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An investigation into the use of ERP systems in the service sector

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Abstract

Recently, service organizations have invested considerable resources in the implementation of Enterprise Resource Planning (ERP) systems, even using solutions initially targeted for manufacturing companies. The aim of this paper is to get an insight into how services approach ERP implementation. A review of ERP projects, especially in services, completed by six case studies has been undertaken. We identify and discuss some characteristics of services, which are discriminatory regarding manufacturing. Main characteristics identified deal with complete or partial integration, product or customer orientation, importance of labour, human factor. In conclusion, trends to standardization and integration seen in the industrial sector are also growing in services, but in different ways.

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Keywords: ERP implementation; System integration; Services; Manufacturing; Healthcare

1. Introduction

During recent years, organizations have invested considerable resources in the implementation of Enterprise Resource Planning (ERP) systems. ERP is a software package that attempts to integrate all departments and functions of a company onto a single computer system that can serve all different departments' needs. Klaus et al.

(2000) have performed an historical analysis and a state-of-the-art report on ERP phenomenon. As far as we know, service organizations were not in the initial target zone of many ERP vendors, which instead developed products for manufacturing companies. However, ERP systems are increasingly being implemented in the service sector. By all accounts, services dominate most developed economies given that significantly more than half of these countries' gross domestic product is in the service sector, and projected economic and job growth through the 21st century is expected to be dominated by services. Concurrent to this growth, the globalization of services and rapid

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technological progress, afforded by information and communication technology, are increasing the pressures for service firms to compete on new offerings (Menor et al., 2002). Since the study of ERP in the service sector is a new area, there is little theoretical research on the topic. Now, the need for such studies has become apparent.

In order to identify and discuss differences between service and manufacturing companies in the context of ERP implementation, one can firstly investigate in ERP return on experiments from services companies. A study with cases in insurance, healthcare, software and telecom services companies has been undertaken, and specificities of ERP projects in services activities have been identified.

Section 2 introduces ERP definition and market, presents motivations for implementation and states problems, benefits and success factors encountered in such projects. Section 3 introduces the main characteristics of services in relation to the industrial sector, like customer contact, product definition, characteristics of inputs and outputs. Section 4 investigates the ERP implementation process in service organizations and more particularly in hospital environments. Section 5 presents six French case studies to complete the analysis of previous research works. In Section 6, we attempt to explain the differences between service and manufacturing firms regarding ERP implementation. Finally, we conclude this investi-

gation work into the use of ERP systems in the service sector in Section 7.

2. Characteristics of ERP implementation

2.1. ERP definition

As illustrated in Fig. 1, an ERP system is an integrated software package composed by a set of standard functional modules (Production, Sales, Human Resources, Finance, etc.), developed or integrated by the vendor, which can be adapted to the specific needs of each customer. It attempts to integrate all departments and functions across a company onto a single computer system that can serve all those different departments' particular needs. Klaus et al. (2000) have performed an historical analysis and a state-of-the-art report on ERP phenomenon.

ERP systems do encompass the “enterprise” and focus on “resources”. However, they also facilitate tasks beyond “planning”. These include financial control, operational management, analysis and reporting, and routine decision support. Furthermore, although the term “financial” is nowhere represented in ERP, the general ledger module remains the foundation for most systems. ERP systems also empower the top, middle, and bottom of the organization hierarchy (Miranda, 1999). ERP implementation requires a “process”

ERP: integration +
standardization

- Data (unique database model)
- Flows (financial, physical, informational)
- Organization (entities, business units, market segments, roles...)
- Process (local/global, performance measurement)
- Software (interoperability)

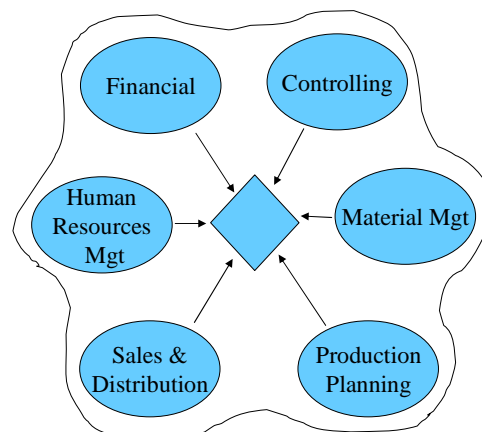


Fig. 1. ERP definition.

view of the enterprise. The current generation of ERP systems provides reference models or process templates that claim to embody the current best business practices by supporting organizational business processes.

2.2. ERP market

Over the past 15 years, businesses have changed enormously with increasing client pressure for faster service, wider choices, and even lower prices. The globalization of the economy has accelerated and, as a result, many organizations have been redrawn. A number of Information Systems have been developed in order to reply to the challenges of the modern economy. When ERP systems first emerged in the early 1990s, manufacturers in a wide variety of industries enthusiastically adopted them. Many of these companies were struggling with issues like globalization, acquisition consolidation, process standardization, and changes in customer expectations. The ERP implementations were often viewed as a component of a much larger business process reengineering and organizational transformation project. Indeed, the very strong growth of this market from 1995 led to a rate of ERP facilities often estimated at more than 50% today.

According to AMR Research (Scott and Shepherd, 2002), the ERP market is the largest segment of the applications budget (34%) and will remain so through 2004. The 15% of companies that do not have ERP today plan to implement it in the next 12 months, as long as the economy allows the investment. The 74% of manufacturers and 59% of services companies are either using or imple-

menting ERP. There is still room for growth in the ERP market in Aerospace and Defence, Automotive, and Healthcare for new implementations and across-the-board opportunities for upgrades and additional “users”. Today, five ERP vendors share 60% of the ERP market: SAP, Oracle, JD Edwards, People Soft, and BAAN.

2.3. Strategic reasons for implementation

According to Davenport (1998), there are many reasons why a company would implement enterprise solutions: the provision of a single source of data, the potential cost reduction (maintaining old computer systems can lead to enormous costs), and the potential gain in business integration when reducing indirect costs, or more precisely, the effect on customer responsiveness and manufacturing productivity if the sales/ordering systems are not linked to the production scheduling systems. Indeed, if the sales and marketing systems have no connection with the financial reporting systems, management can only make decisions by instinct or based on old information rather than according to a detailed understanding of up-to-date product and customer profitability. According to recent surveys in the United States (Mabert et al., 2000) and Europe (Labruyere et al., 2002), the motivations for the adoption of an ERP system can be summarized in Table 1. Overall, improving productivity, competitive advantage, and customer demands are the top three business drivers for companies with ERP (Scott and Shepherd, 2002).

Table 1
Motivations for ERP program

Technology motivations	Operational motivations
System not Y2K compliant	Poor or uncompetitive business performance
Disparate systems	Cost structure too high
Poor quality/visibility of information	Not responsive enough to customers or suppliers
Business process or systems not integrated	Complex, ineffective business process
Difficult to integrate acquisitions	Inability to support new business strategies
Obsolete systems	Business becoming global
Inability to support growth	Inconsistent business processes

2.4. Problems with ERP implementations

After a few years of high expectations due to market expansion, some ERP projects prove difficult and even fail. The expected results seem rarely reached and budgets and planning rarely respected. Furthermore, the needs of companies continue to evolve and lead to new demands, especially concerning the management of the global logistic chain. In spite of the functional wealth of ERP systems, the standardization is often difficult. Some ERP projects lead to almost particular and specific programming blocking any evolution of ERP version. Other ERP projects are the cause of conflict and friction within the organization because of the oppositions among actors concerning the necessary organization changes and budgets of additional development.

A study of the Standish Group (Buckhout et al., 1999) estimates at 31% the rate of non-succeeding projects; this alarming figure confirms the anxiety underlined by numerous headlines in the computer press. Donovan (2000) and Mabert et al. (2001) have undertaken studies that warn against the risks encountered; they often notice the weakness, even the absence of returns on investment. Davenport (1998) explained the failure occurrence by two reasons: the technical complexity of the solutions that requires a great deal of expertise, and the mismatch between technical specifications of the system and the business requirements of the company. Buckhout et al. (1999) suggest that ERP difficulties stem from two issues: the company has not made the strategic choices needed to configure the systems and processes, and the implementation process is spinning out of control.

Some of the problems encountered with ERP implementations are related to motivation for their adoption: legacy systems (poor data quality, interfacing), understanding business processes, infrastructure requirements, customization of new system. However, the main problems are related to people: changing work practices, change management, internal staff adequacy, training, top management support, consultants. The misconception is that ERP is a computer subject, when in reality it is very much a people-related, business subject. The consequence of this misconception is

that many firms have failed to implement and use ERP because of management presumptions that it is just the current software and that it should be implemented just as other information systems have been implemented.

2.5. Benefits and success factors of ERP implementations

Lozinsky (1998) suggests that the rewards of a successful implementation are immense. He states that operating costs will be reduced (leading to an improved return on investment), improved access to information will make possible more agile decision making for better negotiating with customers and suppliers; with no need for re-writing reports, reliable figures will be available to analyze business performance. ERP systems are expected to reduce costs by improving efficiencies through computerization, and enhance decision-making by providing accurate and timely enterprise-wide information.

Subsequently, many surveys (Boston Consulting Group, 2000; Labruyere et al., 2002; Holland and Light, 1999; Mabert et al., 2000) have been performed to identify the actual benefits of an ERP system. In synthesis, we can mention the following tangible or intangible benefits: Information quality, single system/integration, real-time accessibility, inventory reduction, productivity improvement, logistics/order management improvement, cash flow and forecasts improvement. It has to be noticed that not all those benefits are attributed only to the new system (but in conjunction with the changed business processes). Nevertheless, all the goals are not achieved: few companies reported that their initiatives had achieved significant value; many companies claimed success, but few met their objectives or realized significant financial impact; some companies could have achieved similar value for less money; good project execution did not guarantee improved business value. When analyzing the financial impacts of ERP implementations, Poston and Grabski (2001) conclude from their investigation: “A significant improvement in firm performance resulting from a decrease in the ratio of cost of goods sold to revenues was found 3 years after

the ERP system implementation; further, there was a significant reduction in the ratio of employees to revenues for each of the 3 years examined following the ERP implementation”.

Despite the benefits that can be achieved from a successful ERP implementation, project managers focus on the technical and financial aspects of a project and neglect to take into account the non-technical issues. To solve this problem, some researchers (Esteves-Souza and Pastor-Collado, 2000; Markus and Tannis, 2000) are using the critical success factors approach to the study of ERP implementations. Saint Leger et al. (2002) propose to consider also the influence of characteristics of companies since the preliminary phase of an ERP project.

3. Characteristics of services in relation to manufacturing

In theory, the classification of the economy has the three following conventional subdivisions: The primary sector covers extraction of primary resources and agricultural activities. The secondary sector involves the transformation of primary resources into manufactured products. The tertiary sector covers services and administration activities found in government, schools, hospitals etc.

Verma and Young (2000) provide a review of various service typologies and taxonomies. The classification approaches studied are based on unique attributes of services such as customer contact, customization, labour intensity, people versus equipment issues, etc. They provide a theoretical basis for analyzing different types of services: “For example, according to Schmenner (1986), all airlines, trucking, and hotels are service factories; all hospitals and repair services are service shops; all retail businesses are mass service; whereas all doctors, lawyers, accountants and architects are professional service providers. Similarly, according to Kellogg and Nie (1995), all fast-food restaurants are classified as service factory, all health care clinics as service shop, and all consulting as expert service.”

The principal role of manufacturing is to turn physical raw materials into *tangible* products. A *tangible* product is one that can be physically touched, visualized and valued in monetary terms. Service, on the other hand, generally implies an *act*. A service industry also provides a “product” but one that is often *intangible* and cannot be described in the same dimensional terms as manufactured goods.

Several differences between services and manufacturing industries have been identified in the literature. Service operations involve a lack of inventories, consumer contact, joint production, customer-specific inputs and intangibility in varying degrees (Karmarkar and Pitbladdo, 1995). These authors reviewed the consequences of these characteristics for markets, competition and contracting. Moreover, most service operations are highly labour intensive, and efforts to improve system performance cannot ignore the attitudes and behaviors of workers. Verma and Young (2000) discussed customer contact models. They highlight three characteristics of service delivery systems: labour intensity, customer contact and service customization. Another difference is that manufacturing is goods-orientated and service is act-orientated. Some of these differences are detailed below.

3.1. Customer contact

By nature, service involves a much higher degree of customer contact than manufacturing. In most service operations, the customer is not only present but also directly participates in the service delivery process (Mersha, 1990). The performance of a service often occurs at the point of consumption. On the other hand, manufacturing allows a separation between back and front office operations. In theory, product-orientated operations can build up inventories of finished goods, enabling them to absorb some of the shocks caused by varying demand. Service operations, however, cannot build up inventories of *time* and are much more sensitive to demand variability.

If one considers the differences, it is important to emphasize the degree of customer contact. When there is little or no service contact, service

design can be similar to product design. However, the greater the degree of customer contact (for example, in a hospital environment), the more complex service operations become.

3.2. *Product definition*

In services, although the “product” is intangible, it can be measurable depending on the service industry. In many cases, one can devise measures that accurately reflect the quality of service rendered.

Traditional product definition using bills of materials (BOM) and routings used in manufacturing industries is not convenient in the service sector. To define outputs in service activities, one uses terms like tasks, jobs, deliverables, and knowledge, etc. Roth and Van Dierdonck (1995) tried to build a service-oriented product definition for the hospital sector: They used diagnostic related groups defined in the 1960s as a means of classifying patients who consumed similar resources; it was then possible to extend the BOM concept to bill of resources, which led to considering health care as a “product”. Hospitals are essentially capacity driven and not material driven, according to labour content of jobs.

3.3. *Characteristics of input and output*

Manufacturing operations often have the ability to carefully control the amount of variability of inputs and thus achieve low variability of outputs. For example, manufacturing-based productivity models assume that an altered configuration of input resources in the production process does not lead to quality changes in outputs. However, in a service context, changes in the production resources and production systems do affect the perceived quality of services. Indeed, the productivity of a process is related to the effective transformation of input resources into value for customers. For the needs of manufacturers of physical products, productivity concepts and measurement instruments are widely used. However, in service processes, the underlying assumptions of these concepts and models do not hold.

Given this statement and considering little research have been made on service productivity, Grönroos and Ojasalo (2002) develop a concept suited for service operations, where service productivity depends on:

- how effectively input resources into the service process are transformed to outputs in the form of services,
- how well the quality of the service process and its outcome is perceived,
- and how effectively the capacity of the service process is used.

Using this concept, they propose a tentative solution to define instruments for measurement of service productivity.

Karmarkar and Pitbladdo (1995) suggest that a distinguishing feature of services is the absence of finished inventory, which is a consequence of intangibility: most service outputs are intangible and consequently hard to measure (for example, the delivered “quantity” of business consulting or medical services is rather difficult to measure). This induces a short time lag between production and consumption. Moreover, services often require joint production by the supplier and the customer, which may involve the customer actively in the service production or may only require rather passive participation as an input to the process.

3.4. *Conclusion*

In fact, most real systems combine both manufacturing and service operations: addition of services to products (installation, training, after-sales services, etc.) or packaging of services into products (documentations, e-learning tools, knowledge management issues, etc.). From the product development point of view, Bitran and Pedrosa (1998) state that in a world of increasing competition, manufacturing companies are being required to not only design better products but also design the appropriate supporting services. Although products and services have tangible and intangible elements, most literature deals mainly with tangible characteristics of both.

4. Literature review of ERP in services

Due to the increasing needs for better direction and management of service organizations, operations management researchers and practitioners have started to implement integrated information systems developed in manufacturing sectors. Although one would think that ERP is implemented to improve the management of service delivery, it is often the case that project scope does not encompass the functions related to the service itself (Cigref, 1999). It is then necessary to define what is meant by ERP implementations in the service sector.

The main reasons for ERP implementations in service companies, cited in the literature, are:

- solve the Y2K problems (consequences of new millennium on date format);
- reduce administrative workload;
- replace dispersed legacy systems;
- replace unreliable finance and materials management systems;
- improve visibility across the entire system;
- investment security — an important consideration, in particular, among public sector services limited by financial constraints;
- The Euro migration: Consequence of the currency migration to Euro in European Union. Information system had to manage two currencies with specific legal rules of conversion and rounding;
- real-time data processing.

These reasons agree with those presented in Table 1 identified in other sectors. However, security aspects seem here to be more important and business process approaches are not mentioned.

According to Roth (1999), part of the process cost decrease for large service organizations is due to the initial implementation of ERP systems. A common problem faced by service organizations when adopting the ERP package is the issue of “misfit” that is, the gaps between the functionality offered by the package and that required by the adopting organization. As a result, companies

have to choose between adapting to the new functionality and customizing the package.

Before presenting different return on experiments, the following sections list the main characteristics of ERP solutions for services.

4.1. ERP vendor solutions for the service sector

As far as ERP is concerned, service organizations were not initially targeted by many ERP vendors, which instead developed products for manufacturing companies. However, ERP systems are increasingly being implemented in the service sector. New actors arise proposing dedicated solutions like Professional Services Automation (PSA). All software investment of service companies are not ERP, but 24% of the service industry application budget is allocated to ERP (Scott and Shepherd, 2002). Of course, this is dependant of ERP definition. As explained in Section 2.1, in this article, ERP means “standard and integrated package supporting several tactical or operational functions of enterprise management on a centralized database”. This point of view allowed comparing ERP perimeter and specificities in manufacturing and service companies, as one can compare ERP in discrete and process industries, or in industry and distribution.

By the way, many vendors are building ERP functionality that meets the requirements of the service industry. For example, SAP, PeopleSoft, J.D. Edwards or Oracle provide solutions for financial services (banks, insurance companies), utilities, healthcare, higher education, field or professional services, public sector, wholesale distribution or retail, telecommunications, etc. As indicated by a survey from AMR Research in United States (Scott and Shepherd, 2002), PeopleSoft, who began in services, remains leader in this sector, followed by SAP, and Oracle.

According to Scott and Shepherd (2002), when companies were asked what ERP functions they have operational or are implementing, 91% mentioned finance and revenue management (not surprising, since these are applicable across all industries). One functional area that service organizations use more than their manufacturing counterparts is human resources and workforce

management (73% versus 67%, respectively). Healthcare and transportation led those numbers, with at least 82% either using or implementing the functionality. At present, many ERP vendors are expanding their offers for the financial services market. On the other hand, many banks are hesitant about extending their current ERP systems outside the limited functional areas. *Dysart (2000)*, who states that most banking institutions adopt only few modules, such as general ledger, accounts payable, and human resources, confirms those findings. Furthermore, analysts consider mergers and acquisitions as being the major force driving the adoption of enterprise systems in the banking industry.

4.2. ERP implementation in hospitals

Health care service is a patient-oriented service that requires continuous interaction with customers. It uses facilities and equipment, and consumes a large volume of nursing care. Therefore, it becomes increasingly important to health care executives to understand what kind of facility, equipment, and workforce decisions are critical to achieve the commonly acknowledged goal of providing quality health service at a reasonable cost.

Soh et al. (2000) discussed the implementation of ERP systems in seven public hospitals in Singapore. In the mid-1990s, the companies identified the need to replace their mainframe-based financial, administrative and patient management systems. The main reason was to resolve the Y2K problem. The implementation concerned the financial, materials management and inpatient management systems. However, existing human resources and outpatient management systems have been retained. Misfits arose from public-sector specific or country-specific requirements that did not match the capabilities of the ERP package. Public-sector specific requirements revolved around reporting requirements to regulatory authorities, standard formulas, and government dedicated processes (reimbursement to hospitals for services to patients). On the other hand, there were more problems related to patient care systems, where practices vary from country to

country. In addition, the research found that patient care modules were specialized industry modules and were not well integrated with traditional modules, such as finance and materials management. Despite all the difficulties, the overall ERP experience was considered as a success. Besides being Y2K compliant, the system accelerated the transition to activity-based costing and increased the level of data standardization within the hospitals. Furthermore, management was provided with information on resource usage that previously was not available.

A further research by the Dutch Government (*Bakker and Leguit, 1999*) revealed that an integrated approach to information technology applications in hospitals would bring more benefits than the traditional isolated systems. Therefore, a project was initiated, aiming to gather knowledge and experience with an integrated Hospital Information System (HIS). The funds available for the project were distributed over several hospitals in the Netherlands. The HIS was expected to contribute to better quality of patient care, more efficiency in resource utilization, support of research, and support of education. According to *Bakker*, “The goal of a hospital information systems is to use computers and communications equipment to collect, store, process, retrieve and communicate patient care and administrative information for all hospital affiliated activities, and satisfy the functional requirements of all authorized users”. The definition matched the methodology of the project: to collect data on both patient care and administrative processes in the hospital, store those data in a central database and make this data available in a coherent way to all system users. The system was developed over a long period. Although the initial aim was to exclude finance and administration, this domain is covered now, including a human resources application. In 1999, HIS, now called HISCOM, was acquired by BAAN. At present, the HIS consists of over 80 sub-modules, supporting almost all the activities in the hospital, not only medical support departments, but also nursing care, operating theatres, meal supply, finance and administration, logistics, human resource management, medication, appointment scheduling, etc.

Bakker and Leguit conclude that the introduction of IT in a service organization should not be done because “it is the fashion”, but to achieve benefits like:

- improved quality of customer care (in terms of complete, accurate and usable information, available in real-time);
- improved efficiency (saving on labour costs and materials, better use of resources);
- better access to large quantities of information recorded in a uniform way, offering new opportunities for research and education.

The development of an integrated enterprise solution in the hospital environment is not only limited to the case of HISCOM. Enterprise-wide software that covers all aspect of management and operations of a hospital was developed by Citadel. The ERP solution is modular, capable of phase-wide deployment and consists of the following subsystems: operations management, clinical systems, hospital management system, support service system, finance and administration system, and system administration. An example is the development of “hospital resource planning” (HRP) systems (Roth and Van Dierdonck, 1995).

It can be founded on vendor web sites that many hospitals have introduced ERP solutions. Some have implemented the software enterprise-wide (Baxter Cardiovascular Centre “Harvey Cabrera”, California; Schwetzingen District Hospital, Germany; Wesley Hospital, Australia). Others have implemented only some modules (Vogtland Clinic, Germany; Hospital Saint-Joseph, France; HCL, France).

4.3. ERP implementation in other services

According to Ansel and Dyer (1999), the commercial restaurant business has been slow to adopt the most current Information Technology. Technology has typically been viewed as an additional cost of doing business, rather than an investment in future profitability. In general, increased costs are avoided in an industry characterized by small profit margins.

Restaurants initially focused on cutting costs (as did other hospitality firms) by automating their back-office functions, including payroll, accounting and inventory systems. Part of the difficulty that restaurant firms face today regarding updating their IT systems stems from this period, because each company typically installed its own proprietary software, with little concern for prospective integration of those systems and no thought to how well the systems would perform as the company expanded. According to the same authors, the implementation of ERP systems in restaurant chains generate management reports on critical performance indicators and provide data for improved marketing in restaurant companies. The software tracks guest history, helps manage human resources and finances, and assesses customer satisfaction. According to Ansel and Dyer, by tracking customers’ demographic characteristics, dining patterns, average meal duration, and typical amounts spent per hour, restaurants can “do better” at booking the right customers at the right time, serving them and practicing differential pricing strategies. It was found that, in fact, restaurants develop IT applications for areas such as guest history, human resource management, financial management, etc. However, no company seemed to have a long-term perspective that takes into account the interrelationships among various system components. Authors conclude that the opportunity for the future is in function integration and the development of a centralized system that could transmit and share data from all applications.

The demand for IT infrastructure capability will vary amongst industries due to the different level of information intensity, market place volatility, business unit synergies and strategy formation process. Broadbent et al. (1999) proposed to explore the linkage of patterns of IT infrastructure capability and firm strategic context, taking into account different requirements for information. Finance, for instance, is defined to have more IT infrastructure due to higher integration between business units. In the finance industry, firms desire a picture of the entire relationship with the customer. Concurrently, finance firms are

experiencing rapid change due to ongoing internationalization of the finance industry and the need to build infrastructure to support clients whose businesses are expanding globally. Broadbent et al. further discuss the example of the banking industry. Citibank Asia has centralized and standardized back room processing across five Asian countries by adopting an ERP solution. The technology enabled the “Citibanking Vision” in two major ways: first, with a one-stop paperless account opening, instant account availability, instant card and check issuance; second, with a customer relationship database that supports the creation of customized products.

On the other hand, according to Schneider (2000), banks would not move towards implementing entire ERP solutions. The motivation for banks is not there as it would be for manufacturing companies. The author assumes that production companies implemented ERP systems as they were lacking core IT applications.

Government organizations are increasing the adoption of ERP systems for various benefits such as integrated real-time information, better administration, and result-based management. Government organizations, due to their social obligations, higher legislative and public accountability, and unique culture face many specific challenges in the transition to enterprise systems. Kumar et al. (2002) explore the key considerations and typical activities in government organizations adopting ERP systems in Canada.

5. Return on experiments from six case studies

In order to go deeper into the understanding of ERP project characteristics in services, we have contacted companies from different industries, i.e. banks, insurance groups, hospitals, airlines, consultancy firms, etc. Six of them agreed to share their ERP experience.

5.1. Context and methodology

A case study research method was used to investigate the implementation of ERP systems in service organizations. The research was carried out

between 19 February and 30 April 2001 in the National Institute of Applied Science of Lyon, France.

The interviews of business and information technology (IT) personnel were semi-structured and the following questions were asked:

- Which modules have been implemented and why?
- Reasons for adopting an ERP system?
- Was a cost–benefit analysis carried out prior to implementation?
- How were business processes changed?
- What were the difficulties during the implementation process?
- What are the benefits (both tangible and intangible) from the ERP system and have they been measured?
- Does ERP meet expectations?

The questions were open in order to enable a broader discussion on the implementation process. However, some of the requested information was confidential. For instance, it was not possible to obtain financial figures (budget, actual costs, and number of consulting days, etc.). Of course, there are companies that encountered failures in ERP project. We have identified some, but no detailed information was available. Such a failure in a strategic project should need a complete audit to evaluate the difficulties and the main failure reasons. The top management does generally not conduct this kind of audit after the project.

5.2. Presentation of the six cases

The companies are named A to F.

- A is a private French hospital;
- B is a private French non-profit making company member of the public sector hospitals;
- C is one of the largest software companies in the world;
- D is one of the biggest banks in Europe;
- E is among the world’s leading insurers and financial service providers, which operates in both domestic and international markets;

- F offers a complete portfolio of telecommunications and Internet services for both individuals and industrial organizations.

The diversity and characteristics of these companies make this study significant, not for statistical analysis, but to identify critical factors of ERP implementation in services. The experiences of those companies are presented in Table 2.

5.3. Preliminary analysis

In all cases, the scope of the information system does not achieve complete integration; projects are often limited to material management and accounting (except C). Additional standard or specific software concerned legal or business requirements. Motivations cited concerned mainly obsolete technology or legacy systems, but the need of a “full integration” is also given (A, B, F). Other business targets are given such as “common, standardized multi-site integrated system to support Group growth” (F).

Problems encountered are often human related (training, communication, change management); it seems also difficult to address legal constraints such as taxes or financial rules. Benefits included generally better operational efficiency such as information tracing and accuracy (see A), software reliability (see B), transactions (see D), and data integration (see F). Some indirect consequences concern process organization (A, B, D), operational management (stock, financial, operation) (B, F), human aspects (user satisfaction: A, working environment: B), importance of a horizontal view (D).

For three of the six cases, the project was considered as a success and one (F) states that the project did not achieve the objectives. A and B have highlighted some changes in their business processes. For four of the six cases, no ROI was performed (before or after). It is important to take into account the remark of E (whose project was limited to finances): “Benefits would only occur in case of full integration”. In four cases, the company created a competence centre with dedicated resources to support the post-implementation and go-alive phases of the project. This

highlights the importance of human factors for optimal exploitation and continuous improvement.

This issue of integration and scope can be explained with case A. The general feeling was that even if new, specific, software were implemented, it would not be beneficial to the organization. Therefore, a unanimous decision was taken to install an ERP system. But the modules implemented affect only the administrative part of operations; the healthcare units, on the other hand, have their own software systems. However, nurses who work in the operating units and are responsible for the ordering of medicines would use the ERP system. In this case, it emerges that there are not any particular difficulties with the ERP as far as the back-office is concerned. The purchasing, finance and accounting departments in a hospital are approximately the same as those in a manufacturing company. However, problems appear in the operations departments and in particular, when nurses need to use the system.

The same issue can be discussed in case D.

Before the project, each department had its own operating system and therefore, users could not share information. Furthermore, the analytical reporting system was inefficient, and needed a lot of effort to execute the reporting. In fact, information had to pass through three separate (non-interfaced) information systems before it was ready to be sent to corporate level. However, the project scope has been redefined during the project. As an example, client accounting is finally managed by separate software. Furthermore, this software has not been interfaced with SAP as it contains confidential information about Bank’s clients. Although integration was the main objective to solve difficulties in global reporting, the scope has been limited during the project, excluding some operations (client transaction) directly link to bank activity. The balance between standardization with ERP solutions and business specificities with dedicated packages is one of the more important project decisions.

These examples seem not to be unique. Integration of production and business specific operational processes usual in manufacturing project is perhaps more difficult in services.

Table 2
Case studies synthesis

	Project characteristics	Motivations	Problems solved	Benefits	Discussion
A	<p>ERP Qualiacc for purchasing, maintenance, inventory management, and finance.</p> <p>In addition: a decision making module (due to tax specifications).</p>	<ul style="list-style-type: none"> ● Replacement of old legacy system. ● Y2K compatibility. ● Software ability to integrate all functions in a single system. <p>The project was not categorized as capital investment but as a necessity.</p>	<ul style="list-style-type: none"> ● Interface ergonomics (web-based). ● Internal problems (in operation departments). ● Insufficient training. ● Tax. 	<ul style="list-style-type: none"> ● Better organization of processes. ● More rigorous software in comparison with manual information processing. ● More satisfied users. ● Ability to trace information in the whole system. <p>The system met initial expectations and is considered as a success.</p>	<ul style="list-style-type: none"> ● Responsibility became cross-functional. ● Some processes were changed. ● No cost-benefit analysis performed. ● Finding an ERP system that was able to respond to all the specifications was not easy. <p>After implementation, the benefits have not been analyzed or measured.</p>
B	<p>ERP Qualiacc for purchasing, inventory management and accounting.</p> <p>In addition: specific software for the central warehouse operation management.</p>	<ul style="list-style-type: none"> ● Part of a general reorganization of the HISs. ● Replacement of old legacy system. 	<ul style="list-style-type: none"> ● Some minor and easily solved problems. ● Time needed to implement the system. 	<ul style="list-style-type: none"> ● Inventory reduction (not directly attributed to ERP). ● Better working environment and process organization, better financial control, better stock management. ● Integration of all administrative functions into a single system. ● Improved quality of operations. ● Software reliability. 	<ul style="list-style-type: none"> ● Some processes were changed. ● Creation of a centre of completion on the system. ● No Return on Investment analysis performed. <p>The company is satisfied with the software and considers it being a success.</p>
C	<p>ERP SAP for material management, sales & distribution (essentially billing), financial accounting, workflow+CRM.</p> <p>In addition: specific software for service delivery and software development.</p>	<ul style="list-style-type: none"> ● Simplify existing procedures. ● Improve corporate image. ● Eliminate software license costs. 	<ul style="list-style-type: none"> ● Training and communication problems. ● People management problems. 	<p>The ERP project was considered as a success.</p> <p>Further improvements could definitely be done in the Sales and Distribution module (system users do not realise the importance of data reliability and cross-functional responsibility).</p>	<ul style="list-style-type: none"> ● The first wave of ERP software did not address the needs of service organizations. ● Public sector is difficult to address due to social politics and national legislations. ● Creation of a centre of competence on the system.

Table 2 (continued)

	Project characteristics	Motivations	Problems solved	Benefits	Discussion
D	<p>ERP SAP</p> <p>Part of a corporate project: Deployment of a core model in several companies in France on a restricted boundary: accounts payable, general ledger, asset management, controlling.</p> <p>Separate software: Client accounting</p>	<ul style="list-style-type: none"> ● Visibility improvement and better data interchange within the Group. ● System adaptability to the particularities of the countries. ● Single database. ● Time savings and automation of laborious operations (previously done manually). ● Transactions security. 	<ul style="list-style-type: none"> ● Communication problems between the company and the corporate implementation team (different language). ● Too much self-confidence from the corporate implementation team. ● Resistance to change when adopting new software. ● French tax system (VAT, fixed assets). 	<ul style="list-style-type: none"> ● From a vertical to a more horizontal approach. ● From individual operational efficiency to a cross-functional efficiency of the entire organization. ● All transactions between countries became totally transparent. 	<ul style="list-style-type: none"> ● No cost–benefit analysis performed prior neither after to implementation. ● Creation of an internal project team to support the implementation. ● Creation of a centre of competence on the system.
E	<p>ERP PeopleSoft for accounting (the implementation process concern the entire group, but on an independent manner). Separate software: industry-specific software system in order to support operations.</p>	<ul style="list-style-type: none"> ● Obsolete technology. ● No more control on the legacy system. 	<ul style="list-style-type: none"> ● Change management (difficult and time-consuming). ● Cost increased due to use of external consultants. <p>Departments were confronted to specific internal problems and had different expectations: difficult to decide between ERP/specific software.</p>	<ul style="list-style-type: none"> ● Beneficial to companies facing the Y2K and the EURO problems. 	<p>Implementing an ERP system as a basic accounting tool is an unnecessary and costly investment: Benefits would only occur in case of full integration (which consequently limit the interfaces).</p>
F	<p>ERP SAP for material management, financial accounting, and controlling.</p> <p>In addition: billing, customer care systems etc.</p>	<ul style="list-style-type: none"> ● Legacy system (heterogeneity, inefficient, unreliable). ● Need of a common, standardized multi-site integrated system which could support the Group growth. ● Visibility improvement and corporate strategy support. 	<ul style="list-style-type: none"> ● Difficulties for companies which have already an ERP before (re-training). ● Difficulties to get away strict functional boundaries. ● Enterprise-wide integration not achieved. ● Internal communication process not optimized. 	<ul style="list-style-type: none"> ● Better Inventory Management. ● Faster reporting procedures. ● Data integration in the accounting and purchasing departments. 	<ul style="list-style-type: none"> ● No Return on Investment analysis performed. ● No external consultant because internal project director had ERP experience. ● Creation of a centre of competence on the system.

5.4. *Synthesis*

After bank and insurance sectors, this study tends to illustrate the growth of ERP implementation in healthcare organizations, software and telecom companies. In the mid-term, computerization with standardization and integration will certainly be generalized in services companies.

Although the essence of ERP philosophy is the fundamental premise that the whole is greater than the sum of its parts, one of the main topics is integration, which is cited in the literature as a benefit of the ERP system. However, our current investigation notes generally a non-complete integration in service companies, with ERP systems focused mainly on financial, human resources, customer relationship.

Non-profit or non-marketable service organizations (like hospitals in most European countries) whose purpose is to “do well” rather than to generate profits are also concerned. Even if productivity and consequently return on investment are difficult to measure, those companies have operations that need to be managed so that resources are used effectively and end-users are served at a reasonable cost.

The literature review of ERP in services and the present case study must be analyzed in relation to service characteristics identified in Section 3. Based on experiences and knowledge of ERP project in manufacturing, we address in the next section the question “how can ERP be applied in service sector organizations?”

6. **Impact of service characteristics on ERP**

The reasons for implementing an integrated solution in a service company and the problems encountered, correspond mainly to those found in the general ERP literature. However, the main difference lies in the modules that have been adopted and we suggest that differences between service and logistic organizations can explain the ERP configuration seen in service companies.

The most important is the difference in relative weight of information and goods in the value creation of operational processes. For example,

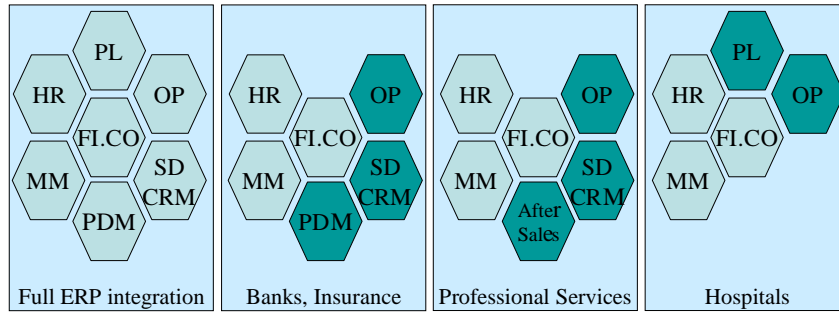
organizations in the finance sector have numerous internal and external legal partners and are subject to compulsory legal reporting procedures. Furthermore, detailed information is necessary not only to be able to manage the daily company operations, but also to accomplish strategic group objectives. That leads to differences in culture and working method, developed mainly for product cost control in manufacturing organizations and for customer relationship control in service ones.

6.1. *Functional fulfilment and level of integration*

Most ERP solutions enable organizations to implement only the modules they choose. It was found that almost all companies adopt finance and accounting modules, whereas human resource management, for instance, is adopted in fewer cases. In addition, none of the service organizations that have been interviewed use the production planning and control module, but well-known modules in others sectors such as distribution, procurement and storage are used in some service companies (postal, hospital). According to Schneider (2000), banks have already achieved transaction efficiency. Therefore, they do not need to implement back-office systems. On the contrary, professional services companies are working on back-office solutions for core processes such as resources allocation, cost control of missions. Both are showing big interest in front-office applications.

Research findings suggested that some companies choose to implement the “best of breed” modules instead of being locked into one supplier. One could argue that the overall risk of implementation failure is lower and the overall functionality is better. However, in order to consider the system as “fully” integrated, the company has to adopt a solution that suits the organization as a whole (see Fig. 2).

Service companies have often implemented an ERP solution in order to replace old legacy systems in the administration, finance and materials management departments. None of the organizations that have been interviewed uses an ERP system to manage service production and delivery. Yet, one should consider the opinion of an



A best of breed approach... depending on service sector

FI-CO: Finance & Control, HR: Human Resources, MM: Material Management, OP: Operations, PL: Planning, SD: Sales and Distribution, CRM: Customer Relationship Management, PDM: Product Data Management

Fig. 2. Functional fulfilment and level of integration.

insurance company Financial Director: “Benefits would only occur if a company could implement all the modules in an integrated solution. Implementing an ERP system only in the finance department is an unnecessary and costly investment”.

While, in manufacturing companies, one could often consider the ERP system as an integrated solution, research findings suggest that, in a service company, enterprise-wide functional integration does not exist (Cigref, 1999; Miranda, 1999; Schneider, 2000). However, there are other logistics modules, such as project management, after-sales services, that could be beneficial to the service sector. For example, hospitals could optimize their back-office operations by implementing an ERP solution. However, the research findings suggest that health care organizations are not willing to adopt the system in all their departments.

6.2. Importance of labour in services activities

It was found that inventory management, for instance, could be an area of major improvement once the new ERP organization is operational. This often makes inventory a key domain for ERP projects in manufacturing. However, in the case of service organizations, especially public hospitals, inventory as a percentage of budgets is not usually a key performance indicator. On the contrary, the

ratio labour/budget is always a performance indicator in service organizations. Nevertheless, often, it is quite directly linked to level of activity and no direct benefits can be obtained by decreasing it. In this case, one cannot look for major improvement from this ratio and integration of labour in service control is not a vital question.

As seen previously, service provides a product that is often intangible as an *act*. Therefore, it is understandable why service organizations do not implement the production planning module (the notion of material requirements planning, for instance, simply does not occur in service companies). Planning in services is essentially based on *skills*, and becomes a strategic link between sales and human resources. This kind of integration is not often developed in existing ERP packages.

6.3. Product definition and operation planning

Manufacturing processes have been deeply analyzed and modelled. Service organizations often have difficulty in defining precisely how their service is delivered. For example, manufacturing-based productivity models assume that an altered configuration of input resources in the production process does not lead to quality changes in outputs (the constant quality

assumption). However, in a service context, changes in the production resources and production systems do affect the perceived quality of services. Therefore, using manufacturing-oriented productivity models in service contexts is likely to give managers wrong directions for action.

It is also important to emphasize that in service organizations, one cannot fully separate the front- and back-office operations. Therefore, before addressing the issue of resource utilization, scheduling and optimization, it is necessary to understand the service delivery process itself. For example, many hospitals do not have an effective staff scheduling system. One cannot treat patients as “products” for which production could be optimized. They are not considered as a value generating “inventory” and in addition, patients are customers.

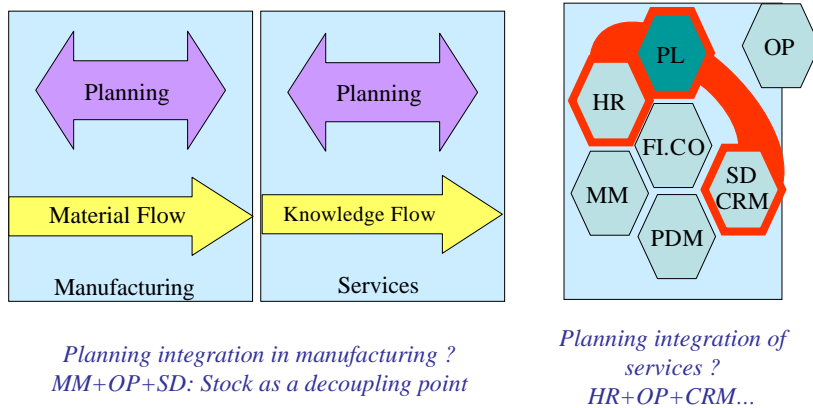
Thus, traditional Material Requirement Planning systems (MRP) are not the answer, given the dominance of labour and capital resources in hospitals (see Fig. 3). As a consequence Roth and Van Dierdonck (1995) proposed a blue print of a HRP system assembling an engine which consists of a central resource requirement planning system using bills of resources and four front-end components (master admission schedule, aggregate admission planning, a demand management module and a rough-cut capacity planning system).

6.4. Requirement fulfilment with standard/specific

For service companies, ERP solutions do not offer as many benefits as for a manufacturing company. Some activities have already been taken into account by ERP vendors like sales and maintenance, project management, etc., but others lack recognized standard systems. Therefore, an ERP solution might not be the most suitable option for service companies and by adopting a standard application, service companies might lose some of the functionality of the old system.

Herewith a list of examples coming from hospital case studies:

- Legislation on public market offers in France obliges all public organizations to archive market-related documentation and keep it for 10 years. Potentially, this could cause an enormous problem when all the different documents are kept separately in each department. In addition, many system users could place an order. Therefore, one would need a unique, centralized system to keep all documentation.
- Public organizations have to use public accounting rules. Vendors, on the other hand, offer standard solutions for the accounting department. Therefore, it is difficult to foresee how integration could be achieved and how much it would cost.



FI-CO: Finance & Control, HR: Human Resources, MM: Material Management, OP: Operations, PL: Planning, SD: Sales and Distribution, CRM: Customer Relationship Management, PDM: Product Data Management

Fig. 3. Importance of labour in services activities.

- According to the healthcare organizations interviewed, “no system could integrate the needs of the administration, examination, treatment, clinics, pharmacy, and management departments in a hospital”.
- In France, all public organizations have to invite bids for all purchases over 50K€. The law states that one should define the specifications of the contract, including detailed information about the organization’s requirements. The suppliers then have 52 working days to evaluate whether they are able to satisfy those needs. This duration depends on whether the bid is placed in France or at European level. The next step in the procedure is to choose a supplier. Taking into account these specificities, public organizations need to conduct detailed analysis of their processes.
- Most ERP systems are generically designed for private sector and for profit organizations, and a number of respondents confirmed modifying the software as a strategy to meet their government specific requirements (Kumar et al., 2002).

Finally, one should analyze the impact of the new software on system users. For example, a very expensive application was developed for the specific needs of hospital pharmacists; the ERP project team faced strong opposition from the departments using this system. We need to answer the question: Is a standard ERP solution better than a system orientated towards the particular needs of the service organization?

6.5. *Process approaches*

Process approaches in ERP project are generally considered as key success factors for mastering integration, change management and process efficiency. However, ERP projects in service companies, as described in literature (Section 4) or in our detailed study (Section 5) seem to give less importance to that approach. Even if benefits of projects often include positive changes in process efficiency and integration, actors do not cite process modelling frequently among motivations or key factors. Moreover, priority is often

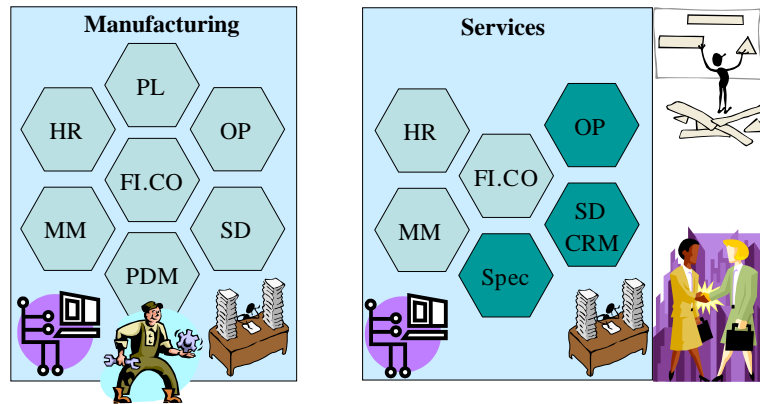
given to security, quality of service, transaction performance.

An ERP project in a hospital used process modelling as a main tool for evaluation, mapping and decision phase of the project. Nevertheless, the implementation phase did not reuse the pre-established process model! Operational priorities limit the possibility of process reengineering, and the technical dimension of the project gains the higher priority. Regarding literature, it is not a particular situation depending only on people involved. Process modelling tools and methodology have to take into account that reengineering a service delivery process is a more difficult “live” operation. Changing a logistic process is always a challenge, but goods have no opinions about their use! On the contrary, employees are key actors when you have to change a process involved in customer relationships.

6.6. *Implementation*

When comparing service and manufacturing organizations, it is important to mention that mainly big international service companies have adopted an ERP solution. One could argue that ERP systems are primarily suited to larger and more complex organizations with more information management problems. Indeed, it is not often that we find an integrated solution, in a small service provider. If we consider the manufacturing sector, on the other hand, there are many solutions aimed at the small and medium size enterprises.

Research in the literature suggested that many companies concentrate on the technical dimension of the ERP project. The general opinion is that once data is integrated, people will follow. However, this is rarely the case. Furthermore, neglecting the organizational side of the project is the major cause of ERP failures. This is even more important in service organizations taking into account the place of human resources as represented in Fig. 4. For example, it has been reported that interface ergonomics caused a particular difficulty during the ERP implementation in a Hospital. There were people who used the system only once every two weeks. They did not have time



*Expert, customer contact, mobility...
Human factor in ERP project even more important*

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Fig. 4. ERP implementation in services.

to familiarize themselves with the interface and often forgot how to operate it.

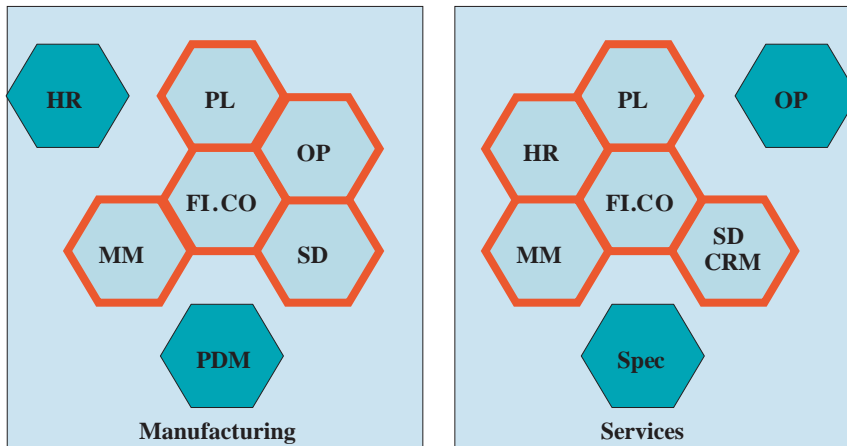
A recent study of integrated standard packages for a small healthcare company (senior personnel services, about a hundred users) suggests the adoption of a non-integrated solution with separate domains for finance and logistics, services management, human resources.

7. Conclusions

Although the essence of ERP philosophy is the fundamental premise that the whole is greater than the sum of its parts, one of the main topics is functional integration, which is cited in the literature as a benefit of the ERP system. In a production company it appears possible to integrate all departments and achieve better visibility and control by eliminating interfaces; but human resource management is rarely “fully integrated” (for example: knowledge management, employee portal, etc.). However, as described in Fig. 5, the dream of such a seamless integration does not seem to be possible in services, which generally launch projects including customer relationship

and human resources management, and less often design and production of services.

One main reason is the very different importance of material flows and labour acts in manufacturing and service companies. The direct relation between financial flows and materials flows is at the heart of ERP for manufacturing companies, which directly link inputs and outputs; this often leads to identifying ERP as an extension of MRP II (Manufacturing Resource Planning). For services, materials can often be considered as an indirect cost, and is not linked directly to activities. The need for direct tracking from accounting to activities management is lower, and in all the cases studied, it was not wanted. On the contrary, customer contact is core for activity control and it can be said for services: “ERP financial systems are customer relationship management-oriented systems.” The importance of the human component in service operations and company culture has a dramatic influence on functionalities and on the project itself. Fig. 5 portrays the two different approaches to integration. Existing project scope depends on company culture and aims and does not always correspond to these integration levels. However, organizations and information systems are constantly pushed



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Fig. 5. Full integration?

towards integration. One question remains “Will these two “alternatives” eventually be revealed as merely different routes towards the ultimate target—Full Integration?”

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