

FROM E-BUSINESS TO KNOWLEDGE BUSINESS IN METAL AND ELECTRONIC INDUSTRIES

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Abstract

Since 1995 as a start of commercial use of Internet network in Finland we have witnessed strong development in this area. This development trend has promoted e-Business to an important subject of decision-making and business planning. One of the factors behind development has been the exploitation and management of information and knowledge. Next step, which is already there observable in some of the companies, is the development related to superior management of knowledge concerning customers, suppliers and business relationships in the e-Business environment. In this paper we will argue and review our view on how the e-Business will possibly evolve to what we call knowledge business era (k-Business), in companies.

This research outlines generic evolution paths using state of e-Business descriptions in selected companies in metal and electronics industries. During years 2000-2001 forty (40) company in-depth interviews with 50-60 managers responsible for e-Business decisions were conducted. Objective was to find out the state of art in e-Business strategies in each company. Interview themes were selected according to analysis of development of business environment, development of ICT (technological) environment, organizational maturity to adopt e-Business practices, and their potential to benefit from e-Business opportunities determined by companies themselves.

The "Four evolutionary phases of e-Business" is suggested as one of the results of the study. This phase model seems to describe the actions made for developing e-Business in metal and electronics companies. Four qualitatively different phases of development was discovered among the Finnish metal and electronic companies. These four phases seem to be also the order of development. Phases are:

- ERP-phase, e.g. putting the foundation on enterprise information systems in order,
- SCM-phase, e.g. boosting the information systems of supply chain management,
- CRM-phase, e.g. deepening and improving customer relations and knowledge,

- KM-phase, e.g. taking advantage of business intelligence systems handling either customer, supplier or business relationship based knowledge in knowledge networks.

Roughly 20% of the companies were still building their foundation of Enterprise Information Systems. Most of the companies, approximately half of them, were focusing on improving the fluency of supply chain. Approximately 20% were already concentrating in collect and exploit of customer knowledge. Only few companies were very advanced in their e-Business initiatives. They focused on deepen their relationships with superior management of supplier, customer, and business partner based knowledge. This research outlines some development paths of e-Business in metal and electronics industries in the near future. It can be used as a guideline how to start the development of e-Business blueprint or in positioning company's e-Business state or in benchmarking where the company is going compared to other companies. This research outline that companies must continuously learn from business partners, suppliers, and customers and deepen the cooperation with them to retain the competitiveness in the future.

Keywords

e-Business, knowledge business, metal and electronics industries

INTRODUCTION

Originally in the mid-1990's started phenomenon of commercial uses of Internet has promoted e-Business to be an important subject of decision-making and business planning. When e-Business comes more common and widely used, and most of the operative order- and delivery routines have moved into information networks in many industries, e-Business will offer a new way to learn from business relations and help to deepen the relationships. As an engine for this development will be the exploitation of knowledge. In the future, and already partly existing, there is the challenge of knowledge systems and superior management of customers, supplier and business partner based knowledge. Future business will be done with knowledge systems built upon effective e-Business systems. In this paper we will call this phase knowledge business (k-Business). Rationale for this argument is that when e-Business comes more widely used, company and industry service models become more alike. e-Business systems will become prerequisites for business and competitive advantage will be derived from customers attention and knowledge. In this phase, enterprise legacy systems, routine-based supply chain management and basic customer relationship management applications need to be effective.

Naturally, it is difficult to predict development paths in advance and how e-Business will evolve and possibly change to k-Business in enterprises. However, in this research we try outline it using e-business blueprints and interpretative interviews of selected companies in metal and electronics industries.

Conceptually e-Business is being used in many varying ways. In this research we first identified factors, which affect the growth of e-Business in organizations. While e-Business is not only technology, it is more important to use this technology to achieve profitable and competitive business. Web, WAP or any other constantly emerging "three-letter acronyms"

will not create automatically better productivity, profitability, customer service, lead-time or any other significant business improvement.

In metal and electronics industries it is characteristic that different companies and whole industries are in different development phase. For example, in a global electronics industry e-Business was assumed to be a different kind of phenomenon than in “old-fashioned” mining industry - not to undermine any industry in this study. However, this doesn't mean that e-Business challenge should not be taken seriously in the industries where electronic business transactions conducted via some network feels awkward at first.

BACKGROUND OF THE RESEARCH AND DEFINITIONS

Empirical basis of the research

Empirical findings of the study were collected nationwide from 40 Finnish metal and electrotechnical enterprises by professors Jaakko Riihimaa and Mikko Ruohonen in cooperation with Federation of Finnish Metal, Engineering and Electrotechnical Industries (MET). The sponsor of the study was director Pekka Pokela and their coordinator in MET was project manager Juhani Kangasniemi. The empirical data consists of 40 in-depth company visits, interviews and related documents with 50-60 directors or managers responsible for e-business decisions. Company visits were done during December 2000 and March 2001.

The practical objective of the interviews was to examine e-Business processes enabling innovative and new kind of products and business concepts. Particularly the focus was on three e-business based innovation issues:

- new type of product concepts
- new processes of marketing, and
- the innovative applications including mobile internet features (m-business).

The sponsor organization MET took the initiative to organize the interviews, for the purpose of identifying innovation elements for their future development projects. Another aim for these purposes was to recognize 3-5 potential development themes of the Finnish metal industry.

To have the best possible scope of the target group for MET purposes it was necessary to have various types of enterprises to be involved into the study. A representative sample of metal and electrotechnical enterprises was brought forward by the experts of MET. They selected the candidates of Finnish metal, engineering and electrotechnical industries based on their knowledge (both members and non-members of the federation). The target group was fulfilled with some potential small and medium size companies (SMEs i.e. companies with not more than 500 employees and turnover of 40-60 Meuros) from Southern-Ostrobothnia. The total number of potential candidate enterprises was over 70. The list of enterprises was created in the end of October 2000.

There were both large corporations and SMEs included in the study. However, the role of SMEs was seen as an important part of the metal industry supply chains governed by large enterprises. The large enterprises also most often administrate the customer relationships and so they have an essential role in networks.

Three quadrants represented machinery- and metal product industry, one quadrant came from electrotechnical industry. About half of the enterprises were SMEs and another half large ones. Geographically they came from different parts of Finland. Due to the fact most of the large companies are headquartered in the capital city (Helsinki) district, there were about a quadrant of these firms from that area. However, geographically there were almost 30 different Finnish cities or municipalities represented.

Majority of the interviews were done during company visits (some in university premises). About a week before the interview selected preliminary questions were sent to every respondent by electronic mail. The objective was to test the attitudes of the respondents for electronic applications such as email.

Typically the representatives of these enterprises were the persons coordinating e-Business in the company. The enterprises selected the persons internally after the phone contact from MET and before the respondents got the preliminary email. Among the company representatives there were organizationally different kind of managers, from chief executive officers to quality managers.

Framework for interviews, definitions

The final process for interviews was based on two phases. As noted earlier, in the first phase we used a short preliminary email-based questionnaire. We wanted to observe the common attitude of the respondents to the procedures the growing use of e-business will necessitate. Additionally we wanted to see, if the respondent would use email at all in answering.

The second phase was to conduct interviews. For the interviews a special interview presentation material was built as working tool i.e. a handout of 13 pages and seven main themes (consult authors for further information). It was given to respondents in the beginning of the interview. Handout material also included some graphical illustrations and textual contribution in order to clarify aspects of e-Business.

The aims were to present the goals of the study, to have a tool for analyzing discussion during the interviews and to function as the catalyst of interviews. We bundled up some relevant theoretical models, which we argued to be in relation to development of e-Business. In every page a particular theme was presented. Theme page of the handout includes an illustration, a diagram or a list of examples and some questions affiliated with the theme.

In the first pages of the handout we presented the research issues once again, depicted the framework with four basic factors presented later in this article and defined three essential concepts of the research: e-Business, m-Business and mass customization.

Definitions were very broad in order give all the respondents an opportunity to construct their concept "e-Business". The preliminary concepts were defined in the following way:

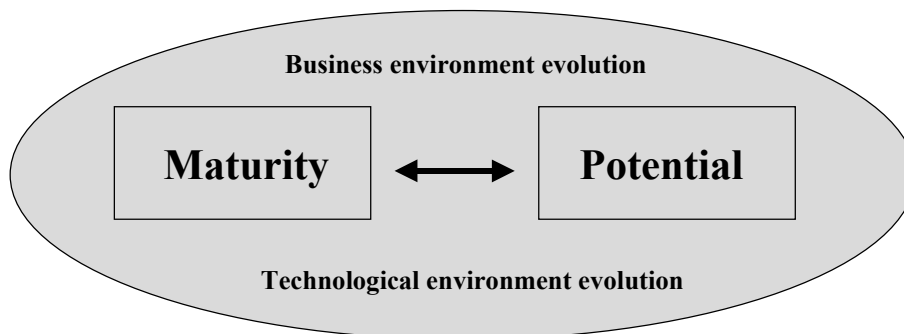
e-Business: the use of information and communication technology (ICT) as a basis for communications, operations and management of an organization and as a driving force for having business changes.

m-Business: the use of wireless information and communication technology (ICT) as a part of communications, operations, management and business changes of an organization.

Mass customization: the fulfillment of customer- or customer group needs as a part of the organizations' product, customer service or manufacturing strategies.

Framework for interviews, four base elements

We identified four factors: evolution of business environment, evolution of technology environment, maturity to apply e-business innovations and potential of e-business innovations in the adopting enterprise.



Business environment evolution was investigated according to two most essential views: A trend away from value chains towards the value networks (Stabell & Fjeldstad 1998) and the depth of the customer relationship (Cross & Smith 1995, Cross & Smith 1997, Kalakota & Robinson 1999, Kalakota & Robinson 2001). The commitment degree of customers was defined according to Cross & Smith (1995).

Evolution of technology environment was viewed by using a list of IT capabilities by Bharadwaj et al.(1999).

The concept of maturity to apply e-Business was derived from the results and experiences of previous SME-focused ITEP -project (Information Technology in Southern Ostrobothnia, Riihimaa & Vuori 2000). The essential observations of ITEP were analyzed and divided to three sub-factors: Organizational maturity, Technological maturity and Management maturity.

Definition of e-Business potential innovations in the adopting enterprise was left rather open in order to find out how useful new innovations were to the adopting enterprises.

STATE OF THE ART IN METAL AND ELECTRONICS INDUSTRIES

Next we shortly present the main observations of e-Business state in Finnish metal and electronics industries.

Evolution of business environment

Pioneers have set their goals

During the interviews our initial assumption was confirmed, that metal and electronics industries have taken seriously the e-Business challenge and in some (10%) of the companies goals are very ambitious. There was no willingness to undergo the first hype bubble phase while by-passing the hype-phase has been healthy for these industries. In the next phase attention has shifted to e-Business solutions where the processes, customer communities and experiences are under examination.

However, many companies are still waiting. In traditional metal industry the business dynamics is more calm than in electronics industry. Enterprises in telecommunication business have being enforced to participate on large renewal projects of information systems. Rearrangement of industries is inevitable in global business environment which demands cost efficiency. However, there are many industries where local and regional knowledge is extremely important. On the contrary to beliefs advertised in media, all business transactions are not moving to global electronic marketplaces.

Cost efficiency comes first

Cost efficiency has always been a good springboard for information system initiatives. This is true also in metal and electronics industries. However, possibilities are not any more restricted to cost efficiency.

The challenges and opportunities related to development of processes and organizations are becoming to e-Business. For example better care of service and customer relations and transfer of knowledge in sales and distribution chain are those subjects that can produce success.

As the customer relations evolve, after sales services will increase

In manufacturing the development has lead to a position where importance of services as a part of business grows. Product and production oriented companies have to acquire knowledge of services production or at least search for partners who has service competencies in their industry. Hence, e-Business provides one way to offer some opportunities in traditional after-sales functions. e-Business is not just one technical loop of order-delivery-invoice –chain, but also a new form of producing services.

Many of the interviewed companies were in the situation where company had many long lasting, successful customer relations and the capital goods these customers had acquired formed a kind of bridgehead for company. As the customer relations evolve, customer needs have to be taken into account better. In manufacturing business for example it means spare part, maintenance, and usability services and auxiliary activities related to monitoring and

extending product life-cycles. Many companies have prepared to build service and maintenance connections to machines and systems, which they already have delivered to all over the world, for example by using mobile communication tools.

Nurturing mass-customization is substantial

Management of different stages of mass-customization is a clear challenge for companies (Pine & Gilmore 1997). In many companies operations have started from very customer-oriented perspective, producing customer defined products, leaving production series short. This kind of customization is usually a joint problem solving with the customer, e.g. cooperative customization. Customer is satisfied and supplier-company gets a good reference.

Cooperative customization can't be carried on forever, at least not for the same customers. This is because almost in all industries productization occurs. This means that originally customized products can turn to be more standard and be bought as a mass product with a lower cost. Standard products can replace previously customized product. This is common for example in software industry. Yet, there are always companies who have superior and unique knowledge not easily imitated, such as different kinds of protected innovations. These companies can prize their products and services with proper margins.

Mass-customization with customer can also be done either in a transparent or adaptive way. In both cases customer doesn't necessarily recognize how his/her needs are tailored into the product or service. Transparent customization requires the use of a large and diversified database, which contains detailed knowledge about customer and customer's product and service needs. In adaptive customization you do not always know what customer wants, but by increasing the modularity of products or services customization level increases. Company can therefore develop customers' needs fulfilling combinations of product qualities with superior management of product data and by developing different kinds of product families.

Products can be customized also with a cosmetic way. Then customer-defined product changes are usually done in the end of the manufacturing process. These can be done for example in the assembly line, of which the car industry is an excellent example. This kind of model for operations demands flexible manufacturing and adequate volume to be meaningful.

Information technology is to be embedded into products

Companies manufacturing appliances, machinery or other goods meant for long-term use had many ideas about intelligence of appliances. In these product areas ability to record usage information, make fault-analysis and control over quantity and quality of production can be significant competitive advantage for Finnish manufacturing industries in the future.

This development has been started by applying logical circuit solutions. However, in some interviews very ambitious projects were discussed. Projects where traditional manufactured product had a computer installed inside with capabilities to store, process and communicate. This way information technology opens new doors for not only to make products utilization possibilities more diversified, but also to manage customer relations and control the supply chain.

Technological development behind the e-Business

Phased development

In Finnish metal and electronics industries e-Business solutions are mainly built on traditional and already tested ICT platforms. Compatibility of these platforms is compromised with many rearrangements, takeovers and mergers where previous or old information systems are downsized or totally renewed, depending of the selections of the group or corporate management.

A number of foreign basic metal industry companies are relying on pretty old-fashioned information technology, which can eventually cause problems. These solutions might not be cost –effective and probably inferior at scalability. Many times Finnish business unit can be the e-Business pioneer in a larger international group.

Traditional ICT solutions stay the backbone of e-business

Networking and subcontracting collaboration has increased in the turn of the 1990's. This has brought some basic structures on electronic interchange of data, which is based in some industry standards (EDI, Electronic Data Interchange). EDI is normally being used with stable business relations and well-established products. This makes it easier to install an EDI solution.

However, for many SMEs EDI is too expensive to acquire and complex, so they have incrementally moved to the use email attachments with their business partners. Domination of Microsoft office applications (Word, Excel etc.) and increased use of email has created an opportunity for “handicraft of electronic data interchange”. Different kind of pilot projects between partners have grown to be an established part of business processes of SMEs.

Current web environment offers a combination of these two forms of electronic interchange of data. In this way EDI clients and clients using lighter ways to transfer information can be managed with one web-interface. Many EDI/XML consultants are working to solve problems of information interchange. They try to figure out systems interfaces and to standardize them. Beyond this, there have been emerging some broker-organizations, who offer electronic data interchange services for order-delivery-invoice –chain. However, situation is not yet established.

Mobile solutions are waiting

Mobile technology solutions are being used in communication and in other support kind of operations (for example in office work). Operations attached directly to value chain are clearly waiting for networking environments to be standardized and decrease of costs of applicable services.

Mobile applications are not well known yet, even though some examples exist for example for management of supply chain or implementing complex systems in industrial sites. Sales representatives and usually distribution support systems are examples of channels where mobile applications come to the picture when basic ICT systems become established. As noted earlier, companies have also prepared mobile connections to appliances and machinery which can be taken into operational use when needed.

Great need for integration of information systems

It seems that stand-alone, company-specific information system development projects are moving to history. In the future companies have to review their entire supply chain and take into consideration not only essential customer groups but also own subcontractors and other partners in the supply chain.

Integration between different information systems are needed, because management of supply chain have to cross organizations. From customers' point of view a best supply chain activates, works customized and reach its services beyond organizational borders depending of customers needs.

However, there are many obstacles for integration. Firstly, there are different kind of information systems in different parts of supply chain. They can differ from each other both by type and life time. Secondly, longest supply chains can range from small machine shops to a global machinery manufacturer, which increases the inner variety of the supply chain. Thirdly, at the end of the chain there is not always a small company. Even the procurement of critical components can in a small company be ordered from a major company with international operations.

Inside of this kind of a chain – or more correctly a supply network – should be very clear description of product data, which is adopted and used in all parts of supply chain. Also a description of division of work inside value chain processes is needed. Today, supply chains are based on very broad forecasting abilities while changes in order and delivery volumes cause additional expenses.

Management of supply chain (SCM, supply chain management) is with many ways one of the key challenges in the development of e-Business systems in metal and electronics industries. The development is very important from a management of change and errors and above all improving the forecasting point of view.

Diversity of CAD-systems

Diversity of computer-based design systems was not a surprise for researchers. Merely only in those cases where company's essential customer was a large international corporation, companies are planning to unify their CAD-systems. In other cases, and especially in SMEs, the problem is solved by gathering experts with skills and knowledge of different CAD environments characteristics. These experts can translate different kind of design plans between different systems.

Coordinating project management within a network

e-Business offers opportunities for project coordination within a network. There were some examples when a group of companies had founded a common project portal to management of long-term construction project or similar (for example plant delivery).

Project portal serves as a storage for project information, instruction base for partners work performance in different phases and at the same time as a common interchange of information about the development of project. Project portal enable continuous documentation of project to ensure the quality.

Foundation of portals serving projects and more generally several stakeholders is one of the key questions of knowledge business. With support of network new kind of allocation of work can be planned and it also enables operations of cooperation based networks.

Brokering application and business services in the industry

The role of third parties as a partner in information transfer and supply chain management is still unclear. This kind of activities has started also in Finland, but real industry specific application service providing (ASP) has not been significant.

Expectations for application and business services provisioning have been high. However, this requires standardization of industrial processes, strong management of product standardization and above all management of industry differences.

As a broker conducting merely routine business transactions can only manage as a very cost effective industry broker, others have to concentrate to manage a part of customers' processes as well. This is partly happening already in electronic industry for example in component and software production.

Administration model of industry's ASP-brokering is still unclear. Broker operations can be founded either by business partners themselves, an independent broker conducting business operations or any of associations serving the industry. The broker can operate only with contract partners or open it immediately for all potential companies. However, experiences from elsewhere have suppressed the biggest enthusiasm. Marketplaces are clearly living their critical period.

From a services acquiring company's point of view ASP-operations are very diverse, because you can find same kind of service supply from independent small entrepreneurs, telecommunication operators, and system integrators.

Maturity to utilize e-Business opportunities

Customer relationship management systems are under development

Many companies had the situation where importance of services are growing and holding old customers is critical for business operations.

Many of the companies had delivered machinery and appliances for years, even for decades. These machinery and appliance installations had founded a customer relation which should now be managed systematically. e-Business offers many opportunities in this situation.

The real challenge is building the multi-channel service model. Companies have to take care of their customers with traditional resources of sales-distribution chain, but at the same time consider service models of electronic channels. Customer service has to be managed through different channels, so that end-customers, sales and distribution representatives as well as producing organizations themselves can utilize the same information resource. Among the interviewed enterprises it was very typical that customer information was spread all over the organization or sales and distribution chain.

Formulation of marketplace strategy is difficult

Discussion of marketplace strategies clearly needs a new focus. In the beginning of e-business, public marketplaces emphasized separate auction sets and undefined mass production type of product sets. These marketplaces did not attract companies of our study. First phase experiences had clearly blurred perception of how marketplaces could operate and how they should be managed.

Electronics industry had clearly a growing interest, and certain kind of procurement portals were expected by industry leader organizations. This will shape the entire industry's way to operate. At the same time, business processes are under standardization, as Nokia's membership in RosettaNet consortium addresses (look: www.rosettanet.org).

Although interviewed companies didn't show great enthusiasm for marketplaces, some of them had very multidimensional marketplace projects. Marketplaces were often designed as industry theme portals, customer targeted services, industry or international collaboration projects.

Marketplaces have to be understood as a very broad concept, as a tool for supplier/subcontractor alliances, customer relations and company's inner and partner organizations relationships management. In network economy it is possible to 'penetrate' organizations even in a level of single project, if it is seen to be necessary. Marketplace debate seems to be without strategic armature and especially SMEs depend on very unreliable industry information.

Great potential in procurement activities

e-Business is initiated most naturally in marketing and sales functions field. However, transparency of whole network requires that single web-based applications will integrate to company's other information systems. Among the interviewed companies many pilot and already established projects were found, but still in electronic procurement haven't been able to proceed no longer than to the next procurement tier.

E-business based value chains depend also from inner power relations of industry. In some industries wholesalers have so significant role that a channel conflict arise very easily. On the other hand, there are some companies who have so great procurement power, that they can partly dictate the rules of information processing to their subcontractors. It is essential for extending the e-procurement, that companies in the role of contract supplier could take responsibility also from development of their subcontractors information processing, even in the form of offering information systems services.

During the interviews a clear "wait and see" -situation was observable, where it wasn't sure who had the responsibility of standards of industry's information processing; industry leader, contract supplier, or all companies separately. Creating supply chain community requires strategic formation of organizations, where common practices are been agreed (processes, data models) as well as community's operational objectives. Next, execution and maintenance of information infrastructure will become easier.

Incoherent practices of procurement chain

Unifying information systems and information transferring is being complicated when procuring from both domestic and foreign countries. Ideal of one unified management of operations is being broken when it is noticed that there are both small, domestic machine-shops and big foreign giants of industry among the suppliers. Unifying the practices won't succeed, because all players of industry have their own rules.

Marketplaces of electronic procurement have partly tried to unify the situation, but change is happening slowly. For example, the Covisint marketplace of car industry and Trading Place marketplace (General Electric) of electromechanical industry have grown slower than what expected. In many industries the common rules of the game are not yet agreed or they are being questioned with equally powerful players. In either case, demand of transparency requires unifying both management of operations and e-Business.

Product data management penetrating organizational borders is missing

Management of product data varies in different industries. In electronics industry product data is based on means of electronic document management. In more traditional machine-shop industry situation can vary wildly. Managers interviewed commented out both technical and operational coherency of product design has a lot to improve.

Technically coherent product data would require common perception of each product's characteristics and storing of these characteristics. This includes for example product families, modularity and versioning.

Unifying means extending quality thinking to design work, for example starting from requirements of manufacturing. Some of the companies had a part or entire Product Data Management (PDM) system in place. In some of the companies it was only just started to implement or it was under the implementation process. Problem was highlighted in companies where product versioning has been done for customers and the life cycle of these products can be as long as decades.

If a company wants to assure after-sale services, it have to take care of accurate storing and open access of product data not only in own organization, but also in partner organizations. Lately this phenomenon is being called Collaborative Product Commerce (CPC), which emphasizes mutual access of product data in partner network.

Management and organization of e-Business is unclear

Management and organizing of e-Business activities varied a lot in the interviewed companies. For example the positions of the interviewed persons, who were responsible for management of e-Business, varied from quality manager to chief executive officer.

In some of the companies e-Business was organized to its own independent development unit, which developed solutions in organizational level. We also found that responsibility of e-Business had fallen to those active, usually sales and marketing persons, who were interested in e-business. In some of the companies a Vice President –level of manager was appointed to be responsible for development of e-Business. Traditionally e-Business can also be

Information Management function's responsibility. In SMEs it was generally responsibility of chief executive officers or owner-managers.

As a conclusion, this implies that companies haven't tried much anchor the e-Business to business strategy or information resources strategy. In many cases e-Business had grown its significance as a phenomenon in companies. In SMEs e-Business is being managed either by service providers or group of people who have familiarized themselves to e-Business practices.

Systematic management of e-Business requires strategic level decision and addressed resources for example implementation and administration of projects.

Potential to utilize e-Business solutions

e-Business is more than order routine

On the basis of interviews it can be stated e-Business is more than just a receiving a order via network. However, that is not necessarily being seen clearly in the companies.

As stated earlier, e-Business is strained with limited understanding of concept, "our machine wont be bought from the net" –attitude. It is harmful to slate thought of electronic channels and services by this argument. When considered more precisely, companies had e-Business operations in many levels.

In many companies e-Business offers a way to maintain competitiveness because either expense or competition reasons. Many industries have taken e-Business opportunities specifically to be the complementary, not substitute, service channel. Instead, transformation of large processes or entire organizations wasn't discovered anywhere but in visions.

Network business can be said to become business as usual. Therefore, the small *e*-letter isn't a magic letter, but neither a forgotten letter. It can be said that it is only moving back to business as a one way to develop organization to be more competitive, productive and profitable.

FOUR EVOLUTIONARY PHASES OF E-BUSINESS

The "Four evolutionary phases of e-business" is suggested as one of the key results of this study. This phase model seems to describe the actions made for developing e-business in metal and electronics companies. Four qualitatively different phase of development was discovered among the Finnish metal and electronics companies. These four phases seems to be also the order of development. Phases are:

- ERP-phase, e.g. putting the foundation on enterprise information systems in order,
- SCM-phase, e.g. boosting the information systems of supply chain management,
- CRM-phase, e.g. deepening and improving customer relations and knowledge,
- KM-phase, e.g. taking advantage of business intelligence systems handling either customer, supplier or business relationship based knowledge in knowledge networks.

ERP-phase

The enterprises in ERP-phase are putting the foundation on enterprise information systems in order. Roughly 20% of the companies were still in that phase.

The challenges of this phase are attached on the interface of the ERP-system - will it allow the networking partners to connect their systems to other partners' ERP. That problem may exist also inside the single company. During the study we discovered a company which some years ago has started to re-engineer 18 different ERP-systems located in different sites.

Most of the current ERP-systems are large, expensive entities with quite a closed interface, so integrating different ERP-systems is very difficult.

SCM-phase

The enterprises in SCM-phase are developing the information systems of supply chain management. Most of the companies, approximately half of them were focusing in improving the fluency of supply chain.

There is the trend towards supply chain communities. This means integration of supply chains across organizational/industrial borders. It is not just managing only transactions, but moving towards joint and shared management of supply chain processes, like planning or execution/control of processes.

The issues of quality questions, efficiency and customer responsiveness, localization or the needs for tailoring (mass customization) becomes important in this phase.

There are many barriers to SCM-development, like the lack of knowledge when viewing the chain from end to end (no transparency), inconsistency or out-of-date knowledge, lack of process integration or old-fashioned SCM-structures.

CRM-phase

The enterprises in CRM phase are deepening and improving their customer relations and customer knowledge. Approximately 20% of the enterprises were already concentrating to collect and exploit of customer knowledge.

In our view CRM-phase is a preceding phase when moving to KM-phase. Managing customer relationships is important, because profitable business is moving to maintenance, repair and total service concepts. Enterprises must know the needs of their customers and also manage the business skills of the customer. It was not unusual among the most developed enterprises that they also served as business consultants for their customers.

Long-term relationships mean managing the entire customer life cycle and databases including the history information. It also means consistent and updated customer knowledge through service processes.

The multi-channel services create a challenge. There is a need of integration of multi-channel service and customer knowledge. The customer may use many parallel channels like

telephone, internet, extranet, e-mail or office visit, and the enterprise must in every case have an ability to offer equal service to customers. That is not yet very common situation in enterprises.

KM-phase

Taking advantage of business intelligence systems handling either customer, supplier or business relationship based knowledge in knowledge networks.

Only few companies were very advanced in their e-Business initiatives. They focused to deepen their relationships with superior management of supplier, customer, and business partner based knowledge.

There were some steps in the road from CRM-focused systems to the systems taking advantage of knowledge management -focused systems (applied from Cross & Smith 1995).

1. Awareness, with "classic" home pages, having huge challenges for large number of pages in Internet. The customer has no experience on enterprise.
2. Recognition, when the customer has noticed the enterprise or its products. The customer may experience samples and having his/her first experiences. This is the step getting new customers.
3. Relationship, when there is constant commerce between the parties. That requires continuous relationship update and management.
4. Community, when there exists active collaboration. Customer trusts on the enterprise and there may also be kind of "reliance".
5. Advocate, when there is true, deep partnership. Customer acts in the community as a spokesman for the enterprise. That kind of relationship is typically possible just after several years of collaboration.

The "living" relationship between the enterprise and the customer expects knowledge about the needs and the business of the customer.

There are certain processes, in which the knowledge aspect is possible to attach, for example:

- ❑ Cross-sales and up-sales (using customer knowledge for increased sales, managing lifecycles, having call & contact centers),
- ❑ Direct marketing and fulfillment (managing customer responses, qualifying leads, informing fulfillment process),
- ❑ Customer service, support and invoicing (service request & account management, customer surveys, service agreements, electronic invoices),
- ❑ Loyalty and retention programs (customer profiles, behavior knowledge), and
- ❑ Field sales and service (unique service concerning customer proposals and promises, configuration and localization).

Naturally there is a great deal of challenges. Those ones identified in this study were the challenge to integrate customer and product knowledge (for example merging together CRM and PDM dressed with web services), maintaining customer support history and following-up of repair/maintenance activities in all different channels, managing the whole service cycle,

the challenge of inter-organizational CRM, for example CRM knowledge delivery for partners and collaborative commerce and the challenge of technology integration.

SUMMARY

Roughly 20% of the companies were still building their foundation of Enterprise Information Systems. Most of the companies, approximately half of them were focusing in improving the fluency of supply chain. Approximately 20% were already concentrating to collect and exploit of customer knowledge. Only few companies were very advanced in their e-Business initiatives. They focused to deepen their relationships with superior management of supplier, customer, and business partner based knowledge.

This research outlines some development paths of e-Business in metal and electronics industries in the near future. It can be used as a guideline how to start the development of e-business blueprint or in positioning company's e-business state or in benchmarking where the company is going compared to other companies. This research outlines that companies must continuously learn from their business partners, suppliers, and customers and deepen the cooperation with them to retain the competitiveness in the future.

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