

# APPLICABILITY OF WEB-BASED INFORMATION SYSTEMS FOR SMALL KNOWLEDGE-ORIENTED SERVICE COMPANIES

## *Case Study from Finland*

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**Abstract:** The aim of this study was to explore the applicability of web-based information systems to the business processes of small knowledge-oriented service companies from Finland. The study explains the current status of web applications in the corporate sector researched, and discusses the future possibilities for applying web-based information systems, taking into consideration the special features of the sector. The applications have mainly been focused on contacts with authorities, paying invoices, marketing on public web sites and extranet services for customers. In two of the cases, web systems were used rather extensively in service processes. These two cases were far ahead of the others in applying web-based systems. However, also they applied web-based solutions mainly in the company's internal processes. In the studied companies, the application of web systems should in the future focus more on knowledge management support than on the automation of individual transactions. In many of the studied cases, the automation of transactions is not even sensible due to their small number. The application of web technologies to knowledge-oriented work based on creativity and innovation seems, however, to be challenging since the related processes normally produce unique solutions tailored to customers' needs, which cannot easily be replicated and thus automated. Therefore, the automation of the entire creative process is impossible, but web technologies may produce added value to individual stages of the creative process, such as collecting and distributing data.

## 1 INTRODUCTION

The service sector has been growing furiously over the past decade, and services (e.g. consultancy and research) have become a fundamental means of competitive advantage and profit for firms. Services are characteristically intangible, non-storable and customer-specific, and the service process overlaps with production and consumption. Some service companies provide only services, with no tangible products attached. Information and knowledge plays a particularly prominent role in the delivery, coordination and quality assurance of services. Services are dependent on the people in the service process, but also include technology-based systems, which require both management and integration. The service process can be partly automated, but human

interaction is also needed (Brännback&Carsrud, 2002). There is room for improvement in the service sector since very few service organisations manage their processes effectively (Perkins-Munn&Chen, 2004).

Although the service sector has been growing, there has been little research about service processes in the service sector supply chains compared to the manufacturing sector. However, best practices of processes from the manufacturing sector cannot be directly utilised in the service business (Ellram et al., 2004). More specifically, there is a gap in the research of application of ICT (Information and Communication Technology) in small knowledge-oriented service companies.

## 2 METHODS

The aim of this study was to explore the applicability of web-based information systems to the business processes of small knowledge-oriented expert companies from Finland. The study explains the current status of web applications in the cases researched, and discusses the future possibilities for applying web-based information systems, taking into consideration the special features of the sector.

Data for the research was collected from 20 small or micro-sized Finnish companies. On the Finnish scale, micro-sized enterprises have 1-9 employees and small-sized enterprises under 50 employees (Yrittäjät website, 2003). The data was mainly gathered from projects carried out by the studied cases, where the researcher was involved as a project manager, steering group member or expert. Moreover, data was collected through semi-structured interviews. Two cases were examined in more detail because the companies in question clearly applied web-based systems more comprehensively. The number of cases (20) allows the generalisation of the results to a certain extent.

Based on the studied cases, this study answers questions introduced in the following:

- In which core processes of the service business did the studied cases apply the web solutions?
- What added value did the studied cases achieve from the web solutions?
- At which stage were the studied cases in internal (ERP) and external (e-business) system integration?

Three theoretical frameworks were utilised to help answer the questions above. These frameworks were core processes of the service business, value drivers in e-business and the ERP-/e-business matrix. They are introduced in subsections 2.1, 2.2 and 2.3.

Furthermore, this study answers the questions:

- What kind of web solution was the most progressive among the studied cases?
- Why did some cases utilise web technologies considerably more comprehensively than others?

In this study, the “service” concept means business services that companies provide for their customers. These services can include for example consultancy and research services. The “knowledge-oriented” concept means that in the service production process, the intangible human resources are more important than tangible resources. Web-based applications refer to solutions built on web and data transmission technologies (e.g. TCP/IP protocol, HTML, Flash, web server). In addition, the

applications can be used on a web browser if the information is meant for human access. On the other hand, if the data is transmitted from one system to another, it is done through the Internet. In this context, it must be considered the fact that web technologies can be applied both to the company’s internal ERP (Enterprise Resource Planning) system and to the e-business system for external communication. ERP thus integrates internal processes, functions and systems, where the users of the system are company personnel. On the other hand, e-business integrates processes, functions and systems between companies. The use of e-mail is not considered as application of a web-based system in this study.

### 2.1 Core Processes in Service Business

Ellram et al. (2004) divides the core processes in the service business into capacity, demand, relationship, service delivery, cash flow and information flow management. The explanations of these core processes are introduced in Table 1.

### 2.2 Added Value from Web Solutions

Applying web-based systems in business can lead to added value in the form of increased purchasing power, improved process efficiency, shorter turnaround times, innovations, improved market efficiency, an expanded market, enhanced customer responsiveness, more efficient usability of capacity and resources, disintermediation of non-value-added processes (Means&Schneider, 2000), more efficient delivery and more holistic service for customers (Nickles et al., 1998).

According to March (1991), actions in organisations can be categorised as either exploitation or exploration. In exploitation, the goal is to improve operational efficiencies by streamlining the processes. In exploration, the goal is to learn about the environment and discover novel ways of creating value or solving problems by innovating. Suppliers must understand market trends and customer preferences and use that knowledge in various ways in exploration. Thus exploitation is about process management, while exploration is about knowledge management. According to Subramani (2004), competitive performance is a combination of operational and strategic benefits. However, knowledge specificity is more potent than business process specificity as a basis for deriving strategic advantage.

Application of e-business can be divided into transaction and collaboration tools (Turban et al., 2002). Transaction tools focus mainly on making the

Table 1: The explanations of core processes in service business (Ellram et al., 2004; Turban et al., 2002).

<b>Capacity management.</b> Capacity allows a supply chain to increase its level of production to respond to customer demand. Capacity management is important in the service sector because services usually cannot be inventoried. Capacity information can include data about the availability of staff, skills and equipment needed in the service work.
<b>Demand management.</b> The starting point of demand management is to recognise factors that influence customer demand. After that, different methods (e.g. campaigns) can be utilised to manage demand. Demand planning is a sub-process of demand management. Demand can be planned for example by forecasting.
<b>Relationship management.</b> This can be divided into customer (CRM) and supplier relationship management (SRM). CRM is about a good understanding of customer needs and how to meet those needs. For example, marketing, sales and after-sales are sub-processes of CRM. SRM is about aligning the processes of the company and its suppliers to improve the performance of the supply chain through e.g. common strategies and business plans. Operations analysis is also a sub-process of CRM and SRM and it includes e.g. the analysis of different performance indicators.
<b>Service delivery management.</b> In service level agreements, a buyer clarifies the specifications and expectations for the service provider. Sub-processes of service delivery management include e.g. order management, scheduling and allocating of work, execution of work, reporting of working time, steering of work (e.g. working instructions), dispatch management (e.g. notice status of work and alert exceptions), and collecting feedback about the service work.
<b>Cash flow management</b> is the management of revenues and expenses. Cash flow management also includes for example the determination the invoicing practices (for example utilization of aggregation invoices and terms of payment) and payroll management.
<b>Information flow management</b> is needed in the service business to better manage the core processes.

elements involved in transactions and processes more efficient. Information system integration is an example of this. It transfers transactions between two companies from one system to another without manual work. Transaction tools are best suited for repetitive routine transactions that require a great deal of manual work, such as orders and invoicing. Collaboration tools focus more on knowledge management and improving the performance of entire processes. Collaboration

### 2.3 Phase of Internal and External System Integration

An ERP-/e-business matrix, introduced in Table 2, describes how the company or company network is positioned on an evolution map of internal and external system integration. In the matrix, the internal ERP evolution is located on the vertical axis and the external e-business evolution locates on the horizontal axis (Norris et. al, 2000). The

tools include e.g. project management systems and design and forecasting tools.

Transaction theory has established that operative transaction costs can be reduced by applying ICT, but the theory does not give explicit answers regarding the benefits of ICT in collaborative data exchange. Collaborative ICT solutions may even increase transaction costs, but they nevertheless help deepen the partnership, improve the control of exchanged data and make it unprofitable to change suppliers (Bunduchi, 2005). matrix has been developed for large enterprises which have numerous business units. In this study, the matrix is adapted for small companies so that an “Integrated company network ERP“ concept is used instead of “Integrated enterprise ERP” concept. Explanations of the concepts in the ERP-/e-business matrix are introduced in Table 3.

Table 2: ERP-/e-business matrix (Norris et. al, 2000; adapted).

ERP	e-business				
	No e-business capabilities	Channel enhancement	Value chain integration	Industry transformation	Convergence
Greenfield					
Non-integrated systems					
Limited/single function ERP					
Integrated company ERP					
Integrated company network ERP					

Table 3: Explanation of the ERP-/ebusiness matrix (Norris et al., 2000; adapted).

ERP	Ebusiness
<b>Greenfield.</b> Company has no ERP solutions.	<b>No e-business capabilities.</b> Company has no e-business solutions. For example, companies that utilise only email, are included here.
<b>Non-integrated systems.</b> Company has non-integrated legacy systems and applications.	<b>Channel enhancement.</b> The Internet is a business enabler and the company has some e-business processes with its supply chain partners. However, back end systems run independently.
<b>Limited/single function ERP.</b> Company has one or more ERP modules (e.g. financial and accounting, logistics).	<b>Value chain integration.</b> The company has integrated or/and automated operational processes with its supply chain partners. Some processes or/and back end systems of partners are integrated with the company's own processes or/and systems.
<b>Integrated company ERP.</b> Company has ERP system that integrates different functions.	<b>Industry transformation.</b> The Internet is a business driver and strategic tool. The value chain includes fully integrated processes and back end systems of supply chain partners.
<b>Integrated company network ERP.</b> Company network has common integrated ERP.	<b>Convergence.</b> Companies from different industries co-operate to provide holistic solutions for customers (e.g. virtual market places of different industries).

### 3 CHARACTERISTICS OF THE CASE COMPANIES STUDIED

Each of the 20 case companies had their own unique characteristics, but the features presented in the following apply to all. The companies employed 3-15 employees and they mainly provided services to corporate or public administration customers operating locally. They provided e.g. educational, ICT, research, communication, advertising and consultancy services. As a result from the services, customers received e.g. marketing material, training packages, e-business solutions and development solutions and plans for business processes. Therefore, the end products were usually intangible and knowledge-based.

The value chain of the examined cases usually consisted of marketing and sales, project management, design, production and post-marketing. The services were mainly carried out through projects, and the end products were usually tailor-made for each customer. In the projects, the design process was largely based on the expertise, creativity and problem-solving skills of the personnel. The success of the design process was very important for the studied cases because mistakes made then were costly to correct later. In addition, errors in design increased the turnaround time of the project. Both the design and the production processes were based mainly on human resources. Thus the most important and utilised resource were the working hours of personnel. The projects were usually completed by teams with representatives from the case company as well as its customer and/or partner. The teams were typically

composed of two to ten people. Within the teams, the most important information was exchanged in face-to-face meetings, whereas less critical communication was carried out from a distance by telephone, e-mail or extranet.

The case companies had relatively little project work (usually several dozen per year), but they were of great value. The projects were normally launched through a sales process, and they often had a fixed project price. However, the number of smaller commissions from contract customers (the post-marketing process) was significantly higher. The commissions were related e.g. to subsequent updates of end products of projects, such as updates of the contents of company brochures. The commissions were normally invoiced based on an hourly fee.

Very few supplies needed to be purchased in the examined cases since hardly any material was required and the services were often provided by the case company personnel.

## 4 FINDINGS

### 4.1 Added Value from Web Solutions and Web-Based Processes

In the studied corporate field, the web was mainly utilised to support business activities, but the web-based applications did not, as a rule, bring significant added value to them. The researched cases usually obtained the greatest added value from contacts and tender requests from potential customers attracted through public web sites. According to the interviews, the cases had acquired

contacts through their web sites that they would not have got through traditional marketing channels. Thus public web sites can be considered to have expanded the market to some extent. Slight added value was obtained also from more efficient delivery, when material was distributed to customers digitally through an extranet. Therefore, web-based systems were typically applied in customer relationship and service delivery management processes to some extent.

In the top two cases that applied web technologies the most extensively, considerable added value was achieved because of the web. Both cases applied the web to their business in a very similar way. The added value was mainly generated not only from a growing market and efficient delivery, but also from improved process efficiency, shorter delivery cycles for processes and improved customer responsiveness. The processes, in which these two cases applied web-based systems, are introduced in the following.

CRM. This was the umbrella process throughout the entire life cycle of the customer relationship. Other main processes were situated under this one. For instance, CRM drew benefit from deepened customer relationships due to better information exchange and from improved customer responsiveness due to collected data on customer needs. Also real-time data on customer- and project-specific performance (e.g. profitability) could be conveyed to management and employees.

Demand management. E.g. sales were controlled with the offer and order database from the system.

The offer database was the most important forecasting tool for the cases.

Service delivery management. Lower transaction costs due to automated and integrated processes and more efficient data retrieval. Also delivery cycles were reduced due to the transparency of data. Moreover, the quality of information products created in the service process improved when the quality of the data improved.

Cash flow management. Cash flow was better managed with the help of reports from the system.

Payment of salaries and invoicing became more efficient because of automated invoicing and payroll calculation. For example, in project invoicing the invoices were prepared automatically in the offer stage from product modules with a fixed price selected from the system. Also external accountants received data on payrolls and reimbursement of expenses directly from the system.

#### 4.2 Phase of Internal and External System Integration

In Table 4, the studied cases are placed in the ERP/e-business matrix according to the degree of internal and external integration. The figures in the cells depict the number of cases in the integration stage in question.

The "non-integrated systems & channel enhancement" stage included the smallest cases with less than five employees. They usually had public web sites presenting the company and its services, i.e. supporting marketing and sales. In addition, the cases used extranet services provided by a third party to pay invoices and contact authorities.

The "limited/single function ERP & channel enhancement" stage includes cases with public web sites as well as internal web-based applications, such as document management, customer and product registers. Their public-access web sites were usually more extensive in terms of content and services than in the previous group. Some of the cases in this group provided their customers with project data through an extranet, e.g. memos and schedules. However, there was no interaction in these extranets. They merely focused on distributing information.

The "integrated company ERP & value chain integration" and the "integrated company network ERP & value chain integration" stages both included one case. The principal difference between them was that the other case was a corporate group where all of the companies used the same application. Both cases had web-based ERP with integrated internal processes. Furthermore, the ERP included project-

Table 4: Phase of internal and external integration among the studied cases.

ERP	e-business				
	No e-business capabilities	Channel enhancement	Value chain integration	Industry transformation	Convergence
Greenfield					
Non-integrated systems		5			
Limited/single function ERP		13			
Integrated company ERP			1		
Integrated company network ERP			1		

specific limited views for the main customers. Here it must be taken into consideration the fact that the systems of the main customers were not integrated with the ERP, but the clients accessed the information through the extranet.

With the exception of four companies, all of the researched cases used content management systems that allowed to update the contents and organisation of their public-access web site without programming skills. This system was in all cases purchased as an ASP (Application Service Provider) service from a third party, i.e. the cases themselves did not have ownership of the system, but only paid rent for it.

In conclusion, the overall use of information systems in the companies was minor. In enterprise resource planning, mainly office applications were used. To invoicing and accounts payable and receivable, financial management software was normally applied. The office and financial management applications were not web-based as a rule, but were operated on fixed work stations. The Internet was used above all to exchange e-mails with customers and suppliers.

#### 4.3 Description of the Most Progressive Web Solution found Among the Researched Cases

Figure 1 presents the systems architecture of the most progressive web-based solution found among the researched cases, and the main and sub-processes to which web-based systems are applied. Two studied cases have very similar systems architecture. Most of the processes of both cases were built on one web-based ERP system. In addition, the cases applied e.g. a web-based query programme and content management system. The user groups with the rights to read and/or write information are displayed on the right side of the figure. The groups are divided into public web site, intranet and extranet users. The arrows point in the direction of the information flows. The work stations and networks used are shown next to the arrows.

In these two cases, basically the entire value chain from marketing to post-marketing was integrated at the level of operative transactions so that the information was entered into the system only once and could then be used in every process due to continuous work flow. There was a link in the ERP system to the query programme and the web site management system. The query tool was used in surveying project and customer needs as well as personnel and customer satisfaction.

The most important difference in how the cases applied the systems was that the group of companies applied the system to handle working hours and

invoicing for e.g. customer projects for the group as a whole and for each company separately.

Both cases owned the ERP system they used, and it was operated on its own web server. However, the query programme and the content management programme were rented from a third party as an ASP service, and it was accessed through the ASP service provider's server.

Efficient queries with a number of search preferences which could be combined freely were an integral part of all the systems.

## 5 CONCLUSIONS

In summary, it can be said that web-based solutions are currently very seldom applied in the activity of the studied cases. The web-based applications were typically used in one part of the customer relationship management process – acquiring new customers. Thus added value was obtained by expanding the market through contacts from potential customers attracted by public-access web sites. Moreover, web-based applications were used in the service delivery management process to deliver information to customers digitally through an extranet, which brought added value by making the delivery more efficient.

In many of the studied cases, the automation of transactions (e.g. orders and invoices) was not sensible due to their small number. On the other hand, there were considerable discrepancies in the number of transactions between the studied cases. Especially advertising agencies received many smaller commissions from their customers. Managing them efficiently would bring savings.

The most progressive web application cases showed that the web can be applied to business in very many ways. In these cases, web-based systems were used quite comprehensively in customer relationship, demand, service delivery and cash flow management processes. However, even in these cases web technologies were mainly used in internal process management. Yet there is potential for more extensive external integration towards customers and suppliers. Furthermore, the application of web-based systems is focused more on improving the efficiency of operative processes than on producing added value e.g. in the form of new business activities.

Why, then, did two cases apply web technologies more than the rest? The most important reason was their culture of continuous development, which aimed at maintaining and strengthening the company's leading position on the market. The case

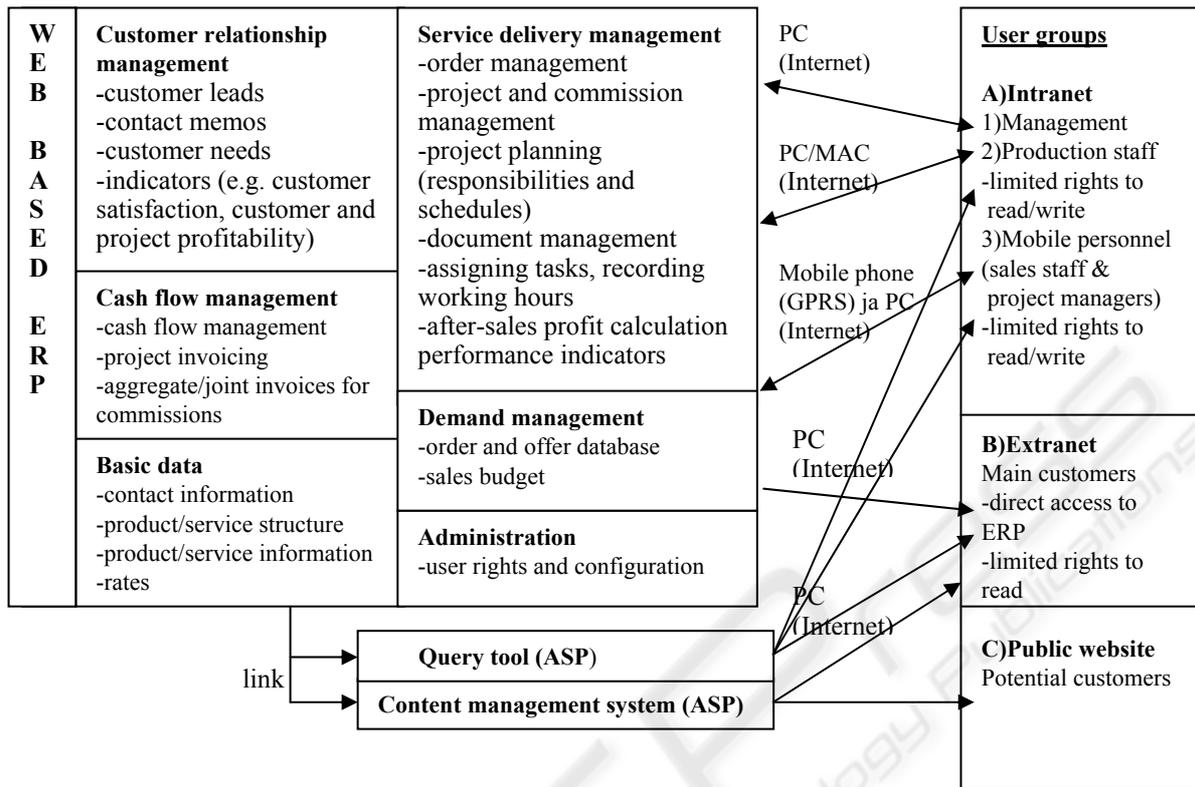


Figure 1: Progressive web-based solution architecture.

organisations had an open attitude towards innovative business models and technologies, and they continuously scanned the web technology markets to find applications to improve their business and bring added value to customers. Another important factor was the size of the case company. Both enterprises (one of which was a group of companies) employed over 10 people and could thus no longer be effectively managed with manual processes. An essential factor was also the geographical distribution of the organisations (offices in different locations and the mobility of sales personnel and project managers), which required the distributed application of a centralised information system. In addition, the number of transactions was clearly above the average number of the other cases. The two cases had also made a strategic decision early on to concentrate their applications on web-based technologies due to their flexibility, cost effectiveness, scalability and integrability.

The web-based solutions of all the cases were quite new, which means that the application of web-based solutions in the studied sector is still in its early stages. quite new, which means that the application of web-based solutions in the studied sector is still in its early stages. All of the cases

researched showed an interest in applying the systems more diversely in the future. Because of higher transaction volume, small-sized companies seem to have considerably more potential to gain operational benefits from web applications compared to micro-sized companies. In the future, however, the greatest potential for both small- and micro-sized companies come from web applications that focus more on knowledge management support than on the automation of individual operative transactions. The application of fully automated web solutions to expert work based on creativity and innovation seems, however, to be practically impossible since the related processes normally produce unique solutions tailored to customers' needs, which cannot easily be replicated and thus automated. However, examples were found on the standardisation and automation of parts of the creative process with the help of web-based systems. One example was the use of a query tool in surveying customer needs as well as personnel and customer satisfaction. The different surveys had something in common: the data collection and saving processes were standardised, but the data was always survey-specific. In addition, the data could be effectively printed as reports with flexible search preferences.

## 6 PROPOSED MANAGERIAL ACTIVITIES AND FUTURE RESEARCH

In this section, areas for future application of new web-based solutions are proposed. Development possibilities can be divided into four main categories: (a) improved efficiency; (b) improved service delivery performance; (c) improved innovativeness; and (d) analysis of performance.

(a) Efficiency can be improved most by developing content management. Efficient content management is essential for an expert organisation because it needs to collect, store, retrieve and distribute large masses of information. Streamlining and automating these content management processes frees time for creative work and shortens turnaround times.

(b) The service delivery performance of the cases researched was usually not very good. There were two main reasons for this: (1) the sales organisation did not know the available capacity and promised overly optimistic delivery times; and (2) an unmanageable project and contents extended turnaround times. In addition, due to unmanageable projects, the amount of work-in-progress was not known very specifically, and consequently, neither was the available capacity. Especially in organisations of roughly ten employees, there could be so many on-going projects and commissions that new information technology tools for capacity, project and content management would be useful. A human being cannot manage these information flows without such programmes or with mere basic office applications. The tools should also be flexible enough to deal with change (e.g. adapt project schedules) because there are often deviations in the activity of the case companies, such as rush orders.

(c) In addition to project efficiency, the companies should concentrate on enhancing the innovativeness of project results. This means innovative customer solutions, service concepts and operational models. A centralised web-based idea database could be used as an aid in innovation. Users could enter ideas and customer needs data through a web browser in a distributed way. The ideas and customer needs could subsequently be developed in a face-to-face creative process. Ideas could also be developed to a certain point in a web-based discussion forum.

(d) Performance is rarely analysed in the studied case companies. The calculation methods for the performance indicator values should be included in the system, which would allow reports to be compiled automatically from the initial data entered into the system.

Further studies could focus more on how web technologies are applied in practice in the core processes of small and micro-sized knowledge-oriented service businesses and how they could be applied in the future. Further research would then present different operational models that are or could be built on web technologies.

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