The role played by interdependences in ERP implementations: An empirical analysis of critical factors that minimize elapsed time

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ABSTRACT

We analyzed the role played by different module types that influence the time spent on an ERP implementation. By using the concept of interdependences together with organizational integration theory, we distinguished between business-support and value-chain modules and affirmed that their respective implementation times would differ. We also highlighted the existence of time-savings and facilitator mechanisms that could reduce the total elapsed time for an ERP implementation with these module types. We found empirical support for our hypotheses by using data from 141 organizations and using econometric duration models. Through contextual, organizational, and project specific controls, our results lead us to the conclusion that value-chain modules take longer than business-support modules to implement. Furthermore, we found empirical evidence of time-savings and facilitator mechanisms in the ERP implementation process.

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1. Introduction

Understanding the factors influencing ERP implementation time is still a managerial problem. In 2003, the Hackett Group reported time overruns ranging from 24 to 100 percent for IT projects. Focusing on ERP projects, the literature has reported that ERP implementations generally take longer than expected [1]. In particular, 90 percent of ERP projects finish late and, on average, the real time spent on each ERP implementation was four times that estimated originally. Moreover, time overruns resulted in additional costs until completion since the success of the implementation is usually linked to on-time completion [21].

Based on the idea that an ERP implementation could be considered a mechanism for achieving organizational integration across departments, we explored complementary explanations of why some ERP implementations take more time than others. Our work was based on three main arguments:

(1) implementation of value-chain modules (e.g., production or distribution) requires more time than business-support modules (e.g., accounting or human resource management);
(2) characteristics of value-chain modules, particularly their high interdependence, allow time savings during implementation;

(3) business-support modules provide integration mechanisms that facilitate a reduction of the time needed for ERP implementation.

Based on duration models, we obtained empirical support for our theoretical arguments.

We collected data from 141 organizations, for the period 2004–2006, through personal interviews with managers involved in ERP implementation. This allowed us to focus on the detail of the ERP implementation phases and, thus clearly determine the time to complete the ERP project. In addition to the number and type of modules implemented, we controlled for contextual and organizational factors, as well as for particular ERP project specifics.

2. Theoretical framework

2.1. Value-chain versus business-support modules: differences in time implementation

Although the total time spent on an ERP implementation grows with the number of modules used, modules do not require the same time to implement. In particular, *value-chain modules* (e.g., supplies, production and distribution processes) take more time than *business-support modules* (e.g., accounting, finance, and human resources management) because of their underlying dependences [2].

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There are three possible types of interdependences – pooled, sequential, and reciprocal; business-support modules implementations mainly have pooled dependences, whereas value-chain modules are sequentially and reciprocally dependent. Business-support modules impact the whole ERP system but although they are supported by the entire system, their successful implementation does not depend on the completion of other modules. However, the integration of pooled modules must overcome any business misalignment, such as differences between the firm's existing business processes and the ERP module processes that appear during the implementation. Moreover, integrating pooled interdependences requires a narrow interchange of materials, resources, and information [18]. Therefore, business-support module implementations are of relatively low complexity, in terms of the cooperation and communication needed between the different areas of a firm [7]; as a consequence, the implementation time is lower than that for other more complex modules.

On the other hand, the implementation of value-chain modules deals primarily with sequential and reciprocal interdependence. In sequential interdependence, a serial relationship exists between modules: the output of one becomes the input of another. For instance, the marketing plan is an input to the production and purchasing plans. Reciprocal interdependence even more complex: the output of module A is the input for module B and vice-versa. Thus, each module is affected by the other. As a result, we conclude that value-chain implementation requires a more coordination and control and that the organizational integration places strong demands on MIS.

In summary, the integration of value-chain modules, takes longer than business-support module implementation. Consequently, our first hypothesis was:

Hypothesis 1. In an ERP system, value-chain modules take longer to implement than business-support modules.

2.2. Relative time savings in value-chain implementations

Each value-chain module implementation requires prior coordination of sequential and reciprocal interdependences with other modules in the value chain. Thus the need to verify correct function requires all value-chain modules to be implemented to perform properly in concert with one another. Prototyping and extensive testing are necessary to find and correct configuration errors. This is because value-chain modules do not run in isolation; the majority of organizational areas involved must be coordinated. The implementation of any value-chain module implies a major investment in terms of time of the specific chain but also in the other modules that share its organizational processes. The configuration of common organizational elements among value-chain modules is reused by the rest of the value-chain modules that share part of their business process structure (company code, plants, sales organization, purchasing organization, etc.). So, value-chain modules achieve time benefits since some individual module requirements are repeated in all the modules. Moreover, homogeneity among value-chains reduces ERP implementation time [6].

However, this is not the only reason for time savings in the implementation of value-chain modules. In particular, greater needs for communication, control, and information are accompanied by greater opportunities for learning [19]. In fact, greater coordination effort provides more opportunities for interaction and access to tacit knowledge. It is reasonable to expect that positive returns from knowledge increase in line with shared competencies and skills. Moreover, interactions during the implementation of highly interdependent modules create valuable opportunities to reconsider initial solutions. Experience gained from "small failures" provides feedback [17]; time savings could accrue from mistakes that are avoided in implementing subsequent modules.

By using these arguments (existence of common interrelations and opportunities for learning), we note that the implementation of a module with sequential or reciprocal interrelations helps the implementation of the modules interrelated with it. As a consequence; when a new value-chain module is implemented it seems reasonable to expect a time saving due to value-chain modules already implemented. This expectation leads to our second hypothesis:

Hypothesis 2. The increment of the elapsed time is smaller with each additional value-chain module implemented.

2.3. Business-support modules as absolute time-savers

In line with the arguments of our first hypothesis, pooled interdependence confers two interesting characteristics to business-support modules: (1) their capacity to be implemented individually and independently of other types of modules, and (2), the possibility that the time employed in their implementation will be lower than for value-chain modules. Since elapsed time is the important variable to minimize, there should be simultaneous implementation of business-support and value-chain modules. The total elapsed time for a global ERP implementation, rather than being the sum of individual times for all module types is that time spent on the module that takes most time: (value-chain modules in accordance with the Hypothesis 1). In summary, although business-support module implementation also requires time and effort, ignoring other factors, the maximum (or absolute) time employed in the total ERP implementation will coincide with the elapsed time in implementing value-chain modules.

However, business-support modules have another attractive facet: they can provide coordination mechanisms that facilitate the whole ERP implementation by reducing the elapsed time for other kinds of modules (e.g., value-chain) and, as a consequence, the total elapsed time. If the organization chooses the proper coordination mechanisms, the absolute elapsed time required to achieve the ERP implementation will be lower. These mechanisms include tools for standardization, direct supervision, planning, and mutual adjustment.

In a standard organization, business-support units supply coordination mechanisms that enable organizational integration. Accounting units are particular integration mechanisms [16]. They help companies to standardize the inputs, processes, results, and knowledge, from different departments, in order to analyze and compare them by integrating pooled interdependences. Accounting processes formalize plans, and help to integrate sequential interdependence. These processes also support direct supervision and control of the business that allows the coordination of reciprocal interdependences by mutual adaptation, using impersonal coordination modes. Also, budgets are effective in coordinating pooled and sequential interdependences [4].

Human resource management provides methods for standardization, oriented to behavior and output control, especially appropriate for the integration of pooled interdependences. Human resource management is responsible for the direct supervision of inputs, contributing to the integration of reciprocal interdependences by mutual adaptation. Human resource planning is an important organizational mechanism to integrate sequential interdependences [12]. Thus, the human resource area also provides mechanisms to coordinate and integrate pooled, sequential and reciprocal interdependences.

These arguments lead us to postulate that business-support module implementation has a special characteristic that converts