

# Enterprise Resource Planning Evolution Process

## A Portfolio Management Approach

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### **Abstract:**

This paper examines how organizations identify and manage the different ERP evolution initiatives using a portfolio management approach. More specifically, this paper identifies and analyzes the different components of the ERP evolution management process. A case study approach with two organizations from the public sector was used to conduct this research. Results show a duality in the ERP evolution where a process is defined and structured for support activity and another is distinguished for project management. The paper examines the impact of this duality on different steps of the ERP evolution process, namely component analysis, component selection and portfolio monitoring and control. The process developed in this study may assist practitioners in the development or improvement of their ERP portfolio management process.

**Keywords:** ERP, evolution process, portfolio management, project management, support activities

### **Introduction**

Organizations are constantly looking for means to be more productive and efficient. Computerizing the work place through automatization of operations and data management has revolutionized the way business is carried out. Specialized programs of different forms (for example Material Requirement Planning) have improved productivity through the use of dedicated software. During the 90's, the need for organizations to integrate their systems and processes led to the emergence of Enterprise Resource Planning (ERP) systems [1]. The ERP market had a first boom during the late 90's as it was considered a good solution to the Y2K bug. After this craze, ERP systems continued to progress with more sophisticated functionalities [2] and with the stabilization and upgrade of the already implemented ERP modules [3].

Hence, the ERP became the nucleus of a continuous improvement cycle aiming at aligning technology to the strategic elements of the organization in order to maximize investments [4]. This cycle, which begins with the initial ERP implementation, is composed of a combination of activities and projects to support the ERP evolution. A recent ERP study realized by Price Waterhouse Cooper mentions that the maintenance costs exceeded the license costs as early as 2005 and that the gap had reached 25 billion dollars in 2015 [5]. These numbers are due to important maintenance efforts coupled with the complexity of certain activities (i.e. software upgrades), which requires project management

activities in addition to the regular support activities [6]. In this context, project management activities and support activities are called components and the ERP evolution requires organizations to consider portfolio management, and particularly IT portfolio management, to manage these components.

Portfolio management is the coordinated management of one or more portfolios to achieve organizational strategies and objectives [7]. A portfolio may be composed of a collection of sub-portfolios, projects and/or operations that are aligned with strategic objectives. A portfolio management process enables the identification, selection and prioritization of projects in the portfolio. In IT, the collection of technological projects may be regrouped in an IT project portfolio [8], which includes ERP post-implementation projects. Hence, the IT portfolio management process carries out the identification, selection and prioritization of ERP evolution projects simultaneously with the other IT activities in the organization.

The objective of this paper is to understand how organizations identify and manage the different ERP evolution initiatives using a portfolio management process. More specifically, this paper identifies and analyzes the different components of the ERP evolution management process. The paper is organized as follows. Section 2 presents the literature review on ERP systems and project portfolio management. The research methodology is then described in section 3. The findings of this study are presented in the following section, while the main conclusions then complete the paper.

## **Literature review**

### *1.1 Enterprise Resource Planning (ERP) systems*

Several definitions of an ERP are found in the literature [9, 10], but it can be summarized as a software system designed to support organizations in the management of the processes or components of their businesses. The ERP automates business processes and gathers transactional business information, giving real-time information visibility to the multiple users dispersed all over the organization. The ERP literature has significantly increased over the last few years [11, 12]. Although the majority of publications are linked to the implementation stage, the interest has somewhat shifted to the post-implementation stage [12].

This study focuses on ERP system optimisation, an under investigated theme associated to the post-implementation stage, which begins when the ERP becomes available to the final users, and ends when the system is no longer used [13]. The researchers interested in the post-implementation stage all agree that the literature on the subject is scarce [10, 14, 15, 16]. Amongst the themes studied by these researchers are found ERP maintenance activities [17,18,19], which are defined by the influencing maintenance strategies [10], the knowledge transfer between the development team and the final users [20], and the knowledge management planning and continuous improvement in ERP implementations [15, 21,22,23].

No clear distinction is made between support, maintenance and evolution activities in the ERP literature, which enhances the interest for this particular study. Several authors [3, 16] consider all activities executed in the post-implementation phase to be maintenance activities regardless of the type (project or support) of initiative. Hence, some activities are defined as support by some authors, but are considered as evolution by others [12].

Empirical research identified several activities considered to be ERP evolution, such as deploying new functionalities, upgrading the system, optimizing existing tools and implementing in other locations of the organizations. Such activities may be perceived as projects according to its definition provided earlier. In

fact, Wenrich and Ahmad [6] state that certain ERP maintenance activities need to be managed as projects in order to be successfully completed. For the purpose of this paper, evolution consists of support activities (permanent structure) and projects (temporary structure).

### 1.2 Project management

In the project management literature, the noticeable links between project management and strategic management helped flourish the theme of project portfolio management. Several authors hence proposed different models of this theme. Archer and Ghasemzadeh [24] built a model that is at the origin of many publications that enabled a deeper understanding of the project portfolio management process. The Office government commerce (OGC) in the UK as well as the Project Management Institute (PMI) also independently developed project portfolio management standards and guides that present well-defined processes.

Project portfolio management is also used to understand the strategic alignment of projects and the portfolio [25], to manage uncertainty [26] and to assess performance of the portfolio [27]. The term “portfolio” originates from the finance literature to represent a group set of investments [28], and may be perceived as a collection of investment projects in an organization [28, 29]. Hence, portfolio management enables a well-balanced selection of projects in order to optimize the allocation of resources and the alignment with business priorities to maximize the return on investment [28].

<b>Steps</b>	<b>Archer and Ghasemzadeh 1999 [24]</b>	<b>OGC 2011 [30]</b>	<b>PMI 2008 [31]</b>	<b>PMI 2013 [7]</b>
<b>Idea generation</b>	Project proposal	Understand (definition cycle)	Identify components and identify portfolio risks	Define Portfolio
<b>Component analysis</b>	Pre-screening and individual project analysis	Categorize (definition cycle)	Categorize components, evaluate components and analyze portfolio risks	Define Portfolio
<b>Component selection</b>	Screening	Categorize (definition cycle)	Select components	Define Portfolio
<b>Component prioritization</b>	Optimal portfolio selection and portfolio adjustment	Prioritize (definition cycle)	Prioritize components, balance portfolio and develop portfolio risk responses	Optimize Portfolio
<b>Portfolio monitoring and control</b>	Phase/gate evaluation	The portfolio delivery cycle	Communicate portfolio adjustments, authorize components, monitor and control portfolio risks, review and report portfolio performance	Authorize Portfolio

Table 1 - Project portfolio management process

Building on Archer and Ghasemzadeh’s [24] model and the subsequent literature, a five step process was developed. It is presented in table 1 along with the association with other models in the literature. The first step of the project portfolio management process is the idea generation for which data on new projects identified by the organization is collected. This step may be carried out by organizations at different frequencies (annually, monthly, etc.) and using different mechanisms to manage and document the ideas.

The second step to the process is Component analysis, which consists of collecting information on specific analysis criteria with the objective of classifying components according to organizational priorities. Components may be categorized according to their size, nature of their activities or the alignment with the business strategy in order to be evaluated and compared.

The third step, Component selection, is realized according to the analysis carried out previously taking into account the components in progress. In order to select the optimal combination of components, the interdependency between components is considered along with the equilibrium between the different categories developed during the component analysis step (size, nature of activity and strategic alignment). At this stage, it is decided if the new components are approved, declined or put on hold in order to define the portfolio.

The fourth step is Component prioritization, which involves the integration of selected components to the portfolio. Resource allocation and execution planning characterize this step. The necessary resources were identified at the component analysis step and the allocation of resources to components is carried out during this step in order to optimize the global allocation of resources within the organization. This step also covers the operationalization of the component implementation in order to adapt itself to the reality of the organization for a determined period of time.

Finally, the last step, portfolio monitoring and control, consists of component progression monitoring activities using global portfolio performance metrics to diffuse. The metrics involve the establishment of indicators for different milestones and for periodic assessments of the portfolio. Results from these metrics are consolidated and communicated in the organization in order to establish a new portfolio management process cycle, and to facilitate punctual decision-making.

The different activities involved in these five steps are aligned with Pennypacker and Retna's five conditions for an efficient portfolio management process: investing in the right project, optimizing organizational capacity, realizing the planned benefits, ensuring the capacity to absorb changes and managing performance [28].

### **Methodological approach**

A case study approach was chosen to conduct this study as it enables the researchers to retain the holistic and meaningful characteristics of real-life events [32]. The sampling was conducted both at the organizational level and the respondent level. Selection criteria were used to ensure the quality of the information provided and to validate the subsequent research results [33]. Data collection was then conducted via semi-structured interviews [34], which were then recorded and transcribed. The number of interviews was established according to semantic saturation and theoretical data saturation [34]. Semantic saturation is obtained when the additional interviews conducted do not bring any new descriptors from prior interviews [34]. Theoretical data saturation is attained when each descriptor in an interview is placed within a theory or a model, obtained either by the author or the literature [34]. A mixed interpretation strategy (descriptive and graphical analyses) was used to compare processes and to develop a process model that will help understand the knowledge transfer process exploited by the organizations [35].

As previously mentioned, the literature on the evolution of ERPs is relatively scarce, which justifies the methodological approach chosen [36]. Furthermore, the distinction between the phenomena and the context is not clearly delimited [37], which also calls for a case study approach. The unit of analysis being the organization, the case study approach was chosen to collect the data for this level of analysis.

A five step methodology was followed. First, organizations and respondents were selected. The sampling was conducted at the organizational level and also at the respondent level. Selection criteria were used to ensure the quality of the information provided and to validate the subsequent research results [33]. Second, data collection was conducted via semi-structured interviews [34] and document analysis to ensure the data triangulation [32].

The semi-structured interview allows the respondent to exchange on a subject defined from the start [34]. The interviewer orients the respondent with reformulated questions to ensure that the themes of the interview are all covered. The interviewer also observes and actively listens when conducting the interview as he must not only take into account what the respondent says, but also how he says it and what he feels when saying it [36]. The narrative and graphical representations of the process followed, for which a mix interpretation strategy was used to analyze each case individually [35]. Following the individual analysis, a cross-case data analysis was conducted to identify similarities and differences in the process. Finally, a panel was conducted with key representative of each company involved to validate and understand the results of the research.

### *1.3 Profile of the organizations and respondents*

Two organizations from the public/para-public sector were chosen to participate to this study. With over 30,000 employees, the ERP of Organization A, a large municipal actor, was implemented in 2006. Since 2010, three initiatives have been developed to add advanced procurement functionalities, a human resource module and a payroll component (all from the same editor). Organization B, which employs 9,000 people, conducts its activities in the field of transportation and has gradually implemented several ERP modules (all from the same editor) over the last 13 years.

For each of these organizations, interviews were conducted with three different profiles (IT support managers, IT project managers and ERP internal customers). The interviews lasted approximately 75 minutes. A total of eight interviews were conducted in the two organizations. We also used some documentation used by the respondent in their respective processes to complete the data gathering and to complement the results.

## **Findings**

From the analysis of the five step process, different findings were discovered through the analysis of the data collected. These findings are presented in this section.

### *1.4 Duality of the IT portfolio management process*

The definition of the business need and its validation by the internal customer is realized during the idea generation step. At this stage, the evaluation of the complexity and scope of the required IT efforts related to the ERP is established. A categorization is carried out to identify and differentiate support activities from IT projects. Both organizations mentioned that they use qualitative and quantitative indicators at this step to categorize the initiatives, with the objective of submitting the idea to an appropriate structure. Structures are set according to the risks associated to initiatives. A project manager from Organization B mentions this fact when mentions IT resources in his day-to-day activities:

*It's a two-tier system. With change requests, generally, the advantage is that we can work on the requests that are, let's say, evaluated in a way that requires little resources, making it easily to realize. They don't have to wait until the end of large projects that last generally 3 to 4 years before making the resources available, generally, we can pass quickly.*

The quantitative appreciation is carried out based on a high level effort estimation, which includes a contingency to assess the risk level. In certain cases, the quantitative estimation does not clearly help in the idea categorization; hence, the use of qualitative factors is then used to justify the categorization.

A manager of the SAP Solution team in organization B elaborates on this aspect, notably exploiting the number of stakeholders to justify his categorization:

*Even during maintenance sometimes, there are change requests [...] that are big. It can take up to 50, 75 work days, but since it is for the system under my supervision, I can take care of them. No need for a project [...]*

An interesting result is the sub-categorization of IT projects, where both organizations have defined a budgetary value for projects that separates small projects from large projects. The nature of the categorization of the IT initiatives also influences the financial structure and governance structure of this initiative. On the financial side, ERP support activities are covered by the operational IT budget while projects are covered by a corporate capital expenditures budget where each project has its own specific envelope.

Regarding the governance structure, the actors involved in the governance structure for the support activities in organizations A and B are operational managers. In organization A, potential support activities are analyzed by the ERP Solution team manager, while for organization B, a coordination committee has the responsibility to evaluate the support activities.

For new IT projects, the component analysis is carried through a decisional committee which consists of executive level managers that represent the entire organization and its IT projects. In Organization A, a prioritization committee evaluates all small IT projects, including the ERP related projects, while a portfolio management committee carries out the analysis of all major projects including large ERP related IT projects. In organization B, a sectorial IT committee evaluates all of the IT projects, including ERP related projects.

Hence, in both organizations, small IT projects are evaluated by similar committees in regards to its decisional nature. However, in organization A, distinctions are made for major IT projects that may be illustrated by two specific aspects. First, major IT projects are not prioritized by an IT committee in this organization. The IT project management office supports internal clients and guides them in the development of a detailed project charter and in the preliminary prioritization level of major IT projects before the documentation is sent to the portfolio management committee. Second, major IT projects are submitted to an extra categorization step, which aims at regrouping the new IT projects according to five strategic organizational axes before evaluating the level of priority of each project.

Here again, we can link the governance structures of organizations A and B with their budget structure. In Organization A, the prioritization committee is responsible for the budget dedicated to small IT projects, while the portfolio management committee is responsible for the budget allowance that is distinct for each of the five strategic axes that regroups all of the major IT projects (IT and non-IT). In Organization B, the budget is under the responsibility of the IT sectorial committee for all projects regardless of the size or scope. The prioritization of the support activities or projects is carried out by the managers or decisional committees responsible for the budget allowance of ERP evolution initiatives

Organization A applies the concept of capital rationing, in which a budget is divided in distinct budget envelopes. Capital rationing is used by organizations to reduce risk and to favor the achievement of specific strategic objectives [38]. In such a context, an amount of money corresponding to the importance of the strategic axe in the realization of organizational objectives is allocated to each envelope. In

Organization A, major projects are analyzed in each of these axes rather than globally. Hence, each axe is considered as a project sub-portfolio for which there is no formal optimized process of fund allocation. The component analysis step enables the optimization of resources in the sub-portfolios, but no mechanism was found to optimize project allocation at the corporate portfolio level.

The composition of the different levels of governance structure is aligned with Goyette's results, which indicate that the profiles of the individuals that document a project are set according to the composition of the IT capital expenditures [8]. When IT capital expenditures aim at supporting operations, a team, composed of operational groups, administrative groups and IT groups, leads the process. When IT capital expenditures are operational in nature, operational groups lead the process under the supervision of a control group (usually outside of the IT sphere). This control group, which analyzes and evaluates priorities of small and large IT projects, is composed of executive level personnel.

	<b>Main results</b>
<b>Component Analysis</b>	<ul style="list-style-type: none"> <li>• Initiatives are categorized as either support activities or projects based on quantitative criteria (i.e. effort, dollars)</li> <li>• Qualitative criteria are used when quantitative criteria are not convincing</li> <li>• Certain organization create a second categorization for projects to distinguish small projects from major projects</li> </ul>
<b>Component Selection</b>	<ul style="list-style-type: none"> <li>• Categorization is linked to the financial structure of the organization: support activities are covered by operational budgets and projects are covered by capital expenditure budgets</li> <li>• Categorization is associated to the governance structure of the organization: support activities are covered by middle level managers and projects are covered by executive level managers</li> <li>• Sub-categorization of projects also creates separate governance structure</li> <li>• IT resources cover the realization of IT components, but there are no coordination mechanisms to manage and share them for support activities and project planning. Resources capacity is hence overestimated</li> </ul>
<b>Portfolio monitoring and control</b>	<ul style="list-style-type: none"> <li>• Monitoring and control mechanisms exist to support activities and projects</li> <li>• Global performance of the IT investments (support activities and projects) portfolio is not measured</li> </ul>

Table 2 - Main conclusions of the study

### *1.5 Impacts of a dual structure on component analysis*

The examination of the component analysis showed the necessity to use two different structures for the operationalization of support activities and projects. The support team manager is responsible for the management of the support activities, while the IT project managers are responsible for the management of IT projects. However, to realize the initiatives in both spheres, the same pool of IT resources (internal and sub-contractors) are used. Hence, each group overestimates its capacity to deliver by not adequately taking into account their respective engagements, which leads to a large number of initiatives approved but that are not delivered in time or on budget according to the original plans. This finding was validated with both organizations in the retroaction phase of the research.

### *1.6 Impacts of a dual structure on IT evaluation*

In both organizations A and B, portfolio monitoring and control is done on regular basis for each component category (support activity and projects), but there is no global view of the IT portfolios. A validation with the organizations confirms the absence of mechanisms to evaluate the overall performance

of the IT portfolio. Organization B also mentions that they were aware of the situation and that they were trying to find a way to provide this global view of the portfolio for their executives.

## Conclusion

The goal of this paper was to understand how organizations identify and manage the different ERP evolution initiatives using a portfolio management process. A five step ERP evolution process was developed using the literature and guided this qualitative research initiative where two organizations, in their ERP post-implementation stage, were analyzed.

Practical contributions were identified during the analysis of the results. First, as the ERP evolution process is composed of two main processes (support activity process and project management process), they must clearly be distinguished to optimize their related activities with the available resources. The empirical results of this research contribute to the project portfolio management literature as the existing research on this process is conceptual in nature. Models, such as Archer and Ghasemzadeh [24], OGC [31], and the different editions of PMI's standard for Portfolio Management [7, 31] are all theoretical models that have not been tested empirically.

Second, the process developed is also a practical contribution as it can support practitioners in the development or improvement of the ERP portfolio management process. The capacity, in terms of IT resources to realize all of the evolution initiatives, emanates in large part from the internal resources of the IT support team. This situation provokes an overestimation of the feasibility of projects and support activities, which leads us to consider the planning of IT capacity for these two processes at a pre-established moment in order to avoid duplications or omissions of resources, hence favoring an optimal resource allocation process. This may give more visibility to smaller initiatives (such as change requests) in decisional committees in other governance structures in order to allow for a more realistic evaluation of the evolution initiative feasibility.

With an appealing access to detailed information, an exploratory approach with specific profiles of organizations and respondents was chosen, but the generalization of the results is not possible with this limited sample. Both analyzed organizations are from the public sector, and hence, our results may not be generalized to organizations from the private sector although, as illustrated by Goyette [8], public organizations rely on a continuous IT capital expenditure management process to generate initiatives, whereas private organizations rely on a cycle with predetermine periods.

Future research opportunities ensue from this paper. A sample from the private sector may be analyzed to add to the results obtained and distinguish both individual routines and common processes in these sectors. Finally, our study revealed a link between ERP evolution management and the finance literature on capital expenditure. The five step ERP evolution process is quite similar to the elements in Burns and Walker's [38] capital expense management process. Hence, it may be interesting to investigate how this branch of literature may influence the IT evolution literature.

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