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ERP and Information Systems

Integration or Disintegration

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Foreword

This book written by Tarek Samara gives a relevant overview of the evolution and impact of enterprise resource planning (ERP) on information systems (IS). As he is both a professional ERP expert and a researcher, the author has a deep understanding of what is at stake nowadays in IS strategy. This book might be considered to address a paradox that has rarely been highlighted in the literature. First, it provides the readers with rich insights into the history of ERP and, going back to MRP, explains how the integration process was made possible by enterprise applications. Second, it shows how this evolution of ERP can sometimes eventually lead in itself to IS disintegration. The author does not only explore the paradox, but he also pinpoints the main factors affecting the relationships between the evolution of ERP systems and the integration or disintegration of the IS.

Thus, the author gives us a useful framework. The seven factors identified by the author are the influence of economic crisis and competitiveness on the level of IS investment, the arbitrage made by companies considering the dependency on the ERP vendor, the success or failure of the ERP project management, the interoperability of the ERP with other applications running in the IS, the choice made between two evolution strategies of existing systems (urbanization or total overhaul), the complexity level of ERP and the evolution strategy of ERP vendors such as the expansion scope of ERP perimeter. The author shows how all these factors are crucial and critical for IS management.

The outline of the book is the following. After an introduction, the first chapter describes the research terms. The second chapter deals with ERP trends. The third chapter explains the research question and methodology.

The fourth chapter explores the literature review. The fifth chapter analyzes the relationships between these research factors. In the sixth chapter, the validity of the research question is verified due to three case studies. Chapters 7 and 8 are devoted, respectively, to a discussion (relationships between research factors and the evolution of ERP systems and IS) and research interests and limitations. Finally, a conclusion is given.

The contribution of the book is threefold. First, it offers a unique typology, which gathers all the different possible ERP evolution scenarios, and highlights their impacts on IS integration or disintegration. In this way, this book is an opportunity to take stock of the different available strategies to prevent the IS disintegration.

Second, the book takes into account the main challenges faced by chief information officers (CIOs) and gives us relevant clues to foster rational selection (and purchase) of an ERP package, and improves the success of its implementation. It is definitely a recent topic because of the growing pressure of ERP vendors on their clients, and of the general context of economic crisis that tends to kill a lot of innovative information technology (IT) projects.

Finally, the book's key quality is to show that the future of ERP system evolution will not be a matter for vendors only. The book refers to the work of Freeman and raises the question of the stakeholders: firms, vendors, consultants, consultancy firms, etc. It is only by involving and taking into account all the stakeholders in the IS governance that solutions can be found. The author posits that stakeholders' participation is a key point to engage enterprises in a positive IS evolution, and advocates such kinds of corporate policy.

For all these reasons, this book could be not only useful for researchers, teachers and students but also for practitioners and IT professional experts. Its content can provide fruitful insights to anyone who wants to know more about ERP issues and how to address them.

Philippe EYNAUD
August 2015

Introduction

The evolution of enterprise resource planning (ERP) packages and the principal types or degrees of information systems (ISs) integration is to be discussed in this introduction. The factors affecting the relationships between the evolution of ERP packages and the integration or the disintegration of the ISs are also discussed.

After the first expansion, between 1980 and 2000, from "material requirements planning (MRP)" and "manufacturing resource planning (MRP II)" toward "enterprise resource planning (ERP)" considering the modules like production planning, purchasing, manufacturing, sales, distribution, accounting and human resources [ESC 99], a second evolution seems to be in progress. In order to meet the new requirements of users, it is important to take into account the framework of the ERP, new modules like "customer relationship management (CRM)", e-business, "supply chain management (SCM)", "product lifecycle management (PLM)", "business intelligence (BI)", etc. For the purpose of our research, the package which is the result of the first expansion is termed "ERP 1st Generation (1st G)" and the package that is the result of the second evolution is called "ERP 2nd Generation (2nd G)."

Various authors have written about the degree and the maturity of "information system (IS)" integration. Depending on the architecture's composition, many degrees or rates of IS integration are present today. Our study draws attention to two principal types or degrees of IS integration: a "total integration of IS (TIIS)" and a "hybrid integration of IS (HIIS)". Many studies have been conducted on the evolution of IS. This kind of research often analyzes paths of integration from a "disintegrated information system

(DIS)" to an "integrated information system (IIS)". These paths could be not only from a DIS to a HIIS or to a TIIS, but also from a HIIS to a TIIS. However, according to our study, a possible way back or a regression from integration toward disintegration (from a TIIS to a HIIS or to a DIS) has never been highlighted. Our study will discuss whether this type of regression is possible due to the evolution of ERP systems.

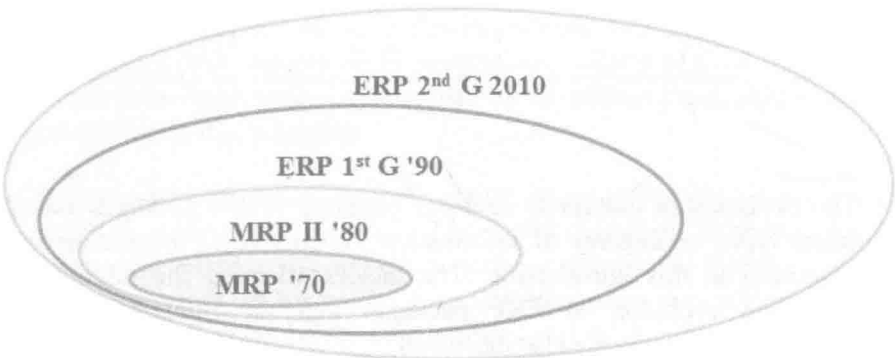

Figure I.1. *Evolution of ERP system*

As an ERP system is an indicator privileging IS integration, its selection and then its implementation by a company (which could be a success or a failure) could also be taken into account as factors that improve (or not) this integration. This study of factors as "critical success factors (CSFs)" and "critical failure factors (CFFs)" permits us to determine the evolution's trajectory of IS (toward integration or not) and also to analyze the contribution of ERPs in the IS integration. Reasonably, CSF could promote integration while CFF could prevent this integration and could even observe the IS in a state of disintegration.

This book analyzes some of the factors affecting the relationships between the evolution of ERP systems and the integration or the disintegration of the IS. More briefly, this analysis aims to study whether assigned values given to these factors could guide the evolution of ERP systems in a way that promotes IS integration; and if the assigned values opposite to the same factors could guide the evolution of ERP systems in a way that provokes IS disintegration instead.

In spite of the fact that the evolution of ERP systems is developed by vendors, this crucial mission should not be delegated solely to these vendors any more. In the future, all stakeholders (vendors, integrators, consultancy firms, clients, etc.) should be involved in the evolution of ERP systems. The experiences and the useful suggestions of integrators and of consultancy firms, as well as important feedback from clients, should also be considered. Accordingly, this research does not limit the analysis of the evolution of ERP systems to factors that are related only to vendors. The studied factors are:

– *"Economic crisis and competitiveness (ECCO)"*;

– *"Total dependency on the ERP vendor (TDEV)"*;

– *"Project management ERP (PMER)"*;

– *"Interoperability of the ERP (INTE)"*;

– *"Evolution strategy of existing systems (ESES)"*;

– *"Complexity of ERP (COER)"*;

– *"Evolution strategy of ERP vendors (ESEV)"*.

The principle behind the selection of the seven research factors is as follows:

– *"Economic crisis and competitiveness (ECCO)"* should be taken into account because of the knowledge that, during a period of economic crisis, firms hesitate to make important and expensive investments. This hesitation could impact the IS integration. "Implementation of ERP systems in many organizations is characterized by troubled multimillion dollar software deals that produce spectacular failures and large spending nightmares" [WAI 09]. Many times in ERP projects, costs exceed budgets [FIS 11, PAN 11, NAU 07]. However, companies can be motivated if a "return on investment (ROI)" calculation shows that buying an ERP system can improve their competitiveness [SHA 00, BAR 02, KAM 08, FED 09]. Therefore, the economic crisis and competitors should be studied together, as this combined factor could be involved in the determination of the IS integration rate. Moreover, competitiveness requires that companies complete the perimeter of their ISs by adding new subsystems: CRM, e-business, SCM, PLM, etc. The successful expansion of the IS's perimeter depends on the firm's evolution strategy of its existing systems;

– *"Total dependency on the ERP vendor (TDEV)"* could impact the IS integration. Firms should make an arbitrage to decide whether they prefer a dependency on an ERP vendor or not [LAM 01, NAU 07]. The IS integration rate could be different depending on this arbitrage. Total dependency means that ERP vendors should be able, within the framework of an evolution strategy, to develop and to commercialize a complete ERP (including old and new modules);

– *"Project management ERP (PMER)"* occupies an important role in the IS integration. Its success or failure leads to different rates of IS integration. "Three quarters of ERP projects are considered failures and many ERP projects end catastrophically" [RAS 05]. The success or failure of a project management is generally related to the complexity of ERP;

– *"Interoperability of the ERP (INTE)"*, which is a measure of how the ERP is interfaced or integrated with other subsystemswithin the framework of the IS, also plays a crucial role [MAR 01, BID 04b]. Interoperability could help to determine the integration rate in IS;

– *"Evolution strategy of existing systems (ESES)"* chosen by the firms is an important factor. When a company implements an ERP system within the framework of its IS evolution, there are mainly two strategies: urbanization or total overhaul. The choice of a given strategy, which depends beforehand on the state of the existing systems [RET 07, MAR 00a, LON 01], could also affect the integration rate in IS;

– *"Complexity of ERP (COER)"* could likewise be involved in the determination of the IS integration rate. ERP systems are extremely complex and difficult to implement, and many implementing companies have encountered unexpected failures [YAJ 05];

– *"Evolution strategy of ERP vendors (ESEV)"*, which defines the enlargement of the perimeter (scope) of the ERP, is also to be taken into account as an indicator of the IS integration rate. The larger the expansion of ERP perimeter, the higher the IS integration rate.

After this introduction, we will define the research terms in the first chapter. We will present the ERP: contribution and trends in the second chapter. The research question and methodology will be explained in the third chapter. The literature review (research factors affecting the relationships between the evolution of ERP systems and IS integration or

disintegration) will be discussed in the fourth chapter, followed by the fifth chapter that analyzes the relationships between these research factors. The validity of the research questions is then verified in the sixth chapter by three case studies. Chapters seven and eight are devoted, respectively, to a discussion (relationships between research factors and the evolution of ERP systems and IS), research interests and limitations. Finally, a conclusion is given.

Contents

1

Definition of Research Terms

This chapter defines the research terms. We turn our attention to the definitions of the artifacts under consideration because the study of a discipline is principally the study of the language of the discipline [POS 88]. Agreed-upon terms lead to agreed-upon meanings [DAV 05].

– an enterprise resource planning *(ERP)* system is an integrated software solution, typically offered by a vendor as a package that supports the seamless integration of all the information flowing through a company, such as financial, accounting, human resources, supply chain and customer information [DAV 98]. An ERP consists of a set of fully integrated modules that run out of a single database. It covers all functions of the company and allows users to have real-time access to data. ERP systems contribute to integration in two ways, process-wise and data-wise: "the uniqueness of the database and the adoption of workflow management systems support the integration of the information flows that connect the different parts of the firm" [BER 02]. These systems are comprehensive packaged software solutions which aim for total integration of all business processes and functions [GAR 05]. For the purpose of our research, we distinguish between two types of ERP (first or second generation):

- *ERP first generation (1st G)*: we have chosen to use "1st G" to indicate an ERP system that comprises old modules only (finance, accounting, controlling, treasury, human resources, production, material management, sales and distribution, plant maintenance, project system and quality management). Most ERP systems before 2005 can be considered to be from this first generation. According to the definition of ERP, this package must be sold by one vendor,

- *ERP second generation (2nd G)*: we use the term "2nd G" to refer to an ERP system that comprises both old modules (ERP 1st G) and new modules (customer relationship management (CRM), supplier relationship management (SRM), supply chain management (SCM), product lifecycle management (PLM), business intelligence (BI), e-business, etc.). ERP systems after 2005 can be considered to be progressing toward the second generation. According to the definition of ERP, this package must be sold by one vendor.

– A *total integration of information system (IS) (TIIS)* is indicative of complete integration (integration rate is 100%); for example, when the IS of a firm consists of only one ERP system such as SAP or Oracle [ANI 01]. This ERP system could be 1st G or 2nd G, according to the users' needs and/or the implementation date (for example, 2000 or 2013).

– A *hybrid integration of IS (HIIS)* describes architecture that is more or less integrated. For example, the IS comprises different applications and ERP systems. It is a well-known fact that some legacy systems are not replaced when companies adopt the ERP solutions [THE 01]. HIIS is a set of subsystems (including ERP systems and other applications) that are more or less integrated [SAM 04].

In addition, an IS could become an HIIS when the architecture comprises many "Best of Breed (BoB)" applications. Some organizations have developed their own customized suites of enterprise applications, an approach known as a BoB information technology (IT) strategy [LIG 01]. Due to the fact that the packages of BoB applications come from different vendors, this strategy can be associated with extensive compatibility and integration issues [MAC 08].

A BoB IT strategy could also lead to an HIIS that is composed of many ERP systems. "If a customer prefers combining several ERPs by a Best of Breed approach instead of an ERP, that is fine. I simply say good luck. Such architecture could work at a given time T, but what will happen when the software in question undergoes updates? You should know that companies must make sooner or later these updates because no vendors ensure maintenance of the T minus 2 versions of its software. And every update is likely to jeopardize the integration work that holds this assembly. In short, if a company wants to spend 80% of the workforce of the IT maintenance, Best of Breed is probably a good way... But I also believe that management may be more sensitive to the functional argument of the approach that we offer with our E-Business Suite" [ANI 01].

– A *disintegrated information system (DIS)* is not at all integrated or weakly integrated. It comprises disparate legacy systems including applications and ERP systems. These applications are often not developed in a coordinated way but have evolved as a result of the latest technological innovation [THE 00]. For the purpose of our research, a DIS could consist of some applications and many ERP systems that are not at all integrated or weakly integrated in an uncoordinated way.

– An *integration rate for an information system* could be measured, according to our definition, by the presence of an integration indicator such as an ERP system and interfaces (enterprise application integration (EAI), enterprise service bus (ESB), extraction, transformation, loading (ETL), extensible markup language (XML), etc.) in the IS. Changing user needs continuously affect the IS integration rate. The integration rate is favorable (integration) when there is an increase in the ability of all subsystems in a given information system (IS) to exchange data, whereas the integration rate is unfavorable (disintegration) when there is a decrease in the ability of all components (subsystems) of a given IS to exchange data.

Elements of comparison	DIS	HIIS	TIIS
Estimated overall vision	< 50%	Between 50 and 80%	100%
Satisfaction of users' needs	Low	Between average and high	High
Architecture coherence	Low	Between average and high	High
Number of vendors	Many	Between two and many	One
Technologies used	Different and varied	Different and varied	One technology
Number of databases	Many	Many	One
Degree of coupling intersubsystems	Missing or low	Between average and high	High
Communications intersubsystems	Asynchronous	Asynchronous and synchronous	Synchronous
Interoperability between subsystems or modules	Missing	More or less effective (not native interoperability, EAI, ESB, API, ETL, XML, etc.)	Native interoperability

Number of interfaces	Neither or maybe a little bit	Many	Native interface
Estimated integration rate	≤20%	>20 and <100%	100%
Type of interfaces	Manually: different tools (universal serial bus (USB), floppy, compact disc (CD) and mails)	Manually, semi-automatic and automatic	Automatic
Importance of the interfaces' configuration settings	There are no interfaces to be configured	Very important	Priority given to the ERP system's configuration
Processing time	Batch processing	Batch and real time	Real-time processing
Evolution strategy of IS	Missing	Often an urbanization, rarely a total overhaul	Often a total overhaul is needed, rarely an urbanization

Table 1.1. *Comparisons between different degrees of integration: DIS, HIIS and TIIS*

– An *information system's perimeter* could consist of different subsystems (ERP systems, BoB applications, applications developed in-house, etc.); many examples are given in Table 1.2. Changing user needs continuously affect the perimeter of an information system.

IS No.	The IS perimeter consists of	Integration rate (IS)
1	ERP 2nd G (only one vendor)	TIIS
2	ERP 1st G (only one vendor)	TIIS
3	Different old applications developed in-house: accounting, controlling, HR, buying, selling, production, etc.	HIIS or DIS
4	BoB (many vendors): old software (accounting, HR, material management, sales and distribution, production, etc.) and/or new software (CRM, SRM, SCM, PLM, BI, e-business, etc.) A BoB IT strategy could consist of one or many ERP systems	HIIS or DIS
5	Some or all modules of IS No. 2 + some applications of IS No. 3 and/or some BoB applications of IS No. 4	HIIS or DIS
6	Some applications of IS No. 3 + some BoB applications of IS No. 4	HIIS or DIS
7	IS No. 3 + new ERP modules: CRM, SRM, SCM, PLM, BI, e-business, etc.	HIIS or DIS