittenberg	36	744	243	3 499	11 303	45 341
RB Dessau	142	3 071	973	14 717	44 904	194 748
Halle (Saale), Stadt	58	2 018	656	10 632	42 641	175 705

Burgenlandkreis	34	831	253	4 113	15 276	62 260
Mansfelder Land	31	690	211	3 088	9 058	39 843
Merseburg-Querfurt	47	1 134	397	5 845	18 088	78 232
Saalkreis	24	635	211	3 179	11 538	51 496
Sangerhausen	18	409	148	1 834	5 987	26 188
Weißenfels	20	386	126	1 833	5 489	25 235
RB Halle	232	6 103	2 003	30 523	108 077	458 959
Magdeburg, Stadt	75	1 789	551	9 031	33 486	131 147
Aschersleben-Staßfurt	25	454	146	2 212	8 670	32 291
Bördekreis	22	628	214	2 881	10 203	42 005
Halberstadt	30	727	226	3 436	9 548	43 057
Jerichower Land	22	525	184	2 517	8 293	34 765
Ohrekreis	49	854	260	4 329	12 149	53 340
Stendal	41	992	328	4 423	16 142	63 245
Quedlinburg	22	584	154	2 317	7 252	34 239
Schönebeck	19	407	137	1 789	7 733	31 578
Wernigerode	26	588	193	2 577	8 783	37 511
Altmarkkreis Salzwedel	27	385	129	1 676	5 585	27 546
RB Magdeburg	358	7 933	2 522	37 188	127 845	530 724
Saxony-Anhalt	**732**	**17 107**	**5 498**	**82 427**	**280 825**	**1 184 432**

Table 11 - Employees and Turnover in the tourism sector – (Monthly data)

Month	Employees	Turnover	
		respective price	Bases price 2000
	Bases 2000 = 100		
Jan 01	95,1	79,8	79,6
Feb 01	94,3	77,7	77,6
Mar 01	95,0	88,0	87,4
Apr 01	96,3	92,8	91,7
May 01	98,7	108,2	106,9
Jun 01	98,8	103,2	101,2
Jul 01	96,2	95,4	92,3
Aug 01	96,8	102,0	98,8
Sep 01	97,1	100,7	98,8
Oct 01	96,6	101,9	99,7
Nov 01	95,3	89,3	87,8
Dec 01	95,7	103,8	101,7
Jan 02	92,8	74,3	71,5
Feb 02	91,8	74,4	71,3
Mar 02	93,0	89,4	85,7
Apr 02	94,3	91,8	87,9
May 02	96,8	103,7	98,6
Jun 02	93,1	97,4	91,9
Jul 02	91,2	89,5	83,5
Aug 02	92,4	90,6	84,7
Sep 02	**90,1**	**95,8**	**90,8**
Oct 02	...	...	...
Nov 02	...	...	...
Dec 02	...	...	...

Only 29.9 percent of all offered beds were in use in 2001 but the number of enterprises and the number of arrivals and overnight stays increased.

Table 12 - Accommodation in the tourism sector (Annual data)

	Measure	1999	2000	2001
Enterprises	Number	1 014	1 028	**1 051**
Offered beds		49 668	50 468	**50 537**
Average workload of the offered beds	%	30,0	29,5	**29,9**
Arrivals at all	Number	2 148 827	2 172 719	**2 214 457**

there under foreign visitors		117 702	143 743	**142 206**
Overnight stay		5 397 178	5 440 659	**5 552 933**
There under foreign visitors		274 544	312 517	**301 871**
Average stays of visitors at all	Days	2,5	2,5	**2,5**

10.1.2 Main companies by sector and their characteristics

Table 13 - Main Food Industry Companies - Saxony-Anhalt

Company:	Wendeln Brot Ost GmbH
Location:	Halle
State:	Saxony-Anhalt
Employee:	900
Turnover:	138.050 T€
Product:	Manufacture of bakery products
Internet:	http://www.kamps.de

Company:	Klemme AG
Location:	Lutherstadt Eisleben
State:	Saxony-Anhalt
Employee:	526 (2001)
Turnover:	45.950 T€ (2000)
Product:	Manufacture of bakery products
Internet:	http://www.klemme-ag.com

Company:	MIDEU Backwarenbetriebe GmbH
Location:	Magdeburg
State:	Saxony-Anhalt
Employee:	450 (2001)
Turnover:	16.750 T€ (2000)
Product:	Manufacture of bakery products
Internet:	

Company:	Hasseröder Brauerei GmbH
Location:	Wernigerode
State:	Saxony-Anhalt
Employee:	329
Turnover:	172.300 T€ (2001)

Product:	Manufacture of beer
Internet:	http://www.hasseroeder.de

Table 14 - Main Building Materials (Sand and Gravel) Companies - Saxony-Anhalt

Company:	Mitteldeutsche Baustoffe GmbH
Location:	Sennewitz
State:	Saxony-Anhalt
Employee:	252 (2000)
Turnover:	35.800 T€ (1999)
Product:	Manufacture of fibre cement
Internet:	http://www.mdb-gmbh.de

Company:	BEFER - Betonfertigteilbau- und Betonwaren GmbH
Location:	Halberstadt
State:	Saxony-Anhalt
Employee:	171 (2001)
Turnover:	12.800 T€ (2000)
Product:	Manufacture of constructional elements for large-sized prefabricated concrete parts as well as of other concrete products for construction purposes
Internet:	http://www.tat-befer.de

Company:	HSK Kies- und Tiefbaugesellschaft mbH
Location:	Sangerhausen
State:	Saxony-Anhalt
Employee:	100 (2001)
Turnover:	9.460 T€ (2000)
Product:	Other civil engineering
Internet:	http://www.hsk-sangerhausen.de

Company:	MKW Mitteldeutsche Hartstein- Kies- und Mischwerke GmbH
Location:	Naumburg
State:	Saxony-Anhalt
Employee:	54
Turnover:	10.000 T€
Product:	Other mining and quarrying n.e.c.
Internet:	

Table 15 - Main Building Materials (General) Companies - Saxony-Anhalt

Company:	Fenster- und Türenbau Berg GmbH
Location:	Rosian
State:	Saxony-Anhalt
Employee:	351 (2000)
Turnover:	16.500 T€ (2000)
Product:	Manufacture of builders' carpentry and joinery of metal
Internet:	

Company:	J. Raab AG
Location:	Luckenau
State:	Saxony-Anhalt
Employee:	90
Turnover:	14.320 T€
Product:	Manufacture of other articles of concrete, plaster and cement
Internet:	

Company:	BEFER - Betonfertigteilbau- und Betonwaren GmbH
Location:	Halberstadt
State:	Saxony-Anhalt
Employee:	171 (2001)
Turnover:	12.780 T€ (2000)
Product:	Manufacture of constructional elements for large-sized prefabricated concrete parts as well as of other concrete products for construction purposes
Internet:	http://www.tat-befer.de

Company:	BEMA Beton- und Metallbau GmbH
Location:	Magdeburg
State:	Saxony-Anhalt
Employee:	110 (2000)
Turnover:	9.200 T€
Product:	Manufacture of constructional elements for large-sized prefabricated concrete parts as well as of other concrete products for construction purposes
Internet:	http://www.kann.de

Table 16 - Main Furniture Industry Companies - Saxony-Anhalt

Company:	Burger Küchenmöbel GmbH
Location:	Burg
State:	Saxony-Anhalt
Employee:	237 (2000)
Turnover:	54.710 T€ (1999)
Product:	Manufacture of other kitchen furniture
Internet:	http://www.burger-kuechen.de

Company:	pino Küchen GmbH
Location:	Klieken
State:	Saxony-Anhalt
Employee:	227 (2000)
Turnover:	91.930 T€ (2001)
Product:	Manufacture of other kitchen furniture
Internet:	http://www.pino.de

Company:	K & K Möbel GmbH
Location:	Köthen
State:	Saxony-Anhalt
Employee:	110 (2000)
Turnover:	30.680 T€ (2000)
Product:	Manufacture of office furniture
Internet:	

Company:	PELIPAL Quickset - Möbel GmbH
Location:	Weißenfels
State:	Saxony-Anhalt
Employee:	80 (2000)
Turnover:	16.360 T€ (2000)
Product:	Manufacture of upholstered furniture
Internet:	

Table 17 - Main Tourism Companies - Saxony-Anhalt

Company:	Hotel und Restaurant Weißer Hirsch Jörg Wieland
Location:	Wernigerode
State:	Saxony-Anhalt
Employee:	50 (2002)
Turnover:	
Product:	Hotels
Internet	http://www.hotel-weisser-hirsch.de, http://www.ringhotels.de

Company:	Country Park-Hotel GmbH & Co. oHG
Location:	Brehna
State:	Saxony-Anhalt
Employee:	75 (2000)
Turnover:	
Product:	Hotels
Internet	

Company:	Hotel Ratswaage Magdeburg
Location:	Magdeburg
State:	Saxony-Anhalt
Employee:	85 (2002)
Turnover:	
Product:	Hotels
Internet	http://www.ratswaage.de

Company:	Maritim Hotel Magdeburg
Location:	Magdeburg
State:	Saxony-Anhalt
Employee:	171 (2001)
Turnover:	8.200 T€ (2001)
Product:	Hotels
Internet	http://www.maritim.de

10.1.3 Priorities of the innovation strategy of the firms in each sector

10.1.3.1 Food Industry

The market for food is saturated. The variety of products and substantial over-capacities shape the situation in the market. However success is largely based on the innovation ability in national as well as in international markets. A substantial problem is aggressive displacement competition, which results in restraints on the ability to invest in new products, technologies and new markets. The fact that this problem exists is reflected in the fact that statistically only 20% of the enterprises in the food industry develop a new product per year. Product innovations are created mainly in the product groups of beverages, sweet goods, dairy products and frozen food. These four product groups are approximately 60% of all new food products.[1]

Expenditures for innovation activities as well as research and development activities within the food industry are on a low level compared with other branches of industry. Altogether approximately 1.43 Mrd. € are spent for innovation activities in Germany (1997). This is 2.1% of the conversion of the food industry. [2] The actual R & D expenditures of the food industry, which is only 0.2% of the conversion, are substantially smaller.[3]

Substantial differences exist within the sector regarding the expenditures in R & D. Only some large enterprises invest clearly over the line average of 0,2%. The majority of the enterprises spend amounts on R & D, which are hardly sufficient for a purposeful and systematic development of new products. A substantial part of the R & D is in other sectors, for e.g. with the production of plants or suppliers of ingredients, auxiliary materials and packaging.

However the long-term is on increasing R & D and rising expenditures. This will be driven by new and complex requirements and new technological developments. These developments include the desire for health-promoting components in food or the possibility for genetic-technological changes in components and the need for understanding of the food-physiological and medical understanding of food components.

Accordingly the sector has to accommodate new trend, for e.g. “Functional Food” as well as developments in bio products.

10.1.3.2 Building material industry

A whole number of new products have been developed and successfully introduced to the market. Examples are facade components, fabricated cement roof slabs, cement roofing tiles, module buildings and dry construction systems. With most investment projects the ecological objectives and economic requirements are connected with the increasing use

[1] vgl. Christensen, J., Rama, R., Tunzelmann, J. (1999): Innovation in the European food and beverages industriy. EIMS Publication No. 35. Brüssel: Europäische Kommission.
[2] vgl. ZEW (1999): Innovationsreport Ernährungsgewerbe/Tabakverarbeitung. In: ZEW Branchenreport Innovationen, 6 (2).
[3] vgl. Haid (2000): Verstärkte FuE-Anstrengungen in Deutschland erforderlich. In: Wochenbericht, 68 (7/00).

of low-emission and energy-saving machines and the recycling of residual substances and by-products. The average productivity of the sector has quadrupled within four years.

Innovations in the production process are also accompanies by individual enterprises of the building material trade concentrating on the improvement of the material flow. Furthermore, technical innovations in building production depend to a large measure on the developments within the area of construction machines and equipment. Important innovations are also beginning in the area of building engineering, which forms an interface to numerous branches of the processing trade. This is particularly so within the area of energy use; these range from efficiency increases within the area of traditional heating systems up to the development of economically usable solar plants.

Research and development have only a small value within the build-implementing economy. There are hardly any separate research departments. Innovations are carried out thereby mainly by the large-scale enterprises and larger medium sized companies.

In summary:

- A larger number of high-innovative enterprises exist within the area of the building material economy. Relatively close co-operation relations therefore exist between the individual enterprises and research institutes of Berlin.
- There are several initiatives for the development of new construction machines and devices. However the realization and/or market introduction is made more difficult both for financial reasons and by investment obstacles for the medium-size building contractors.
- Innovations within the building area require increasingly the co-operation of different participants at planning and production stages. Particularly in the build-implementing trade this co-operation is often missing.

10.1.3.3 Tourism

The tourism economy represents an important sector in Saxony-Anhalt in terms of economic added value. It makes its contribution by offering employment, through the promotion of a service mentality, by enhancing location attractiveness and by thinking in global terms for local advantage.

The portion of the tourism of the BIP in 1997 in Saxony-Anhalt was approximately 4 per cent and in the East Harz region approximately 6 per cent. However the numbers exclude the direct added value standing in connection with the tourism economy.

In 1997 the total number of the persons employed in tourism in Saxony-Anhalt was approximately 60.000. In restaurants and accommodation provision this was approximately 28,000 persons. Altogether the number of the employed persons in tourism within the area corresponds to approx. 5.7 per cent of the total persons employed in Saxony-Anhalt. The all-German comparative number of the tourism sector is 7.6 per cent of the total occupation.

The classical overnight accommodation is covered predominantly by hotels and pensions in Saxony-Anhalt. In 1998 the country had approximately 2 per cent of the

accommodation capacity offered in Germany. The extent of utilization of tourist accommodation enterprises in Saxony-Anhalt at 28.3 per cent clearly under the Federal average of 34,9 per cent.

The general company size of enterprises involved in the tourism economy is less than 100 employed persons. However the large majority of all enterprises employ only 20 persons.

In 1994 the country initiated the project "Tourist information and reservation system" (TIRS) from which was developed the much publicized follow-on project "SATourN 2000+" in 1999.

Furthermore in March 2001 the structure of the tourism portal was begun for Saxony-Anhalt (www.sachsen-anhalt.de/tourismus). The Internet portal, which was initiated by the national marketing company (LMG), was driven by the requirements to develop marketing opportunities via the Internet, to better exploit the market and provide better means of customer connection. The offering will be enhanced with further products related to the tourism economy and this will increase the content value for visitors to the site. At present there is still a substantial deficit of target-group-specific "content". There is a need of support for the introduction and application of new media and technologies within the tourism industry and the Ministry for Economics is planning a special program to support this need through "Tourisms in the information society - Promotion of innovations and competitive ability over the employment of new media in the tourism economy".

10.1.4 Factors favouring or hampering market performance on the companies

10.1.4.1 Food industry

There is hardly a doubt that the present situation of the manufacturers is not good. The developments of the trade, the boom of the trade marks and the requirements of the consumers brought the manufacturers into a difficult situation.

Discounters in Germany within the food sector have clearly exceeded the 30% limit. Also, within the drugstore sector and within the textile sector, the Discount approach has won large market share.

There are four reasons for increasing pressure on this sector:

- The proportion of brand name products will continue to rise. A possible margin improvement, higher customer brand identification and the possibility to overcome direct price comparison are major drivers for dealers to create their own brands concepts and to refine and expand these into other product categories. Fresh food will continue to be a major influence on developments within the food sector.
- Further price discounting will continue with some dealers already calling for the "assistance" of many suppliers.

- Concentration in the trade continues. A comparison with other Western European countries indicates that this development is still far from finished and that the buyers' power will continue to rise.
- European-wide image comparisons show that only a few retailers have a well recognised trade mark - at least within the food sector. The consumers cannot recognize a clear profile.

10.1.4.2 Building material industry

The country wide stagnation in the building industry affects also the industry of building materials. Thus the depression of the building industry that has continued for four years could not be turned around in 2002. The building investments are to decrease in the current year again by approximately 0.5 % in relation to the previous year. However, due to the high need created by both new building and modernization measures, trade associations have called once more for an investment offensive. The clear decrease of building permits serve as an indicator that the year 2002 will be the fourth year in a row with negative business development in the building industry and concomitantly in the industry of building materials.

A change is possible only if the basic conditions for building significantly improve.

- Both with regard to the preservation and repair of public buildings and with the establishment of new buildings a substantial blocking of investment has accumulated. Government initiatives at national and local levels are needed to unblock investment and to stimulate the building industry.
- In the area of private house building it is difficult for young families to acquire low-priced building plots because of the scarceness of inexpensive building plots. This contributes to the bottleneck factor.
- The establishment and letting of multi-family houses have to be better promoted than to date. In particular the stringent safety laws relating to tenants have to be changed so that it will become lucratively to invest in such property. These measures could lead to a stimulation of the building industry and thus also the industry of building materials.

The production of raw materials is also increasingly affected by administrative obstacles related to environmental protection. However, the Saarland stock of raw material locations are now included in the draft of the new land development plan as “location areas for raw material extraction”.

10.2 Regional Profile – South-Central Bulgaria

In the south-central Bulgaria region, the leading industrials sectors that have been selected to participate in the LAURA project are:

- Wood processing – Furniture Industry
- Agriculture – Food-processing Industry
- Construction Industry and Building Materials
- Tourism

This report includes a number of information with some generic economic data for year 2001, providing us an overview of the size and the structure of south-central Bulgaria region.

10.2.1 Size and structure of the sectors in the region (South-Central region in Bulgaria)

10.2.1.1 Wood Processing

The share of wood-processing industry in the South Central Region of Bulgaria in the country's total net sales as a whole is small, despite the fact that 31 per cent of the companies in the region are registered in this branch. The companies had reported profit in amount of BGN 62 million over 2001. This sum represents about 0.61 per cent of the sales of all companies from the region and occupies about 21 per cent of the sales of all companies from the sector in Bulgaria. 60 per cent of the sales came from sector Saw-milling and planning of wood; impregnation of wood, which is the most developed sector in the region. More than 50 per cent of the employees in the branch work in this sector.

The wood-processing sector in the South Central Region of Bulgaria represents about 19 per cent of the export from the country. The main partner of the companies from the region was Greece. The export from this country over 2001 reached USD 10 million or 62 per cent. The main part of the import was from Turkey, but over the first nine months of 2002 the main partner was Italy.

10.2.1.2 Furniture Industry

Furniture industry is one of the most successfully developed industry branches in the South Central Region (SCR) of Bulgaria. The favorable combination of raw materials, production capacities, experienced (comparatively cheap) work force, historical and cultural traditions is the base for a 14 per cent growth in the production over 2001.
During 2001 268 companies from the region operated in the branch. The major part of them (225 companies) belong to the group of the small and medium-sized companies with personnel of less than 250 employees.

The furniture companies reported only 0.37 per cent of the total amount of sales in the region. The enterprises from the South Central region form about 17 per cent of the total amount of the sales in the structure of the furniture industry in Bulgaria.
The export orientation of the branch is its main characteristic. There was a significant growth in the export to EU member countries. Almost half of the furniture producers in the region (119 companies) have executed export of production during 2001 to the total value of USD 12.8 million. The growth in the export as compared to 1999 was about 10 per cent during 2000 and 48 per cent during 2001.

10.2.1.3 Agriculture

The South central region includes 6 districts (Plovdiv district, Pazardjik district, Smolyan district, Stara Zagora district, Haskovo district and Kardjali district) with a total area of 27 516.2 sq. km., which makes it the biggest region in Bulgaria. The settlement network in the region include 1512 settlements (59 of them are towns and 1453 are villages), in which live 24 per cent of the population of the country. Only the population in the South Western region, which includes the capital city Sofia is bigger in number (25 per cent).
The priority branches in the region are agriculture, food-processing industry, tourism, tailoring and textile industry, wood-processing and furniture industry, which are related mainly to the branch of the small and medium-sized enterprises.
The climate in the region is favorable for the development of agriculture. With the exception of Smolyan and Kardjali district which are mountain districts, in the other parts of the region is well developed the production of cereal and vegetable crops, perennial plants, industrial crops (mostly rose and lavender). In Kardjali district tobacco is grown.
The stock-breeding is well developed. Over the last year in the country as a whole there was a constant trend of decline of the number of the animals and the animal production.

10.2.1.4 Food-processing

South central region (SCR) is a traditional producer of food and beverages in Bulgaria. The main precondition for the favourable state of this sector is the developed agriculture and the existence of established institutes and centres for education of employees (Higher Institute of Food Industry – Plovdiv and Agricultural University - Plovdiv). The region is the biggest producer of canned fruit and vegetables in the country.
The sales of the companies from the region demonstrate a permanent trend of increase (from 3 to 5 per cent per year). The major part of them is private and in the brewing industry are attracted entirely foreign investments.
Besides meeting the demands of domestic consumption, SCR also provides a considerable part of the export of the food-processing industry (about USD 70 million per year). The companies from the region keep a positive trade balance for the trade with food and beverages and for 2001 the export exceeds the import twofold.
In 2001 the region exports 42 per cent from the country's total export of food products prepared on the base of grain, 38 per cent of vegetables and over 30 per cent of these of foods from fruit and vegetables, fats and oils. To Germany are exported over 30 per cent of the processed fruit and vegetables and over 25 per cent of the fresh fruit and soft and

alcohol beverages. Just to compare, in 2000 the same shares were about 20 per cent. Over 50 per cent of the processed meat products are exported to France.
A significant part of the country's import of food products is executed by companies registered in SCR and the biggest importers are producers which indicates that raw-materials for manufacture are being imported.

10.2.1.5 Construction Industry

Construction industry in South central region is a branch with a stable rate of development (16-19% per year). The main construction activities are executed on the territory of the big regional centres – Plovdiv, Stara Zagora and Smolyan in which the construction of new buildings and construction equipments dominates.
The potential of the branch is due mainly to the bigger infrastructure and investment projects that are realized on the territory of the region, such as: Gorna Arda cascade, LOT1 of the highway Trakia from Orizovo to Stara Zagora, the electrification of the railroad line Plovdiv-Svilengrad, the construction of new capacities in TPS Maritza iztok 1 and rehabilitation of TPS Maritza-iztok 3, rehabilitation of the road through Republic of Hainboaz passage, construction of new industrial equipments by foreign investors in the regions of Plovdiv, Haskovo, Pazarjik and others.

10.2.1.6 Building Materials

The branch "Production of construction materials" is directly related to the construction in South Central Region (SCR) and is not export-oriented. The annual amount of sales realized by the enterprises operating in the branch is around BGN 100 million, which is some 1.5 per cent of the total turnover realized by the companies in the region. The major part of the enterprises from the branch (78 per cent) consists of small companies with less than 10 employees. The most developed sector in the branch is Production of ironware for construction, which provides work for 58 per cent of the employed in the branch in this region and realizes 41 per cent of the total amount of sales.
Some of the largest production enterprises based in SCR, which are of national importance are: the cement-producing company Vulkan JSC (Dimitrovgrad), which is owned by Simen France, Elpo JSC – Nikolaevo, producing ceramic isolators, and the producer of lime – Ognyanovo K JSC.
The production of the branch cannot fully meet the economic demands in the region, which is compensated chiefly with imported materials. The constantly growing import is not compensated by proportional growth of export, which makes South Central Region a net imported of construction materials.

10.2.1.7 Tourism

There is a developed tourist base in the South Central Region (SCR). Almost all kinds of tourism are performed:

- *Fishing tourism*- dam Dospat
- *Skiing tourism* - Pamporovo, Chepelare and Byala Cherkva.

- *Hunting tourism* - Kastrakli reserve, Lisichevo, Mursalitza, Chairite and Skalnoto Chudo districts
- *Cave tourism* - Trigradsko gorge, Dyavolskoto gurlo cave and Yagodinska cave.
- *Balneology tourism* – Devin, Hisarya, Banya
- *Cultural tourism* – Koprivshtitza, Panagyurishte, Batak, Kazanlak, Plovdiv (the old city)

On the territory of the region is located the International Plovdiv fair. The fair city is the biggest one on the Balkan Peninsula – it is situated on area of 360 000 sq. meters. An average of about 18 exhibitions annually are organized in it.

10.2.2 Overview on the innovation activities in the four LAURA sectors in Bulgaria

10.2.2.1 General Overview

Only 2.3 per cent of all investments made in Bulgaria are allotted for development of new technologies and innovations. For a country with aged necessary equipment and under-developed production, such as Bulgaria, this is unallowable. Some of Bulgaria's advantages are: still highly qualified specialists, good level of education and relationships between universities and scientific research institutes. Unfortunately, these advantages are not efficiently used. For example, there is no institute for generation of ideas, which could later become profitable products. The technological development of a country's economy is determined by investments in fixed tangible assets. In Bulgaria, BGN 6.669 have been invested in acquisition of fixed tangible assets (FTA) in 2001. This figure has grown almost twofold compared to 1998, when it was BGN 3.388 million. As a share of GDP, investment in FTA has grown by 13.2 per cent in 1998 to 17.8 per cent. At first sight, this is an encouraging trend. If, however, we analyse the situation more thoroughly, we would find it is not so good. Bulgaria's production facilities and equipment are aged and not up-to-date with the innovations in almost all spheres. In Slovakia, for example, 31 per cent of GDP is allotted for investments. In the countries from the Eurozone this percentage is also high – 20 per cent.

The Gross domestic investment as percent of GDP in Bulgaria represented a little over half of its level in the other countries from Central and Eastern Europe, where its share is almost 30 per cent.

Country/Year	**1996**	**1997**	**1998**	**1999**	**2000**	**2001***
Bulgaria	8.1	9.9	16.9	17.9	18.3	20.4
Czech Republic	35.0	32.8	30.2	27.9	34.9	30.4
Hungary	37.2	27.7	29.7	28.5	30.6	31.1
Poland	21.9	24.6	26.2	26.4	26.4	25.2
Romania	25.9	20.6	17.9	17.2	19.4	21.0
Slovakia	37.1	36.6	36.1	31.9	30.1	35.4
Average/excl.	29.4	28.5	28.0	26.4	28.3	28.6

Bulgaria/						

These funds are mainly used for development and introduction of new products, and not for replacement of the aged production facilities and equipment. Most of the investment inflow is directed to the Service sector – 59 per cent. There is significant drop of investments made in the industrial sphere – from 42.8 per cent in 1998 to 38.8 per cent in 2001. Only 2.2 per cent of the funds are invested in agriculture. The largest amount of funds is invested in trade. Trade attracts the major part of foreign investment inflow as well. This, however, does not help to establish export product.

Software industry and tourism are the branches with the biggest growth potential in Bulgarian economy. Tourism, however, needs additional stimuli, in order to continue to boost economic growth. The share of hi-tech products is constantly increasing. Hi-tech products are already introduced in all industrial branches. Young people are enthusiastic about the unlimited possibilities for on-line communication and the number of those, willing to learn hi-tech disciplines is rapidly growing.

Bulgaria, however, is far behind other developed information communities. This fact is chiefly due to the presence of pirate software on Bulgarian market. It accounts for 80 per cent of the share of this business in Bulgaria. Some other obstacles to the sector's development, outlined by the branch's analysts, are computer technology's long amortization period and the difficult access to credits. Macro-economic stability is the basis of growth, but such a growth could not be achieved unless company strategies are improved. Bulgarian small and medium-sized enterprises are not well prepared to compete adequately on the united European market. Besides, 70 per cent of our entrepreneurs are operating with old technologies. Only 5 per cent of the enterprises invest in innovations.

A positive fact, related to this branch, is that the Ministry of Economy intends to establish National Innovation Fund, which will co-finance up to 50 per cent of the cost of the sector's scientific projects. The fund shall be established for a period of 15 years and shall be started in 2003. It will amount to USD 460 million. The funds will be provided from the budget, as well as from international donors. For 2003, the Ministry of Economy suggest the granted amount to be USD 9 million, specified Mr. Andrey Breshkov (Ministry of Economy official). For the first half of 2002, the amount of net sales in this branch grew by USD 17 million. Direct investment over the period 1999-2001 amounted to some USD 98 million, where in 2001 alone they were around USD 15 million. Starting in the middle of 2004, it is expected that Bulgarian producers of some industrial products will be able to mark their production with the European safety mark CE. This will happen, after Bulgaria and EU sign Mutual Written Statement for Certification of the results from these products' testing, which is expected in the end of 2004.

10.2.2.2 Wood-processing and Furniture Industry

Wood processing and furniture industry in Bulgaria have already been entirely restructured. The working big companies are fewer and the small and medium-sized companies are more and they realize considerable turnovers and take bigger market

shares. The specification of the two sectors does not allow introduction of many innovations. Bulgaria has a higher institute in which there is a faculty wood-processing and furniture industry. There also exists a financing on the programme Sokrat for education of the students. This programme is called Development of education on furniture design and was prepared in 1995-1996 and the offering was submitted on January 30, 1997. The financing is executed on Tempus programme and concerns activities connected with the development of the study plan, materials and the technical services for the new faculty Engineering design (Interior and design of furniture). There is also a base for education of medium specialists. The problem is that with the restructure of the sectors the connection between the academic spheres and real production has lost. The creation of personnel is not market-orientated and this interrupts the realization of innovations in the country. However we can not deny the fact that in any areas Bulgaria realizes a big amount of export.

According to the branch organization, Bulgarian furniture industry applies double standards – at manufacture for export and at the furniture, prepared for the domestic market. At domestic market there is production with low quality and away from the requirements, standards and tendencies of the world and European markets. The synthetic materials take 80 per cent of the manufacture of furniture for the while abroad they are almost out of use with a share of 20 per cent. The problem is that no one executes efficient control over the furniture production at the domestic market, according to the specialists.

Bulgaria has still a problem with the export of raw wood material that can be used for the needs of Bulgarian manufacture. According to the specialists at this market has to be produced individual type of furniture of average class and with this to attack the foreign market. Bulgarian companies, more of which are with a personnel of 50 – 100 people, can not realize a huge production. The Director of Bulgarian Industrial Association Mr. Tosho Kirov considers that there must be improved production in accordance with the requirements of the European market.

10.2.2.3 Agriculture & Food Processing Industry

The main reason for the low level of innovations in agriculture is due to the food-processing companies' lack of interest in the problems of agriculture. Moreover, the companies operating in food processing industry not only do not stimulate agricultural producers, but also stop their development by fixing low production buy-out prices and allowing the involvement of mediators in the process of buying out agricultural production.

A typical example, demonstrating the low level of innovations in agriculture, is the Vine and Wine Sector. Currently**,** the connection between the producers of grapes and wine in Bulgaria is interrupted. This, naturally, impedes the buying out of grapes and the implementation of sufficient control by the producers of wine on the grapes' quality. The existence of similar structure does not allow the introduction of modern and innovative methods of agro-chemical protection and modern technologies for processing and gathering of grapes. The state itself does not cooperate for the increasing of the amount of

investment inflow in the sector. A typical example of this is the fact, that vine growing is regulated by the Ministry of Agriculture and Forests, and wine production, which is entirely dependent on it, is controlled by the Ministry of Economy.

The practical implementation of legislative initiatives and overall introduction of the land reform was realized with extremely low rate and resulted in sharp fragmentation of the arable land and a large share (30-35 per cent) of uncultivated lands. According to modern world practice, agricultural massifs of under 1000 decares are inefficient for use of modern innovative methods of approach and technology in the field of agriculture. Therefore, land consolidation becomes a major prerequisite for increasing the share of innovative processes in agriculture.

Innovation process in food processing industry is much more developed than in agriculture. The main reason for this are the large-scale foreign investment inflow in this industry and the strong competition between foreign investors in sub-sectors with big commodity circulation, such as production of chocolate and sugar articles, brewing, soft-drink industry, etc. Among the numerous foreign investments in new production in the sector over the past few years (realized by companies such as Interbrew, Brewinvest, Kraft Foods, Coca-Cola) we should bring special attention to Nestle Sofia. In the end of 2002, the company opened a new chocolate desserts production line, in which USD 4.3 million were invested in the form of equipment and innovations. As a result of this, Bulgaria is the second country in Europe, after Great Britain, in which a production line for the chocolate desserts Kit Kat has been brought into exploitation.

10.2.2.4 Construction Industry

In construction industry, new technologies are borrowed from the developed countries. They are rapidly introduced in Bulgaria. In the near future, the Ministry of Regional Development and Public Works (MRDPW) is going to announce tenders for four projects, for which EU's PHARE program grants gratuitous assistance. Under the first project, the programme shall grant EUR 10 million for construction and repair of municipal roads providing access to sites of tourist interest. The budget will provide EUR 5 million. Currently, evaluation is being made for the purpose of selecting executor of the project. A consultant, specifically appointed for this project, shall develop the criteria.

The second project, sponsored by PHARE programme, which started in 2002, is related to services for the small and medium-sized business and technological grant schemes (schemes for gratuitous assistance). The aim of the project is to improve the competitiveness of the small and medium-sized enterprises in the EU pre-accession period through introduction of innovations, technological modernization, enterprising skills, and business culture. The programme grants EUR 4.7 million, and the budget financing is in the amount of EUR 1.2 million; the private sector will participate in it with EUR 3.2 million.

The third project of the programme for this year is related to labour market initiatives, aimed at stimulating enterprising and opening new job positions. PHARE programme is granting EUR 6.3 million for its realization, and the budget – EUR 2 million. The project includes selection of executors of reconstruction of buildings, which will be used for

professional training. International contracts for equipment of the centers will be signed. PHARE grants EUR 3.7 million under the project for social cohesion through measures of employment, enterprising and education among ethnical minorities. The budget has engaged to provide additional EUR 1.1 million under this project. Tenders for construction companies will be announced. They shall repair buildings, selected for centers for people with unequal social status. International contracts for equipment of the centers shall be signed as well. The contracts under this project are due to be signed no later than December 31 2003. The payments under the contracts shall end no later than six months before the end of the programme – December 31 2004.

The main reason for the comparatively low level of innovations in the sector is the slow development of large infrastructure projects. Big infrastructure projects have been widely discussed since the beginning of the transition period, but there always seems to be something that slows down their realization. Those, whose implementation has begun, are started with big delay (Makaza), others are being slowed down (Danube Bridge, Maritza – Iztok 1 and 3), and for third it is not known whether and when will be started, because of ambiguities in their planning (Gorna Arda).

10.2.2.5 Tourism

Tourism in Bulgaria has been developing with good rate. In 2002, our country was Number 1 destination for German tourists. One of the problems of Bulgarian sea resorts is infrastructure. Large-scale investments were also made in sea and winter tourism. Our country should start organizing and popularizing alternative forms of tourism – cultural, rural, religious, in which Bulgaria has big potential.

Cultural tourism is profitable on a world scale, but not in Bulgaria. The problem is that the modern tourist wants rest, information and comfort all at the same time. Although we have preserved authentic folklore traditions and five civilizations lived on our territory, this type of tourism remains highly under-developed.

Bulgarian companies have no sufficient funds to invest in advertisement abroad. Larger budget is needed to restore and maintain historical monuments. Our country is popularized on international festivals and exhibitions, through pictured brochures, circulated by Bulgarian representations abroad. Tourist agencies find that this is highly insufficient.

Recently, the foreign tourist interest in our cultural sites has been growing (mostly Europeans, and lately Japanese as well). The biggest attraction for the foreign tourist is the Rilla Monastery, Tzarevetz, Arbanasi, Bachkovski Monastery. There has also been a growing interest in folklore festivals – the Rose Celebrations in Kazanluk, the festival in Koprivshtitza.

Some attractive ideas are suggested by the Agency of Agricultural Information and Innovations (AAII) with Chairman Mr. Roman Rachkov. It established the attraction wine-tasting center in Lyaskovetz. For a short period of time, the center managed to become a place of tourist interest, more than 1000 people have already visited it. AAII

has a project to establish a 250-decare massif of white oil-bearing rose near the village of Razsoha, financed by the German company Walla.

The concept of religious tourism has not been developed at all. Most churches and monasteries near Bulgaria's old-time capital are in a deplorable state. Some of the possible tourist attractions are the archeological excavations near the town of Nikyup, where the ancient Roman town of Nikopolis ad Istrum was situated. This year, archeology students and professors from the Veliko Tarnovo University St. St. Kiril & Metodii, together with archeologists from the local museum, made a restoration of gladiator fights in the amphitheater of Nikopolis. A similar attraction could attract a lot of tourist to come and visit this place.

10.3 Regional Profile – Epirus, Greece

10.3.1 Geomorphologic Information

The Epirus district covers the northwest part of Greece and is comprised of the Arta, Preveza, Ioannina and Thesprotia counties. It has a total area of 9,203Km^2, covering the 6,7% of Greece's total surface. The mountainous regions cover 77% of the total surface. The mountains are effectively the extension of the Albanian Alps and are named Pindos. The only level surfaces are situated in the Arta and Preveza counties as well as in the valleys of rivers Aherontas and Thiami. The most important rivers are Aoos, Thiamis, Aherontas, Louros and Arahthos and the most important lake is the Ioannina one. In the skirts of Epirus there is a large number of sensitive and/or protected regions which include two national parks, a RAMSAR region, twenty two regions-candidates for incorporation to the Pan European Grid of Protected Regions NATURA 2000, a nature monument, two protected landscapes – cosmetic forests and 30 CORINE regions.

10.3.2 Demographic Characteristics

The population of the Epirus district is 371.690 (1998) and it represents 3.54% of the total population of Greece. The diagram (Figure 32) presents the percentage of the population variation in comparison to the population variation of Greece for the periods 1971-1981, 1981-1991 and 1991-1998.

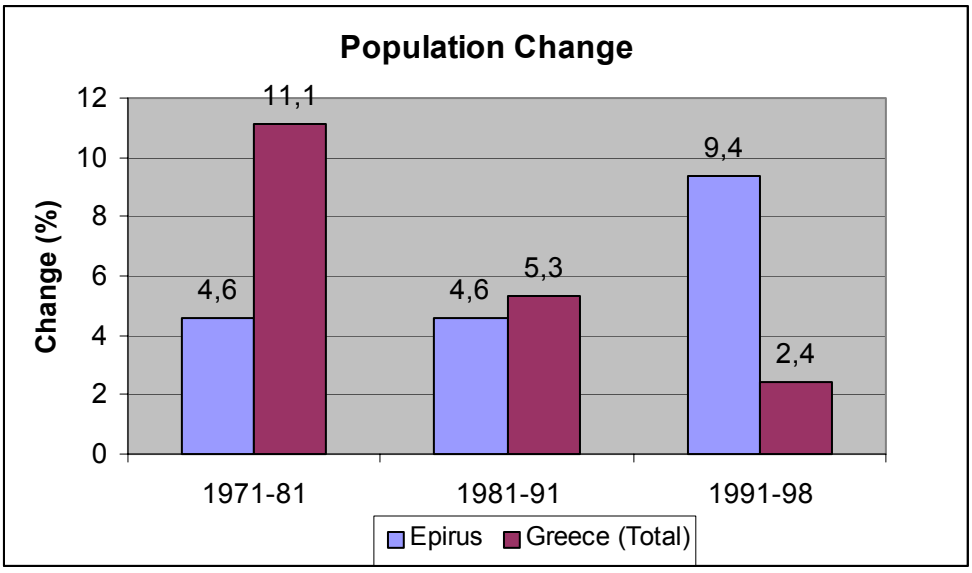


Figure 32 - Population Change in Epirus and Greece

According to the demographic data of the last five years, these trends continue to exist resulting in a rate of population increase for the district that is generally higher than the one of Greece in total.

The Epirus district is one of the most under populated regions with a population density of 40.5 people per Km^2 while the same figure for Greece is 79.7 people per Km^2. The urban population represents 31% of the total population (1991). The rural population has decreased in comparison to 1981 and is nowadays 59% of the total population of Epirus while the urban population shows a small increase and is 10% of the total population.

10.3.3 Regional GDP – Sector Allocation

According to the most recent information, the Epirus district produces 2.3% of Greece's GDP. The distribution of this GDP to the three sectors (primary, secondary and tertiary) is 17%, 23% and 60% respectively while the same figures for Greece are 15%, 25% and 60% (1994).

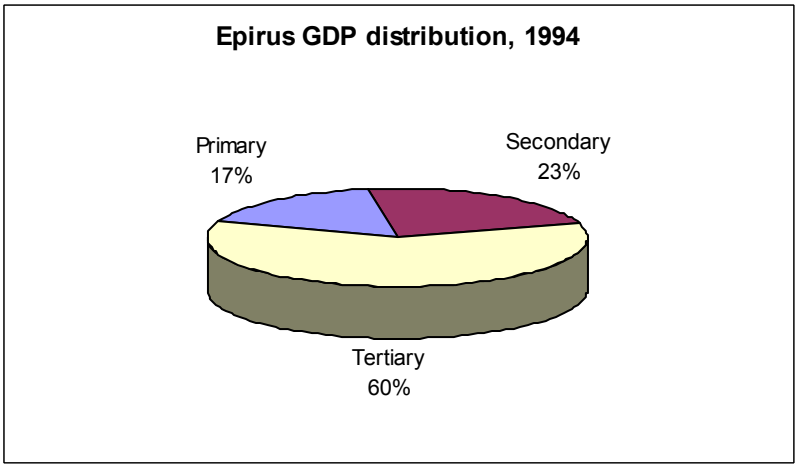


Figure 33 - Epirus GDP Distribution, 1994

As seen in the next diagram, the GDP per capita of the Epirus district is generally lower than the one for the whole of Greece. More specifically, it is just the 64.3% of Greece's GDP per capita (1994), ranked in 13th position of Greece's districts.

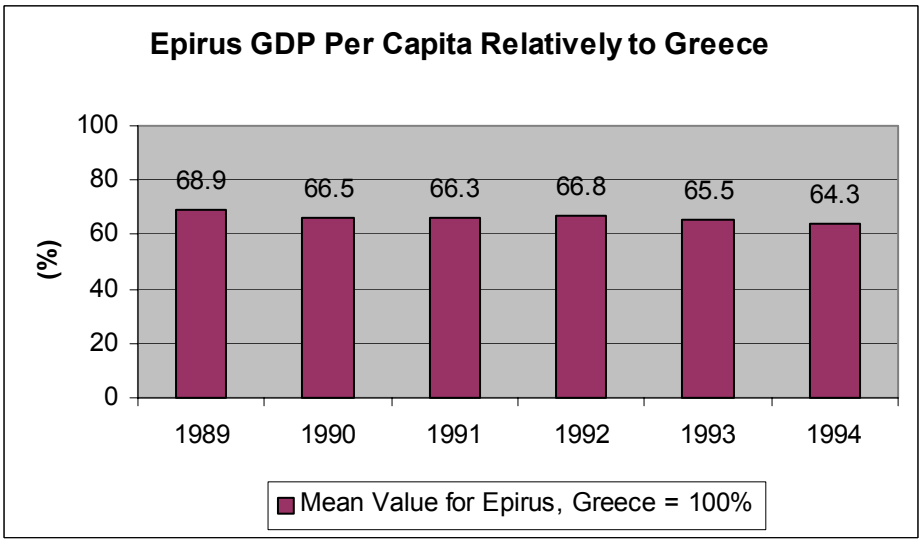


Figure 34 - Epirus GDP per Capita Compared to Greece

Since the GDP per capita of the Epirus district is just 43.8% of the mean value of European countries, Epirus is one of the most underprivileged regions of the European Union together with overseas regions of France. It should be mentioned that in 1986 the same figure was 47.4%.

10.3.4 Production (sectors – products)

The agriculture economy of Epirus region is mainly focused on stock-raising, where sheep breeding has a major position in the total domestic production and it is the base of an important proportion of secondary sector (food industry). Furthermore, some other

important business activities are cultivation of citrus trees and the cultivation of plants for stock-raising.

Some of the most important companies in this sector are:

- DODONI S.A. (dairy products)
- IPIROS S.A. (dairy products)
- PINDOS S.A. (poultry)
- NITSIAKOS S.A. (poultry)
- POULTRY ASSOCIATION OF ARTAS (poultry)
- VIKI S.A. (cook pork meats)
- HELPA S.A. (eels)
- HITOS ABEE (bottled water)
- IPIROTIKI VIOMIHANIA EMFIALOSEON S.A. (bottled water)
- IPIROTIKI ELEOYRGIA E. FLOLOU O.E. (oil industry)
- INOPIIA ZITSAS S.A. (winery)
- INOPIIA MONASTIRI ZITSAS S.A. (winery)
- SDOUKOS ANTONIOS ABEE (dried fruit and coffee process)
- KRINANTHOS S.A. (legume process)

In the manufacturing sector, the areas with the biggest contribution are the food and drink industry (see above table). Most of the industrial units in the secondary sector are quite small. More specifically, there are only 40 industrial units, which employ more than 20 persons (latest figures 1991). The sector's value added is lower (89%) than the national average.

Concerning the tertiary sector, and mainly sea transport, air transport and tourism, the Epirus region has a strategic position to Western Europe that may be exploited with the construction of Igoumenitsa port that will be the gate of Greece to Western Europe.

Within the region, there is an airport in Ioannina counties. Furthermore, there are a number of infrastructure projects underway which will pull the Epirus region out of its current isolation from the rest of Greece and will be of great importance for the development of the whole region. These include:

- Egnatia Road,
- Western Greece Road,
- Rio – Antirrio bridge,
- Aktio – Preveza bridge

Epirus region has some major competitive advantages (clear coasts, excellent topography, archaeological places, national parks, local cultural tradition, traditional settlements such as Metsovo, Zagorohoria, etc.) which allow for culture and tourism (in alternatives forms) to be major areas of development. Epirus region is mainly addressing internal tourism but there is insufficient volume and quality of accommodation in the region, and the average duration of tourist's residence is very low.

Companies that are activate in the tourism sector in Epirus region are mainly big and luxuries hotels in the Ioannina and Arta counties, such as:

- HOTEL DU LAC
- EPIRUS PALLAS
- VIZANTINON
- PALLADION HOTEL

Finally, the travel agent "DIONI TRAVEL" works on the business tourism and it is has developed a separate department focused in this area.

There are also a number of agro tourism accommodations in mountainous villages of Epirus region and a number of summer seaside accommodations that are mainly family businesses.

10.3.5 R&D in Epirus Region

In the Epirus region, there are situated almost 4.4% of the total Greek Research Centres and Institutes (figure as of 1993). The region is ranked 7th among the Greek regions. The University of Ioannina, with its current research activity, could be an important factor for the development of the R&D sector in the region of Epirus.

10.4 Regional Profile of Messinia, Greece

10.4.1 Review of the situation in the Messinia business environment

Within the context of the LAURA project, a large number of companies have been contacted in order to draw the profile of the business environment in this region and to identify the utilization of information technology in general and of electronic commerce solutions in particular. Furthermore, we have taken into account the findings of many probing studies of the business environment in Messinia region that have been conducted within the context of other European projects and national surveys.

The general feeling received from all these studies is that there are shortcomings, which need to be addressed in the application of e-commerce solutions, and these are due to a number of diverse factors emanating from different sources.

One of the major problems is the lack of understanding of the international business environment, due to the changes in business conditions and to the use of new IT applications in all forms of production, manufacturing, logistics, economic management, distribution and communication.

The situation in Messinia, as with most of the rural regions of Greece, is one of disarray as far as a perception of the present and the future of businesses is concerned. Businessmen have little idea of how an enterprise is rendered viable within the modern business environment and either refuse to understand or hesitate to accept this situation. This negative behaviour is due to the isolation of Messinia's companies and the small-scale transactions that take place within closed local groups of businesses. This attitude is further exacerbated by the aged profile of the population as well as language barriers. The aged population is a result of the clustering of business activities in urban centres and the migration of the young in the population toward these sources of employment. This has left rural regions under the control of elderly people that see little of the future that lies ahead, or, if they do receive adequate information of international developments, they tend to lack the strength or agility to respond.

The previous sentence highlights another problem: lack of information and information bottlenecks. It has been shown that information is the most difficult thing to manage, e specially if there has been no training in doing so. At the moment, the way that the state operates, shows that most information is mishandled, inadequately distributed, or misplaced. Because of this, a great deal of opportunities described in such information clusters are missed, resulting in slowing development and growth, with consequent direct effect on the economic viability of businesses.

A great deal of effort is required for any company to receive accurate and coherent information for commercial activities; information that many may handle but few really understand. Temporary dissemination networks have been established but after a while fade away due to improper management. Job allocation is left to hierarchy and not to effective evaluation criteria, resulting to inappropriate placement of personnel to vital positions.

This has severe repercussions on the selection and handling of information and management of these processes, resulting in information dead-ends, bottlenecks and circulation of paperwork. Clearly, this is a problem, but the introduction of a unified system could provide a solution to alleviate these problems.

Nevertheless, there are still companies that have a healthy attitude towards business and consequently e-business, and have realised the importance of entering international trading. However, despite being willing to do so, they lack both training and appropriate supportive tools. A uniform platform to support cooperating business on a regional, inter-regional and cross-border level together with a help-centre to aid and troubleshoot their transactions, would greatly help their integration to the growing community of e-business.

10.4.2 Size and structure of each sector in Messinia region

10.4.2.1 Wood Products Industry

The wood products industry in Messinia region is rather strange. Although there are quite a few enterprises involved in all aspects of wood processing, sales and distribution, most of them are very small, single-person shops or workshops. As Messinia, is not a wood-producing region, all wood is either directly imported from abroad or through very few wood wholesalers in metropolitan centres of Greece. The local wholesalers of Messinia are quite few and these are the ones that are of any real significance to LAURA. However, although these businesses are comparatively large in terms of turnover, they are nevertheless quite small on a respective international, or even national basis.

In the region there are also some very small wood-workshops that are comparatively small and are not considered to be a target for this project.

10.4.2.2 Structural Materials – Construction Industry

This sector is more developed than the wood products industry, but operates almost on the same basis as that sector. There are a large number of small enterprises comprising of brick makers and asbestos producers with typically 2-3 employees each, having as clientele the local construction industries.

There are a few bigger companies that are also active in wholesaling, and these are the ones that might have some interest in the LAURA project, although they tend to feel comfortable with the existing business practices - as long as their sector does not look to be under immediate danger from international competition. Furthermore, most of them do not employ staff with the adequate IT skills. They have typically purchased only one or two personal computers for accounting purposes.

Finally, there is a very small number of large wholesalers and construction companies that have developed during the last decade. Some of these companies have been set up by civil engineers, while others have grown from smaller companies that realised the benefits of being a (local) market leader. These may show interest in the project and vice versa.

10.4.2.3 Agriculture

First, we need to consider suppliers of fertiliser products and agricultural pharmaceuticals on the one hand, and agricultural products wholesalers on the other hand. Although there are many small firms, concentrated in localities, there are quite a few wholesalers of fertilisers and pharmaceutical products that supply the smaller businesses or the agro-industry itself.

On the other hand, there are a huge number of small companies selling agricultural products, but few large wholesalers and exporters. This difference is due to the fact that Messinia is an agricultural region and its major products are ones of agriculture and foodstuffs production. In this sector we will find many companies that have stable export or import activity, as well as national distribution, and would be interested in anything that would help their businesses to respond to new market opportunities.

10.4.2.4 Food Industry

The food industry sector is a very diverse one, but it is also the most suitable area to investigate in the context of the LAURA project. This sector includes companies that are traditionally dealing with the import and the export of most consumable foodstuffs in Messinia.

These are quite large companies compared to the national standards and are aware of the urgency of keeping up with the times and with technological evolution, both for their internal production processes and their external dealings with suppliers and customers. These companies have realised the fact that development is of paramount importance, and have developed mostly empirical methods and ways of collecting information concerning their trade. Because of this eagerness to expand, these people have acquired knowledge and expertise that will enable them to exploit in the best way any platform or practice that could come from LAURA project. Furthermore, this sector includes a large number of small enterprises that cover the local demand and distribution requirements.

10.4.2.5 Tourism

Tourist and hospitality enterprises are the most extrovert in their business practices. In this sector, we may identify a large diversity in types of business and clientele. However, as well as the small, family and personal tourist businesses there are the major tour agents and hotels. These larger companies already have in place some IT systems to support their business deals and transactions with national and international clients and suppliers, but they do lack an integrated solution.

More specifically, there is a great diversity in the methods they use for the communication of trading information (purchases, sales, availabilities and potential business), and therefore there is a clear need for an integrated solution that will facilitate access to available information through a uniform and trustworthy system. The large companies in the sector have already in place the appropriate technical skills to provide us with usable and reliable feedback on the needs and requirements of such a system.

Table 18 includes some interesting figures regarding the size of the regional sectors and the main firms that are activate in each business area:

Table 18 – Size of the Sectors and the Main Companies - Messinia

Sector	No. of Businesses	No. of Large Businesses	Indicative Names of Large Businesses
Food Industry	142	27	OINOMESSINIAKI S.A., PAPADOPOULOI E.PE., ASTIR S.A., ARGIRIPOULOS E.E., DERESKOY S.E., LAMBOU S.A., AGROVIM S.A., TAKIS TRAND S.A., APOSTOLOPOULOS S.A., NESTOR S.A., STEFANOURIS S.A., MEFINO O.E., PAPADIMITRIOU S.A.
Wood and Timber Industry	227	6	MATHIOPOULOS GEORGE, BABALIS & CO. SA, MESSINIAKI WOOD INDUSTRY - CHANTZARAS PLC, KOUMANIS SA, BACHRAMIS NIKOLAOS, POULAKOS SOTIRIOS
Tourism	64	15	MANI TOURISTIC SA, NEDON CO., HOOPS PLC, KORONI PARADISE SA, PANELENI SA, PANORAMA SA, MANIATIS TRAVEL, KAPSAS NIKOLAOS, TRIGILIDAS TRAVEL & HOLIDAYS, BEST CAR, DOUFEXIS CHARALAMPOS, VASILOPOULOI BROS. CO., VARDIA SA, EMOT-ELITE SA, KARELLAS HOLIDAYS
Agriculture	23	3	PANTELOPOULOS CHARILAOS, AGREXPO SA, AGROVIM SA
Structure Materials - Construction	314	29	DEDOUSI O.E., ANAFNOSTARA S.A., ASTRON-ELECTRIC CO., DROUTSAS CLASS, DOMISIS S.A., GIANNAKOPOULOS CO.,

10.4.3 Major markets and crucial factors influencing market performance

Examining the five industrial sectors of Messina, we can identify the major markets for each one of the sectors:

- Local, regional markets for the Construction Sector and the Wood / Timber Sector;
- Local, regional and national for the Agricultural Sector with some projections toward exports; and
- Local, regional, national and international for the Food Industry Sector and Tourism.

The agricultural and the food industry sectors are overlapping sometimes as far as products are concerned due to the fact that there are firms that are considered to be agricultural, but they also process and package the raw agricultural materials into

marketable goods. There are a variety of recipients for the products of each sector. For the ones with export activity, the recipients may be retailers, distributors or private customers at local and/or international level. For the ones that are involved with importing and processing materials for local and regional consumption, the picture is obvious. The latter category uses national and international markets as source for the goods they handle. Finally, tourism is involved with the supply of services towards both directions, and accordingly presenting demands to both directions as well.

Factors affecting the performance of the companies are usually concerned with national sourcing, as even the ones sourcing from international conditions are filtered through the national environment due to the corrective or adaptive actions taken by the state. These factors can be of a various nature: Firstly, there is the economic and market state of affairs, both on a national and international level. Then we have the educational and training situation in the region that affects the quality of personnel manning the companies, with consequential effects on the management, production and service quality of these companies. This is closely related to the employment conditions in the region, as the availability or the lack of technical and specialised workforce affects the company dynamics and consequently its productive capabilities. It also affects the microeconomics of the sector due to the large gaps in salaries and the abundance of non-specialised workforce. Furthermore, the lack of technically or managerially trained staff has direct effect on the wages and staff turnover, making it complicated for companies to manage staffing affairs, reducing their willingness to be involved in growth activities.

10.4.4 Conclusions

Although there are quite a few problems to overcome, the LAURA project does provide the initiatives to deal with the needs and problems of the Messinia region and to provide an integrated solution for business-to-business e-commerce activities. We feel that project, if given the support and development required to become a workable and applicable platform, shall meet the needs and requirements of local small and medium sized enterprises.

11 Annex B - European Institutes in the Area of E-commerce

Table 19 - European Institutes in the Area of E-commerce

Institute Name	University	Country
NetAcademy	The NetAcademy is a network of research communities	
E-COMMERCE COMPETENCE CENTER	A consortium of four universities based in Vienna	Austria
IWE - Forschungsstelle für institutionellen Wandel und europäische Integration	Austrian Academy of Sciences	Austria
Maersk Mc-Kinney Moller Institute for Production Technology	Odense University	Denmark
Technical University of Denmark		Denmark
R&D CENTER FOR INFORMATION TECHNOLOGY IN EDUCATION	University of Joensuu	Finland
eLab@INSEAD	INSEAD Digital Economy Initiative, Fontainebleau	France
BIBA - Bremer Institut für Betriebstechnik und angewandte Arbeitswissenschaft	University of Bremen	Germany
Electronic Commerce Center Handel (ECC Handel)	University of Cologne	Germany
ecLab	University Witten-Herdecke	Germany
FAW	University of Ulm	Germany
Fraunhofer Institute for Systems and Innovation Research ISI	Karlsruhe	Germany
German National Research Center for Information Technology		Germany
Institute for Management (IM)	Faculty of Informatics, University Koblenz	Germany
Lehrstuhl fuer Electronic Business	WHU - Otto Beisheim Graduate School of Management, Vallendar	Germany
FZI Research Center for Information Technologies	University of Karlsruhe	Germany
Centre for Research on Innovation and International Processes	Universita Bocconi, Milan	Italy
E-Markets Research Group	Norwegian School of Economics and Business Administration (NHH), The Foundation for Research in Economics and Business Administration (SNF)	Norway
e-Business Center	PricewaterhouseCoopers and IESE Business School, Barcelona	Spain
Mid Sweden University		Sweden
Centre for Electronic Commerce	Erasmus University	The Netherlands
Center for Telematics and Information Technologies (CTIT)	University of Twente	The Netherlands
Infolab	Tilburg University	The Netherlands
Institute of information of law (IViR)	University of Amsterdam	The Netherlands
Research Institute for Decision and	Erasmus University, Rotterdam	The Netherlands

Information Systems (EURIDIS)		
Tubitak-Bilten		Turkey
Centre for E-Business Research	Aston University Business School	United Kingdom
Centre for Electronic Commerce	University of Sunderland	United Kingdom
Center for the Network Economy	London Business School	United Kingdom
eCommerce Innovation Centre	Cardiff University	United Kingdom
Centre for Applied Research in Information Systems	Kingston University	United Kingdom

Source: Europa Newsletter, http://europa.eu.int/information_society/topics/ebusiness/ecommerce/2research/institutes/index_en.htm

12 Annex C - A list of E-commerce Organizations

Table 20 – E-Commerce Organisations (from OBI Consortium, www.openbuy.org)

URL	Name	# Members/ Endorsements	Comments
www.oasis-open.org	OASIS	126	Facilitate adoption of standards-based formats
www.smbxml.org	SMBXML		Establish elements of purchasing & banking standards especially for SMEs
www.unece.org/cefact	UN/CEFACT		Facilitate EC & global growth via adopting standards
www.cs.mu.oz.au/research/icaris/	ICARIS (Univ.)		Define BSI & simple-EDI to facilitate SME in EC
www.ebxml.org	ebXML		Set up XML-standardized infrastructure for the exchange of e-business data (esp. for SME)
www.cenorm.be/isss/	CEN/ISSS		Provide standardization-oriented products & services for Europe's Information Society
www.eema.org	EEMA	many	Enable European members to benefit from EC, information management & communications
eco.commerce.net	eCo Frame		Develop framework for EC (i.e. databases integration, open registries & agent-mediated buying)
www.oecd.org	OECD	29 countries	Promote healthy EC infrastructure
www.pkiforum.org	PKI Forum	78	Promote adoption of Public-Key (security & trust) Infrastructure
www.opengroup.org	The Open Group	223	Enable enterprise integration and standard convergence for wireless communications
www.globalcommerceinitiative.org	GCI		Bridge gaps among global supply chain standards (esp. data access, security, content & flow)
www.ietf.org	IETF	open	Define spec for sending EDI messages securely
www.ipmulticast.com	IP Multicast	51	Promote IETF-standardized IP products & services
www.openverticals.org	Open Verticals	55	Offer a framework implemented on Java with XML support

ichnet.org	ICH		Develop enterprise IT architectures & frameworks
www.gii.org	GIIC	47	Public-private cooperation in information networks & services to advance global econ. growth
www.omg.org	OMG	800	Develop open spec & marketplace for interoperable enterprise application and architecture
www.openapplications.org	OAG	58	Provide software & application integration for enterprise & supply chain functions
www.biztalk.org	Biztalk	open	Promote XML in EC & application integration, and set up framework for standard bodies
www.xedi.org	XEDI	2	Represent EDI semantics in XML syntax (esp. to facilitate SMEs)
www.xmledi-group.org	XML/EDI	many	Create the new combined usage of EDI & XML together to improve EC
www.xml.org	XML	28	Establish information repository to leverage XML usage for B2B
www.cxml.org	cXML	52	Accelerate cXML standard in B2B EC
www.disa.org	DISA	5	Facilitate cross-industry specs & define X12 for EC development
www.cgmopen.org	CGM Open	11	Define an interoperable standard for graphical information exchange
www.niso.org	NISO	68	Develop technical standards for libraries, information services & publishing
www.unicode.org	Unicode	80	Develop universal encoding standard to create global multilingual software
www.eccma.org	ECCMA	many	Develop eProcurement codes (i.e. browers, mailings & product classification) to facilitate standards
www.icann.org	ICANN		IP, protocol, domain name & root server system management
www.fstc.org	FSTC	76	Encourage standards and R&D to set financial IT architecture and to direct gov't initiatives
www.ifxforum.org	IFX	31	Accelerate standards adoption so that applications & products can be electronically delivered
www.finxkl.org	FinXML		Support an universal standard for cross application data interchange within the Capital Markets
www.isitc.org	ISITC-IOA	many	Foster alliances & advocate standards that promote STP of securities transactions
www.fpml.org	FPML	19	Provide a communication protocol for sharing info. on & trading in financial derivatives instruments
www.fixprotocol.org	FIX Protocol	many	Define an open protocol for real-time electronic communication of securities transactions
www.ofx.net	OFX		Define a unified specification for the exchange of electronic financial data over the Internet

www.xbrl.org	XBRL	38	Develop spec for communicating & reporting financial statements & accounting data
www.otp.org	OTP	34	Develop protocol for interoperable software products for ePurchasing
www.rosettanet.org	RosettaNet	185	Develop & deploy standard eBusiness interfaces for EC & IT supply chain partners
www.openbuy.org	OBI	75	Provide standards & interoperable solutions for MRO eProcurement
www.bolero.net	Bolero.net		Move world trade onto the Internet and design spec to exchange data without an EDI agreement
www.ecrc.org	ECRC		Provide IT & EC assistance to SMEs and the supply chain of the Dept. of Defence
simap.eu.int	SIMAP		Support an open marketplace/infrastructure for eProcurement in Europe
www.ecentre.org.uk	EAN (UK)	15500	Establish UK's EC excellence esp. for SMEs by adopting standards
www.ecp.nl	ECP-NL	170	Establish NL's EC excellence in eProcurement, interoperability, security by adopting standards
www.bme.de	BME e.V.		Define the XML messages necessary for exchanging information between electronic catalogues
www.is-ms.com	IS-MS		Develop technical infrastructure within organizational management
www.ecinstitute.org	EC Institute		Offers training (esp. IT management) for EC professionals