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# Going Beyond ERP Implementation: An ERP Assimilation Cross-Case Analysis

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**Abstract.** ERP systems have long been known for their significant impacts on the adopting companies, irrespective of size and industry. To better understand and to maximize the positive impacts, ERP research has mostly focused on the selection, evaluation and implementation stages. Failure rates, however, indicate that post-implementation is another essential stage for ERP projects success. Based on a qualitative research design using case-study methodology, this study investigates the determinants of ERP assimilation success during the post-implementation stage. A comparison between three Canadian manufacturing companies is made. A set of lessons learned based on this analysis are presented.

**Keywords**. ERP system, assimilation, post-implementation, case study, SME.

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**INTRODUCTION**

Since their emergence, ERP systems have been promoted as a critical technology in a growingly complex and intensive knowledge economy. As a matter of fact, and owing to its increased capabilities and continuous evolution, ERP systems have moved out of manufacturing workshops and large companies to not only various industries but also to small and medium sized companies (Loh & Koh, 2004).

In spite of the large-scale adoption of enterprise systems and the concomitant momentum that these systems are gaining worldwide, attaining the expected benefits is still a challenging task. It has been argued that if planned, implemented and assimilated properly, ERP systems can significantly improve information flow, streamline internal processes and hence develop the firm's efficiency and its competitive advantage (Beard and Sumner, 2004; Musactello & Parente, 2006). By using a common operating platform and enhancing the network capabilities, different departments — and even different sites — of the company can communicate instantly between each other and can access and transfer information more easily, a thing that would enable a better control over operations (Dowlatshahi, 2005). Other advantages of ERP systems include: the integration and the synchronisation of the firm's supply chain activities (which means a better and faster customer service), a reduced cycle time and an increased productivity, an increased flexibility by enabling easier access to the firm's data, a reduction in redundant entry and reduction in process time, the economisation of resources by quickly identifying problematic areas, an increased autonomy in data use and access which supports and facilitates the decision making process in the different firm's departments and sites (Dowlatshahi, 2005; Amoako-Gyampah & Salam, 2004). Important to mention here that despite the tempting advantages, several ERP implementations have not lived up their adopters' expectations and horror stories and failure experiences have littered the ERP landscape. Several reasons for ERP projects' failures have been cited in the literature (Botta–Genoulaz et al., 2005). Most of the reasons referred to in the literature, however, deal with the early stages of the project (i.e., the selection, the preparation and the implementation stages). These include the wrong choice of the software, the inappropriate timing of the project, the improper planning, business process reengineering and implementation, the lack of resources (material and human resources), improper employee involvement, lack of good communication and inconsistent management support (Umble et al., 2003; Barker & Frolick, 2003). In spite of its importance, the post-implementation stage and its issues have not been sufficiently addressed in the literature (Botta-Genoulaz et al., 2005; Nicolau & Bhattacharya, 2006). Problems could also emerge after the implementation process and could result into several problems including total failure. The underutilization of the system and the rejection of the system are but a few symptoms of more serious problems that have to be addressed during the post-implementation stage (Botta-Genoulaz et al., 2006).

Although there has been a growing interest in the post-implementation stage, there is still a need to investigate the different issues and aspects of this phase in the ERP's project life cycle. Given the potential benefits that and ERP system can generate for a company in the first place and the large financial commitment that it requires in the second place, it is  important to understand and to investigate the determinants that facilitate the assimilation process of ERP systems in a company. Given the increasing adoption of ERP systems by small and medium sized enterprises (SME) and their need to address the problems that could arise once the system is implemented, it is essential for these companies to understand the determinants that facilitate ERP assimilation. Our objective in this paper is to study the experience of three manufacturing firms have adopted an ERP system and to investigate the different factors that facilitate or hamper ERP assimilation.

The remainder of the paper is organized as follows. First, the research methodology is explained. Next, the case analysis is exposed. Then, our research results are presented and discussed. Finally, the paper will conclude with the main lessons learned from this analysis.

## RESEARCH FRAMEWORK

In seeking to understand why some companies fail while other succeed in their ERP initiative, it is critical to recognize that drawing ERP projects success is not a simple matter of buying and installing the technology. Once installed, the ERP needs to be assimilated by the different direct and indirect users and to be embedded in the firm's work processes and value chain activities (Chatterjee et al., 2002; Purvis et al., 2001). Amoako-Gyampah (2007) further argues that a system can only be considered to be successful if the intended level of usage is achieved. If not, the resulting costs of an underused or unused system would be tremendous

Organizations are increasingly adopting ERP system in order to have an integrated IT infrastructure which would further allow the integration and the coordination of their business processes. In order to realize this objective, the system needs to be properly assimilated in the organization. Assimilation refers to the extent to which the technology is used in a comprehensive and integrated way and becomes routinized and embedded in the firm's work processes and value chain activities (Armstrong & Sambamurthy, 1999; Purvis et al., 2001; Chatterjee et al., 2002). If an ERP system is implemented successfully and fully comprehended and assimilated by managers, such a system can significantly help them in their decision-making process. In this research, we propose to evaluate assimilation based on three criteria: the significance and type of decisions taken using the system (execution/operational or planning or strategic), the significance of activities/processes supported by the ERP, and finally the level of acceptance and reliability of the users on the system. Our focus in this research is on operations managers and those who have an impact on operations. Hence, the fact that managers become increasingly dependent on the system in their control, planning and strategic decisions is indeed an indication of the better assimilation of the system. The following figure illustrates the decision levels in a manufacturing company and the corresponding manufacturing decisions and data sources. The dashed rectangle defines the areas of interest of this research.

The decision making process involves different time horizons and different manufacturing decisions that are based on different types of data. For operations management, 4 levels are distinguished: execution, control, planning and strategic for long term decisions. These correspond to process, dispatching, production plan and capacity decisions. Off-line data is used for process, while transactional, aggregated and multi-module data are respectively used for dispatching; production plan and capacity decisions.

Drawing on the ERP implementation and IS assimilation literature, we highlighted three main sets of factors of three contexts that could influence the ERP assimilation process: the technological context factors; the organizational context factors and the environmental context factors. Three main propositions will be considered in this research:

*Proposition 1: Technological factors influence the ERP post-implementation assimilation process*

*Proposition 2: Organizational factors influence the ERP post-implementation assimilation process*

*Proposition 3: Environmental factors influence the ERP post-implementation assimilation process*

Figure 1 illustrates the conceptual framework of our research with the assimilation process being influenced by the three sets of actors and resulting in the expected ERP benefits (Kouki et al., 2007).
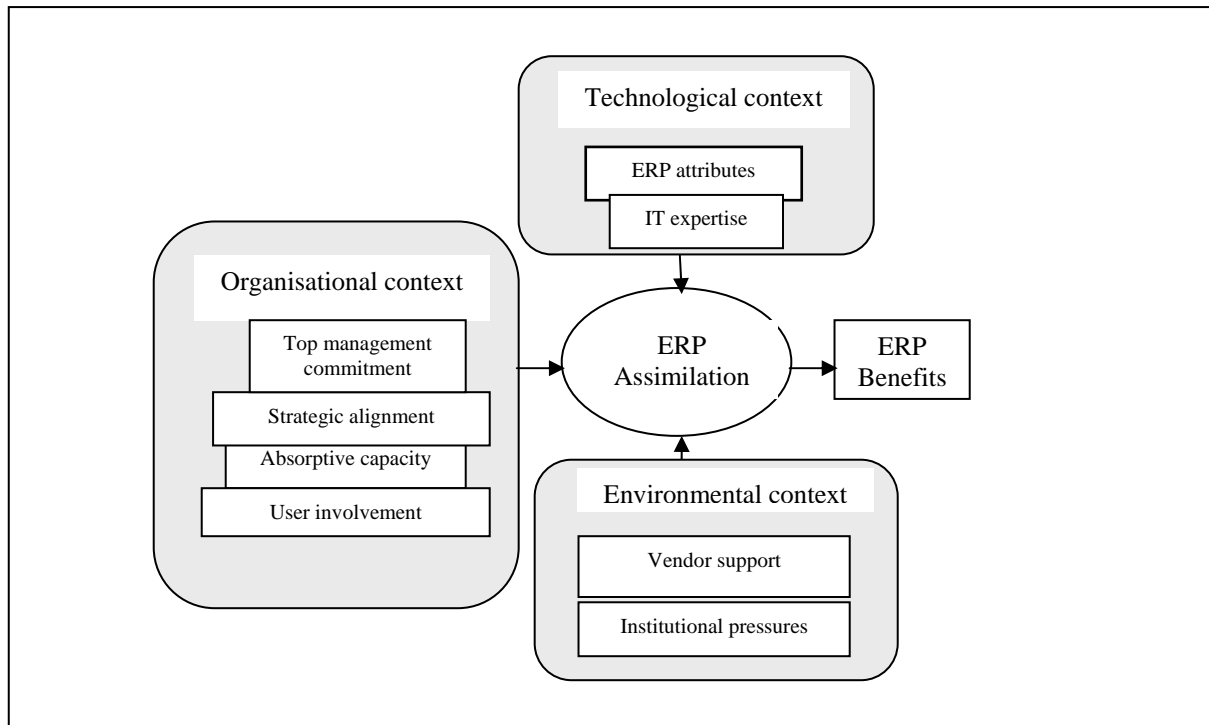
*Figure 1. ERP Assimilation Framework*



Table 1 presents the different constructs on which the three companies were evaluated on ERP assimilation during the post-implementation stage (Kouki et al., 2007).

*Table 1. Variables Description*

| Variable | Description |
|---|---|
| **ERP attributes** | Describes possible ERP systems' technical attributes that might influence the acceptance and the assimilation rate of the system by its users. |
| **IT expertise** | Describes the IT people competence in maintaining, updating and supporting the ERP users. |
| **Top management championship** | Refers to the extent that top management supports, directly and indirectly, and commits to the continuous use, upgrade and progress of the ERP. |
| **Absorptive capacity** | Refers to the firm's efforts to encourage learning in the organization, including the organization's commitment to learning principally by training and putting in place procedures to capture, codify and disseminate ERP knowledge. |
| **Strategic alignment** | Describes the continuous fit between the ERP system (which are part of the IT infrastructure), the business strategy, the IT strategy and the organizational structure. |

| User involvement | Refers to the psychological engagement of users with the ERP system by considering their problem and suggestions about the system. |
|---|---|
| **Reward system** | Refers to the changes that the reward system in the company might have undergone after the introduction of the ERP system. |
| **Institutional pressures** | Refers to the mimetic, coercive and normative pressures that a company might undergo to encourage further assimilation of the system. |
| **Consultants effectiveness** | Describes the effectiveness of external consultants during the system's upgrades. |
| **Vendor's support** | Refers to the strategic relationship and the close fit between the software vendor and the user organization that could be established between the vendor and the company. |
| **ERP assimilation** | This variable is evaluated using 3 criteria: the significance and type of decisions taken using the system (execution/operational or planning or strategic), the significance of activities/processes supported by the ERP, and finally the level of acceptance and reliability of the users on the system. |

## RESEARCH METHODOLOGY

This article examines the determinants of ERP assimilation in three manufacturing companies and investigates the factors that influence this process. There are no hypotheses to be tested in order to explain the impact of these determinants because we have not conducted an experiment with the studied organisations. Also, the paper does not attempt to explain the financial impacts of the assimilation process following the ERP implementation. It has been argued that ERP failure could occur when the installed system is underutilized and, hence, many of the idiosyncratic features have not been fully extended by their target users (Davenport, 1998; Shehab et al., 2004; Jasperson et al. 2005).

When behavioral events cannot be adequately controlled and when little is known about a phenomenon due to the lack of theory, qualitative approach such as the case study method is highly recommended as an alternative means to gather evidence and to understand complex phenomena (Yin, 1994; Eisinhardt, 1989; Stuart et al., 2002). Yin (1994) defined a case study as an "empirical inquiry that: (a) investigates a contemporary phenomenon within real life context, especially when (b) the boundaries between phenomenon and context are not clearly evident. In our case, ERP systems projects represent a major undertaking in a firm, often involving all the company departments and processes, requiring heavy investments in both time and money, and could extend on periods ranging between months to years. All of these factors contribute to the ERP systems initiative complexity. Consequently, a quantitative methodology would not allow an in-depth understanding of the firm's and the interviewees' experiences with the system. Therefore, a case study strategy has been employed in this research.

Our analysis of ERP assimilation at the post-implementation stage is based on three Canadian manufacturing companies. The criterion used to select the case study companies was that each of the case studies should have implemented ERP software to its operations. For reasons of confidentiality, we have given assumed names to each company: Food Co. for the SME, Plastic Co. and Wood Co. for the large companies.

Interviews and observations were the primary sources of data whereas archival online and paper documentation were the secondary sources. Interviews were conducted by the researcher and a research assistant familiar with IT systems. The interviews were conducted within the span of 5 months. Four to five members were interviewed in each company with each interview varying between 50 to 80 minutes. Respondents include: the vice

president (VP) operations/production, the VP marketing, the VP finance or VP accounting, the VP Information technology and a plant manager. Some key respondents were visited and/or contacted more than once to validate the collected information. Guidelines about data validation and data accuracy were respected while and after the realization of the interviews. A questionnaire that was amended after the feasibility study in the form of a semi structured questions was developed using the 10 constructs of Table 1. These questions were used to guide the interview sessions. All interviews were recorded after the approval of the respondents.

Several strategies for controlling bias in data interpretation were included in this study. First the questionnaire was field tested through a pilot study in three manufacturing companies and with some ERP experts. In case of doubt and lack of clarity, the data were rechecked with the informants. Finally, in order to insure the researcher by herself transcribed and analysed the interviews.

## CASE ANALYSIS

### Companies' profile

We present in this section the background of the chosen companies and their need to implement the ERP system. The profiles of the three organizations are summarized in Table 2.

### Food Co.

Food Co is a leading food processing company in Quebec with annual sales of CAD 225$ million and 5 production facilities. Its SAP ERP system was implemented in 1998 using a Big-Bang approach. The tax changes, the Y2K problem and the increasing requirements of their clients needs strongly encouraged Food Co. to adopt an ERP system. The company used to have several "information silos". Even though the IT department did try to group the company's data in a single data warehouse, it was not possible to coordinate the different sets of "information silos" and to have a unique view of the firm. At the time when the system was implemented, all basic modules — such as finance, managerial finance, asset management, sales, purchases, warehouse management, time management, pay, human resource management, maintenance — were implemented.

### Plastic Co.

Plastic Co. is one of the leading North American producers of plastic products with annual sales exceeding CAD 200$ million. It employs more than 1000 employees, including 800 in Quebec, operating in 4 facilities in Quebec and New Brunswick and a network of sales offices and warehouses in Canada and the United States. The company manufactures over 400 products which are marketed to several industries including food, chemical, forest products, petrochemical, construction, integrated waste management industries, transportation, defence and maple sugaring. Prior to the implementation of the ERP system, Plastic Co. had three separate systems; one of them was the main manufacturing system. As Plastic Co. needed to upgrade their system, the latter's vendor advised the company that the system was not to be supported anymore. Plastic Co. decided then to go with a single integrated system. Note that the ERP project was part of a bigger project of continuous improvement in the company. The system started in February 2004 by the choice of the system. In December 2004, the company switched to the ERP system, in the two Quebec plants, following a Big Bang approach. One year later the system was implemented in the New Brunswick plant. The third plant in Quebec was planned to have the ERP system two months later but the project was postponed to September 2007.

### Wood Co.

Woody Co. is a North American leader in the design and manufacturing of business, commercial printing, publication as well as technical and specialty papers. It has three main divisions: paper, pulp and wood. Our research will concentrate, however, on the wood division's ERP project, called hereafter Wood Co. This division offers

several types of lumber and its co-products such as wood chips, sawdust, and shavings. After having implemented an SAP ERP system at the paper division in 1996, the wood product's project started in 2001 and went live in January 2002. The objective of the company was not only to standardize the financial and accounting systems but also to change its production orientation from a push to a pull mode. Wood Co. will designate hereafter the wood products division.

*Table 2. Food Co., Plastic Co. and Wood Co. Profiles*

|  | *Food Co.* | *Plastic Co.* | *Wood Co.* |
|---|---|---|---|
| **Industry Sector** | Cookie and cracker manufacturing | Injection-molded and extrusion molded plastic products for several industries (food, chemical, forest products, petrochemical, construction integrated waste management industries, transport, defence, maple sugaring) | Manufacturing, marketing and distribution of lumber and wood-based value-added products, and the management of forest resources |
| **Number of Employees** | About 500 | About 1000 | About 2000 |
| **Sales** *(as of December 31st, 2006, in millions of Canadian dollars)* | About $250 (more than 400 products) | About $225 (150 products) | About $400 (10% of Woody Co.'s sales) |
| **Type of System Used** | SAP | JDEdwards<br><br>Excel applications run in parallel<br><br>A planning software | SAP |
| **Implementation Date (go-live)** | Oct 1997 | Dec 2004 | Jan 2002 |
| **Reason for System Selection** | ▪ Suitable for the firm's operations<br>▪ "Felt" that SAP was the best solution for them | • Requires less people to support the system than other products<br>• Less complex than other systems<br>• Satisfies the business needs (mainly financial) | • Already used for the paper division<br>• Has potential for customer service, accounting, operations, etc. |
| **Drivers for Adopting ERP System** | • Y2K problem<br>• Clients' pressure to have timely and integrated information<br>• Need to have a system that evolves | • Previous manufacturing information system was outdated<br>• Need to integrate the firm's functionalities | • Need to standardize the financial and the accounting systems of the division (headquarters and mills)<br>• Having a system that |

|  | *Food Co.* | *Plastic Co.* | *Wood Co.* |
|---|---|---|---|
|  | with the increasing sales and firm requirements<br><br>• Need to provide detailed information for taxation purposes<br><br>• Need to integrate the firm's functions and processes |  | supports growth |
| **Problems Encountered** | Some VPs are still hostile to the use of the system | • Inadequate end user training<br><br>• Use of excel in parallel in several departments of the company<br><br>• Resistance to change lead to the departure of some employees<br><br>• Lack of appropriate training<br><br>• Heavy workload for the IT department | • Inadequate user training<br><br>• Resistance to change<br><br>• Scarcity of resources |
| **Major Benefits** | • Integrated, fast and better quality of information<br><br>• Better decision making<br><br>• Satisfying customer demands | • Integrated, fast and better quality financial information<br><br>• Normalised processes with several checkpoints<br><br>• The integration of the different departments and plants of the company | • Integrated, fast and better quality information<br><br>• Responsiveness to environmental changes<br><br>• Identification of problematic areas<br><br>• Normalised processes<br><br>• Improved visibility of the division's operations<br><br>• Improved decisions |

### Case studies' analysis

This section describes each of the constructs and presents a summary of the findings of the three case studies for each variable. Respondents' statements were quoted when appropriate.

*ERP attributes*

It has been argued that ERP attributes affect the users' satisfaction and hence the technology's assimilation and diffusion (Wu & Wang, 2006; Moore & Benbasat, 1991). Wu and Wang (2006) suggest that eleven ERP system characteristics are basic in assessing user satisfaction. These are: ERP system information accuracy, timeliness, reliability, response time and completeness, output requirement (the layout design and flexibility of the output content), relevancy (the degree of congruence between user tasks and ERP functions), system stability, auditing and control (type of auditing rendered by the system), ease of use and usefulness of the system for the user. Flexibility has been considered in the literature to be another key characteristic of ERP systems and an essential requirement for the companies (Gupta & Kohli, 2006). ERP system should be flexible enough to support various business lines and to enable the addition of modules (software segments) to support supplementary functions and business processes (Ahituv et al., 2002; Shehab et al., 2004).

In the case of Food Co., the ERP system's modularity and flexibility enabled some users, mainly superusers, to stretch the system horizontally by adding small programs which satisfy the users' needs without changing the system's core. For one respondent, it was more a matter of change management than of system attributes. "For sure a system full of buttons and full of fields would appear complex and difficult to use, hence, we worked more on simplifying the system for the users…it was a matter of presentation that we have succeeded in".

At Plastic Co., some users still consider the system to be complex, and not answering their needs. They try, therefore, to simply bypass the system by using their own applications. In some cases, there were even departures of some users who couldn't handle the change. According to one respondent, these problems were mainly due to the lack of training and appropriate communication. Many users had higher expectations about the system's performance and were disappointed after its implementation. This lead to users' frustration and resistance to change and had an impact on the rate of assimilation of the system.

Wood Co.'s case was quite similar to Plastic Co.'s. Some respondents argued that the shift to the complex ERP system was not strongly justified since they "liked their previous system and felt comfortable with it…and it was adapted to their business and it satisfied their clients' needs…(it was as if they switched) from a Ferrari to a Toyota". With time, however, our respondents acknowledged that the more the ERP system is improved and adapted to their needs, the better it is accepted and the smaller the "technological gap is and the shorter the waiting time is". They've also argued that the ERP system is "very" rigid when it comes to reporting. It was perceived, however, as being also flexible since data can be downloaded to excel and manipulated depending on the user's needs.

*IT expertise*

In both companies, the IT team high competence and high expertise were considered to be an essential factor which has facilitated the assimilation process of the system in the company.

It is the IT department which looks after the system including troubleshooting, helping users, system programming and development, customization, implementing upgrades etc. At Food Co., the IT team has been described as being "excellent, very competent and skilled". They are directly involved with the users by providing them with the required help and assistance. Moreover the operations manager, who participated in the ERP project and who is a superuser, is highly involved with the system users, proving assistance and guidance, developing small programs to make the most of the system's capabilities in his department.

At Plastic Co., the IT department is responsible of the IT systems in the 4 plants. Given the size of the company, one respondent argued that the workload of the IT team is too heavy given the system and the users' requirements. The fact that the system is not stable yet and that users are not yet acquainted with the type of reports that the system produces, requires lots of troubleshooting, customization and maintenance of the system. In spite of

these difficulties, the IT people at Plastic Co. are considered to be very efficient and competent and a capital facilitator of the assimilation process of the system in the company.

Unlike the other two companies, Wood Co. benefits from the services of an ERP center of expertise which serves the paper division also. The respondents were very satisfied with the ERP people services and described them as being efficient and competent especially when it comes to user assistance troubleshooting and system maintenance.

### Top Management championship

Top management (TPM) championship refers to the extent that top management supports, directly and indirectly, and commits to the continuous use of the ERP. It has been argued for long that this factor is the most predictive determinant of ERP project success (Somers & Nelson, 2004). Given the continuous technological developments of ERP systems and their endless requirements, top management support should be sustained as long as the system is operating,

In spite of the fact that it has been implemented since about 10 years, top management at Food Co. still considers the system as one of their top priorities. One respondent affirms: "Our CEO decided to invest in 4 fields: 1) equipment, 2) R&D, 3) information systems, that is having always the topnotch IS and 4) integration". TPM has always provided the necessary financial resources to improve the system and maximize its advantages. All respondents stressed the fact that there was never a blockage when it comes to financial resources whether they are intended for global upgrades requiring considerable expenses (consultants, equipments, training , etc.), or for less costly system requirements (new modules, training, etc.). The vice president operations considers that the top management's continuous willingness to invest and to always look for an added value of the system is one of the main factors which has helped to assimilate the system. He says: "If I say for instance, I would like to have such and such functionality and that it would cost us a consultant- knowing that their cost can reach $1000 or $2000 per day, I have never had to justify myself with reports and scientific studies...(Top management) willingness is always there…We have never had a blockage". Moreover, top management takes part in the regular meetings of the ERP team where problems and new suggestions to improve the system are discussed and decisions are taken about the system.

At Plastic Co., things went quite differently. The ERP project was considered as part of a bigger enhancement project.  At the time when the system was implemented, the CEO wanted to finish the project on time and within budget. The problem was that the people who were required to support the project (superusers-to-be) were not liberated and their daily tasks were seen to be more important than the project. This lack of commitment has significantly delayed the project and negatively influenced the project quality. In 2006, the CEO changed as well as 6 VPs and 6 managers. The new CEO was determined to successfully lead and realize the project. One respondent reported that "among the very first things that the new CEO said when he took his position is that they have spent about $3 or 4 million on JDE and that JDE is to stay and to operate successfully". Likewise, most of the new VPs had already an experience with the ERP system and are sufficiently aware of its advantages and of the required sacrifice to make the project a success. As the VP IT and project manager puts it:" I asked for resources, I had them…when I need people (to train) I don't have to ask 10 times to have a person. As a project manager, I talk to the VP and, I tell him that we need to train this person for the system. Just one week later the person is liberated and he or she joins the training team to learn new things which are a prerequisite for a superuser".

In spite of the problems that the company had and the considerable amounts of money which were invested in the system, top management are still committed to supporting it. Even though the ERP project is not at the very top of the company's projects, it is still considered as being important and necessary for the company's operations. Wood Co.'s system is presently at a stabilization period. Hence, top management is not planning to acquire any new modules.  Financial resources are, however, provided to make the necessary updates and development. Nevertheless,

some respondents argue that more commitment is required when it comes to training. When the project expenses escalated during implementation, training was the first activity to be subject to budget cuts. As a consequence, the system acceptance and assimilation had been negatively affected especially that many users and managers are still unaware of several functionalities and capabilities of the system.

### *Absorptive Capacity*

Several definitions have been suggested to identify the absorptive capacity (ACAP). The most widely cited definition, however, is that offered by Cohen and Levinthal (1990) who view the ACAP as the firm's ability to identify, acquire and assimilate new knowledge. A firm's absorptive capacity includes two main components: its prior relevant knowledge, and its investments in acquiring and assimilating new knowledge (Ravichandran, 2005). Indeed, Szulanski (2000) argues that the availability of a pertinent knowledge in the organization doesn't necessarily mean its utilization in all the units of the organization, especially when the fundamental competences which allow the proper deployment of this knowledge are absent.

When it comes to the first component, Food Co.'s system users can be classified in two major categories: those who are very interested with the system enjoy "playing" with it and even developing it; and those who are not very enthusiastic with it and who even, in some cases, avoid but still use its information for their daily activities. The first category generally includes most of the superusers and relatively young decision makers who feel comfortable with computers. The second group includes those who see that the system has been made for the operations people and not for them and those who are generally hostile to computers and prefer their older work methods. Nevertheless, the ERP team has tried to integrate indirectly the second group into the system by pushing the information to them. In other words, instead of going into the system, looking for the required information, the reports they require are prepared to them and are presented in the format to which they are used.

As for the second component of the absorptive capacity (i.e., the investments in acquiring new knowledge), Food Co. highly supports and encourages training and knowledge acquirement. IT and ERP team members attend SAP and SAP users' conferences. Such events provide the team members with the opportunity to learn about new functionalities, about other experiences, meet the applications' developers, etc.

At Plastic Co., the impact of the quality and the level of the absorptive capacity was sharper. Overall, the level of computer literacy among users is low to average. The VP IT argues that "computer literacy plays an enormous role in the successful assimilation of the system, then comes the resistance to change and the learning capacity of people (users and managers)". Indeed, resistance to change at Plastic Co. caused the voluntary and involuntary departure of several employees. Others who are still skeptical about the new system, have preferred to bypass the system by working with their own applications, using excel for instance. "There is a continuous comparison between JDE's reports and Excel's reports. In case of divergence, Excel's reports are given the priority over JDE's". These problems as explained by the VP IT were due to the lack of training, education and appropriate system testing which resulted from the hasty "go-live" of the system. He argues that the costs of errors, troubleshooting, extra time spent with users for support and the increased dependence of the latter on the IT people during the post-implementation stage could have been avoided if the go-live was delayed by at least one month. In his opinion, the issue is not about whether the system is difficult to learn and to master or not. It's rather about whether people are used to that type of system and trained to use it or not. He explains: "if I have a user who uses already a Windows' suite and the Web and if I have these features in my new system, the user will eventually quickly master and learn the new system". This statement supports Cohen and Levinthal's (1990) view where they point out that an organization "needs prior related knowledge to assimilate and use new knowledge".

Another point that is worth noting concerning Plastic Co.'s absorptive capacity in general and its investment in acquiring and internalizing ERP knowledge in particular, is communication. According to one respondent, the information that users has received about the system, before its implementation, was exaggerated and it reflected

neither the limitations nor the real capabilities of the ERP system. He argues that communication should have been clearer and should have reflected the real capacity of the system. According to him, the communicated information about the system's capacity was so exaggerated that many users had high expectations about the system. Once they started using it, they were disappointed by its performance and outputs which did not meet their expectations. This has further accentuated the resistance to change and further encouraged the use of old methods of work.

When it comes to Wood Co., computer literacy among managers compared to other users is good especially that they had an information system to work with. The new system's environment, however, was problematic. The difficulty of navigating, the high number of screens and fields in each screen represented a handicap for assimilating and mastering the system. The more the system is used and the more the ERP team develops and improves the system, the more the system is accepted. With the absence of an official and structured training program, some respondents are convinced that there is till a big need to learn about the system functionalities through training, communication and education. They argue that such activities would help users and mainly managers to benefit more from the system. This would, as a result, improve the division's productivity and effectiveness.

### Strategic alignment

For a long time, it has been argued that the strategic alignment between IT applications and strategy is associated with superior performance (Somers & Nelson, 2003; Hirschheim & Sabherwal, 2001). Somers and Nelson (2003) maintain that firms need to better integrate their business plans with the IS in order to ensure the alignment of their information systems with the business strategy. Given the importance of ERP systems, firms need to successfully integrate and align their system with their business strategy. Firms should use several integration mechanisms in order to ensure the ERP alignment with the business strategy. Among other integration strategies, Somers and Nelson (2003) suggest organizational adaptation (using business process reengineering in order to adapt the company to the ERP package and training and educating both top management and users about the system's capability), package adaptation, alignment of ERP with strategy (by placing some IT development resources under a business unit control and by ensuring that the system is perceived as strategically important in the firm), effective project management (by carefully planning, scheduling and monitoring the project, carefully selecting the consultants and the vendor, etc.), and having a steering committee (to make resource allocation decisions, provide organizational leadership, ERP increased visibility and coordination.

At Food Co., respondents assert that the system is perfectly supporting the firm's growth strategy and aligning with it. According to them, this perfect alignment further justifies the high level of assimilation of the system and therefore its success in terms of justifying the firm's needs. Indeed, a steering committee including the top management, IT people and VPs, regularly meet to ensure that the system is aligned with its strategy and to evaluate the new needs and to make the required decisions about the system. In case new modules or major updates are introduced, the necessary training and educations sessions are organized for users.

Similarly, a steering committee consisting of the VPs and the IT people at both Plastic Co. and Wood Co. meets on a monthly basis, in order to review the system progress and examine its new requirements; decisions are then made and later evaluated based on what was realized. It is worth noting that the IT unit operates under the finance department and that, in general the IT people work closely with the different departments.

At Plastic Co. and as was mentioned earlier in section 3.2.3, the new CEO and the new VPs are more aware and better educated and convinced about the system's capacity. The problem remains, however, with some users who are still considering the system to be a burden and useless or who at least don't believe in its capabilities and use therefore parallel applications and reports. This negatively affects the integration level and the fit between the system and the business. Indeed, the lack of training and education are at the origin of this problem. According to our respondents at Plastic Co., users should be better educated and trained about the system. Moreover, parallel reports

should not be allowed in the company and rigorous rules should be set in order to eliminate the redundancy and the resulting loss of productivity and efficiency.

Wood Co.'s respondents stressed the fact that the system perfectly supported their sales strategy and that it even provide them with a competitive advantage compared to their competitors who "were jealous" of their system and of its performance. According to the VP operations, the ERP system is mainly useful for operational rather than for long term forecasts and other strategic decisions since it mainly "provides information useful for managing the division's daily activities". He further argued that there is a "very good linkage between the operations and the sales people in order to identify what's coming in the following weeks".

### User involvement

User involvement has been strongly advocated in IS literature as a means of increasing user satisfaction and acceptance of the system by developing realistic expectations about the system (Kumar et al. 2003; Markus et al., 2000). In fact, if the users' needs are ignored, the risk of resistance and rejection of the system increases and could result in personnel departure and high turnover (Kumar et al., 2003). In the case of ERP systems, taking into consideration the users' suggestions and their feedback, along with an effective education and an efficient communication, could significantly improve the users' buy-in of the new system (Kawalek & Wood-Harper, 2002).

Given that the system has been around since about 10 years, most of the users at Food Co. have adapted with it the system. This is in addition to the fact that generally the people at Food Co., as one respondent asserted, are open to changes and innovations. There are, however, some users who are willingly more involved with the system and with the superusers, mainly the VP operations, by frequently contacting them to suggest and even make improvements, changes and extensions to the system. "They are those who are he most comfortable with computers. They are almost always the same ones who call us. May be because some are more interested than others and that they have a kind of network with the other users".

At Plastic Co., even though most of the users are more and more comfortable with the system, there is still a lack of system buy-in in the company in general which is due to the lack of training and awareness about the system capacities. The ERP unit, however, are presently making efforts to better educating high ranked managers about the system progress, needs and capabilities. Similarly, the superusers are also continuously trained and educated about any new applications and features in the system who will in turn train users in their business unit.

In spite of the discomfort that Wood Co.'s managers had when the system was implemented, their presence on the EPR steering committee and the consideration of their needs and suggestions had a positive impact on their assimilation of the system. Several respondents agreed that the more the system is developed and adapted to their needs, the more comfortable they are. The VP IT further stresses it is essential that "managers and superusers be the owners of their processes and of the use of the ERP system and not the IT". Both the VP IT and the consultant who participated at the system implantation agree that ERP projects are business rather than technological projects. This justifies the need that managers and superusers should be in charge of the system while the IT people look after the ERP's technical aspects.

### Reward system

The link between reward strategies - such as recompensing the acquisition of new skills, linking compensation to company profits and other strategies - and learning improvement and the institutionalization of favorable behaviors has been established in the literature (Jerez-Gomez et al., 2005). Reward systems can also increase the retention rate of skilled employees and encourage further improvements at work (Jerez-Gomez et al., 2005).

In the three companies, however, the reward system and the compensation system have not been changed. According to one respondent at Food Co., the reason is that the "for employees the change was not "harsh", their

responsibility did not change and their regular tasks are unchanged, it's just that they are better done". It is worth noting hat there were no departures at Food Co. since the system was implemented. At Plastic Co., however, there were some employee departures following ERP adoption. There is no evidence however, that this was due to the unchanged reward system. According to one respondent, this was mostly due to the frustration and their rejection of the new system.

### *Institutional pressures*

According to the Institutional Theory, organizations are influenced by their institutional environment and their decisions are made not only to increase their efficiency but also to legitimize themselves in their external environment and not purely to increase their efficiency (DiMaggio & Powell, 1983; Scott, 1995). Institutionalization occurs when organizations face several pressures (like competing for resources, customers, political power, social and economic fitness) which push them to be isomorphic with their environment (DiMaggio & Powell, 1983; Teo et al., 2003). These pressures are described by DiMaggio and Powell (1983) as mimetic, coercive and normative forces.

a. ***Coercive pressures***: Coercive pressures are the external pressures exerted by resource-dominant organizations (dominant suppliers and customers) and regulatory agencies and legislative bodies (DiMaggio & Powell, 1983; Teo et al., 2003). As mentioned earlier in section 3.1, the system at Food Co. has been primarily adopted in response to clients' pressures and requirements to provide quick, integrated and high quality information. Such coercive pressures are, in fact, permanent for Food Co. The superusers and the VP IT admit that these pressures are "obliging them to go further" with the system by adopting new business processes and new functionalities. The firm had to adopt, for instance, new business processes in order to satisfy the clients' requirements for products traceability. Also, some of the clients required recently that Food Co. uses the Advanced Shipment Notices (ASN). This compelled it to integrate the license plates to their processes which they didn't use before. Food Co., on the other hand, is not undergoing any pressure from its suppliers. Similarly, at Plastic Co. some of the clients have special requirements about the exchanged data quality and timeliness. Moreover, since the events of 9/11, new regulations have been administered by the customs which require detailed and timely reports and specific types of information. Using the ERP system helped Plastic Co. providing the required information on time and with the required details. As for Wood Co., coercive pressures are indirect. One respondent brought the case of a change in an antidumping tax that was imposed by the American government. The firm was able to satisfy the governments' requirements thanks to the good understanding of the accounting and finance people of their needs and the IT people development competency. It is interesting to note that thanks to their properly developed system, Wood Co. was ready before the government and the custom broker.

b. ***Mimetic pressures***: Mimetic pressures force firms, especially under conditions of uncertainty, to imitate other structurally equivalent firms, mainly successful ones (DiMaggio & Powell, 1983). Being one of the leaders in the industry to implement an ERP system, Food Co. did not feel any mimetic pressures when they adopted the system. Nevertheless, as more and more competitors are adopting the system, Food Co. feels that they "lost what used to be a competitive advantage". Possessing an ERP system is not anymore a prestige. Because of this, Food Co. realizes that it has no choice but to take the most out of the system and to make extra moves forwards. As the VP operations maintains "(…) benefiting from all the advantages of all the functionalities is sure an advantage , but (we) have also to set off with innovations in this field…we have to be open to new functionalities .. (…).We should not be content by saying my system is stable… it is stable but it should go more forward… so if we don't do that we will be outdistanced". Neither Plastic Co. nor Wood Co. had undergone any mimetic pressures. As the Plastic Co.'s VP operation related: "If there is a (mimetic) pressure, that would be our operational effectiveness which strongly pushes us to better assimilate the system…we have to improve in order to be competitive…by default we have to be better in order to cope with competition, no matter how they arrive, we have to go".

c. ***Normative pressures:*** Normative pressures are exerted by professional communities and professional standards (DiMaggio & Powell, 1983). Because of the evolutionary nature of ERP systems, normative pressures which tend to emerge through ERP user group communities, professional agencies,

conferences, training and other professional events, could hardly be avoided. Indeed, Food Co. has already undergone two major upgrades which were smoothly introduced. Moreover, new modules and functionalities are continuously being added. For Plastic Co., the system will be soon upgraded but the respondents don't feel that normative pressures have an impact on encouraging or hampering the assimilation of the system in their firm.

*Vendor-consultant support*

Several studies have shown that ERP vendor long term relationship is essential for the system's success (Somers & Nelson, 2004; Chang, 2004). In the case of the company, the original vendor no longer exists and upgrades are bought from other vendors. Food Co. has been, however, continuously up-to-date with the system upgrades and innovations through SAP people, conferences, user groups, etc. When an upgrade or a new functionality needs to be installed, either the module vendor sends a consultant to help them with the installation, or the training or they hire an independent consultant. The superusers work full time with the consultant. Then they take the responsibility of transferring the knowledge they acquired to the appropriate users. Having already a few bad experiences with consultants at the time of the first major ERP implementation, the interviewees assert that the good choice of the consultants is one of the important factors for the proper assimilation of the system.

The situation at both Plastic Co. and Wood Co. are quite similar. Both firms do not maintain long term relationships with their original vendors. A consulting firm leads the project including business process reengineering, system installation and training. When Plastic Co. needed to install new modules, a consultant was recruited. For Wood Co., a consultant with an expertise in the industry was recruited to support the firm's implementation efforts. Hence, the consultants' expertise has been considered by all respondents as capital since they are responsible for knowledge transfer for both the IT team and the users.

**Assimilation**

The ERP system's impact varies within a company over time (Gupta & Kohli, 2006). The system at Food Co. is infused today in all the company's department. Our respondents assert that the system perfectly satisfies the business needs in terms of integrity and integration. Even though the system has been implemented since about 10 years, the ERP system at Food Co. is not directly used to make strategic decisions. Likewise, planning decisions are made outside the ERP system, as the operations manager consider it to be too complicated compared to the other software that they use. It is important to stress, however, that the basic source of data for both the strategic and the planning decisions is the ERP system. Control decisions, on the other hand, are totally made with the ERP system using the latter's transactional data. The operations manager has pointed out that the heavy information load produced by the ERP systems can be confusing at a certain point. In order to solve this problem, considerable programming is required. He has also asserted that a more user friendly web interface could be more useful for the manager's decision making.

The ERP systems at both Plastic Co. and Wood Co. are at a stabilization stage. Plastic Co.'s ERP team is still struggling with several problems such as redundancy, the use of parallel systems, the lack of understanding of users and even some managers of the system's value and potential, and the implementation of new modules. When it comes to operations management, the VP operations, who has already an experience with ERP systems, is a strong advocate of the system. He argues that JDE is satisfying several needs of control decisions in the three plants where the system was implemented. At the time when interviews were made, we were informed that extra reports were being built in order to provide a wider and a multifaceted view of the firm's operations. A maintenance module was also planned to be implemented during the following months. Similar to Food Co., planning is done with a separate software as "JDE lacks the flexibility that a real planning software has". Nevertheless, the data used for planning is imported from JDE. In terms of integration, the system is not yet implemented in all the company's business

processes and plants. Even though many information flow walls have fallen between several business processes, with or without the will of the users, there is still work to be done in order to fully integrate the firm's business processes. It is worth noting that, according to the VP IT, the arrival of the new CEO and the new VPs, who have a better understanding of the system's potential, has accelerated and facilitated the project 's advancement.

The following figure positions the three companies according to the level of support of the system to the three main decision levels (execution/operational, planning and strategic) and the width of activities. Note that the size of each circle is proportional to the level of acceptance of the system in each company.

*Figure 2. Companies' positioning based on their ERP assimilation level*
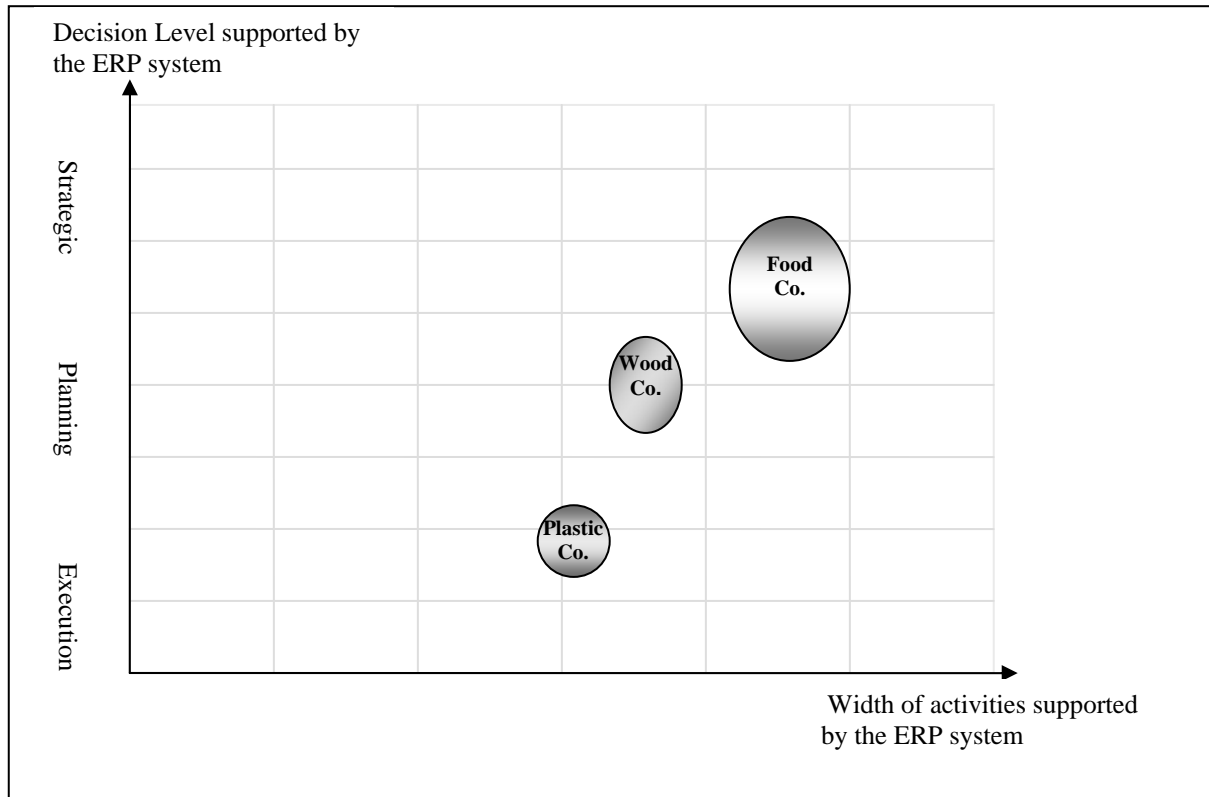


**CONCLUSION AND LESSONS LEARNED**

The results of our research provide the following insights about ERP assimilation and its determinants of success.

- Size in terms of number employees does seem to be disadvantageous for the smaller firm. With about half the number of employees of Plastic Co., it was easier for Food Co. to manage its employees, to train its users and superusers and to educate managers about the system. This has in turn facilitated the assimilation process in the company and limited problems such as resistance to change and turnover.

- Both companies are similar, financially, at least in terms of revenues. Food Co. had the means to buy an expensive enterprise system, regularly extend and develop its system by introducing new modules with the assistance of consultants and provide its ERP people with the required training. Financial resources

could be, therefore, considered as an indirect necessary but not sufficient determinant for improved assimilation.

- The longer the system is in the company, the better it is comprehended and the more the firm depends on it in its operations and decision making processes.

- ERP attributes such as timeliness, accuracy, reliability, flexibility are more attractive during the early stages of the project cycle. During the post-implementation stage, managers and users are aware of the system's capabilities, except in case new modules are introduced or training and education about the system were not adequate.

- IT skills and competence are capital for ERP assimilation. Their presence is crucial to support managers and users, to maintain the system and to make the necessary system programming and development. When specific technical support is outsourced, close interaction with subcontractors is required in order to ensure the IT-strategy alignment and the efficient knowledge transfer.

- Top management championship remains a capital factor for ERP assimilation. Their support is as important during implementation as during the post-implementation stage. They should comprehend the system and emphasize the importance of integration and cooperation across the firm. They should also establish rigorous rules about the use of parallel systems, as is the case at Plastic Co., in order to increase the project's efficiency and to speed up the system's benefits realization.

- Absorptive capacity is another important determinant for assimilation. Adequate training, and education mainly about the system, their tasks and their business process, should be carefully planned according to the managers and users and requirements.

- The continuous evaluation of managers and users' skills and knowledge could avoid the costly and heavy dependence on the IT personnel and would further improve their system's buy-in.

- The system and the business strategy alignment is another requirement for assimilation. Indeed, the ERP system needs to support the strategy of each business unit in order to help managers in their decision making process.

- Considering the managers and users feedback is another important determinant of successful system assimilation. For managers, the fact of being a member of the ERP steering committee helps build a sense of responsibility and of ownership in them which would improve their assimilation. Moreover, they would be more willing to liberate the required employees to participate in the ERP team activities. One other important outcome of manager and user involvement is lower turnover and higher level of loyalty.

- Reward system does not seem to be critical for ERP assimilation. Once the system is integrated in the firm's business operations and becomes a necessity, users and managers have no choice but to use it and to depend on it.

- Coercive institutional pressures exerted by customers or by the government could influence the firm's assimilation and efforts to better deploy the system. When the firm is a leader in its industry, as was the case of Food Co. and Plastic Co., mimetic and normative forces have almost no impact on the firm's assimilation of its ERP system.

- A long term strategic relationship between the vendor and/or the consultant and the firm is not a requirement. When an upgrade or a new module is required, the firm shops for the product. The vendor could send a consultant to help the firm implement the module or it could simply hire an independent consultant who is specialized in that module.

Despite the limited number of case studies, these results may provide guidance to managers, IT professionals and consultants concerning the contextual factors which can influence positively the realisation of the aspired for benefits of ERP systems. This research may also provide insight for the factors which are most problematic and most critical for the system's assimilation and long-term success in the organisation.

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