

REVIEW

Open Access



Survey on ERP's customization-driven requirements engineering

Frankie Etame* and Roger Atsa

*Correspondence:
etamefrank@yahoo.fr
Computer Science
Department, University
of Yaounde I, Po. Box 812,
Yaounde, Cameroon

Abstract

Since the dawn of time, the implementation of an information system has always been useful to represent an organization and its processes. ERP was then quickly adopted by organizations, because it is composed of the standard generic processes and good practices. Many scholars agreed that it is cheaper for an organization to mould its business process to an ERP and vice versa. The challenge now is to customize the ERP, so that it may be in adequacy with the business process of the organization and keep all its innate advantages. This document is, therefore, an introspection in the ERP domain and, particularly, its customization based on requirements engineering.

Keywords: Customization of an ERP, Implementation of an ERP, Requirements engineering

Introduction

Governments because of their social obligations, their high public and legislative responsibilities, willing to double the efficiency of their actions and, to offer a best quality of service to their citizens, migrate more and more towards the Enterprise resource planning (ERP) (Kumar et al. 2002). ERP is a definable computer science application modular an integrated which aims at federating and optimizing the organization management process by proposing a unique referential, coherent, and basing upon rules of the standard management (Pérotin 2004). ERP is, therefore, a tool enabling the use of a unique information system, identical to the organization and, that allows an integration of all these processes, and a flow of information and activities.

The implementation of ERP is the focus of many research works believing altogether that one of the greatest challenges of this activity is its contextualization or customization to the environment of the organization (Purohit et al. 2012). It is a matter of assuring the adequacy between the requirements of the organization and the functionalities of the information system (Tobie et al. 2016). Developed at the base for generic business processes and of “best practices” of the organization's processes, ERP does not offer the same quality of service for business processes specialized and specific to the organization (Rohde and Zhong 2014).

This document is, therefore, interested in the empirical works on implementation of ERPs in a particular way. It emphasizes on fields like implementation phases of the ERPs in a particular way; reasons that brought their customization, critical elements for the

success of an ERP's customization, methods, models, and techniques existing of customization of an ERP. These subjects not being the only affordable for a complete view on past works concerning ERPs, we shall evoke the limits of past works in the matter of customization of ERPs.

The concept of ERP's customization

Agreeing with Luo and Strong (2004) (Parthasarathy and Sharma 2016), the customization of an ERP is a process that implies the modification of an ERP, so that it may correspond to the company's process. They summarize customization into three operations, namely: the selection of modules of the native ERP, configuration of tables, and code modification. This definition contrasts light ones (2001) who, in a less procedure oriented perspective, consider customization as an activity, producing changes or adding to the existing functionalities on the ERP. In opposition to the previous views, Davenport (1998) thinks that: customization of an ERP is just a choice, the configuration of modules and tables. Adaptation and modification terms of an ERP are also used to designate the customization of an ERP. Brehm et al. (2001) define adaptation as the setting of module parameters of ERP, to reflect the business process of the organization. They define modification as changes operated on the source code of modules of the ERP to improve it to make it equivalent to the business process. The difference between these two terms is clearly situated in the fact that, to perform a modification, an organization needs an external expert, whereas the possibilities of configuration are innate to the ERP.

Hong and Kim (2002) describe modification as that alteration of the source code of modules that do not change the identity of the basic ERP. In their research, they talk about adaptation to describe the eight (08) types of adjustment referenced to in the research of Brehm. They also talk about customization, extension, and modification as designated in glass researches (1998).

From what precedes, it is clear that there are many interpretations and conceptualizations of the term customization of the ERP in the existing literature. To clarify these different terms that all referred to customization, the Table 1 explains what is understood by each of these authors to express their ideas.

The words: configuration, modification, adaptation, customization, and extension have the value of synonyms but with different meanings and understandings. This impacts on the implementation of an ERP which may differ from one organization to another. This difference can be justified by the reasons that led to the customization of this ERP.

Reasons leading to customization of ERPs

The reason mostly used for customization of an ERP is that it enables to fill the gap between the functions of an innate ERP and the business process existing in the organization (Luo 2004; Brehm et al. 2001). In spite of the functional differences, the other reasons for customizing an ERP can be noticed according to their influence upon the beneficiary social groups. Following Luo (2004), these reasons can be presented according to the different steps of the lifecycle of an ERP, knowing: "before implementation" and "after implementation". The reasons of customization before implementation are: resistance to change, the uniqueness of the business process, and unadaptation of the functions of the innate ERP. The reasons of customization before implementation are:

Table 1 Different types of customization in the previous works (Tasanen 2018)

	Luo (2004)	Brehm et al. (2001)	Glass (1998)	Hong and Kim (2002)
Configuration	Configure the modules of the innate ERP to represent the business process of the organization	Regularize the modules of the innate ERP to reflect the functionalities of the organization		Choose in the beginning the concerned processes and set the parameters of the innate ERP
Modification	Modify the source code of the innate ERP	Modify the modules code to produce a unique business process	The user changes the source code of the innate ERP	Modify the source code of certain modules
Adaptation		Includes the configuration and the modification	Synonym of customization	
Customization	Includes the configuration and the modification	Synonym of configuration	Settle the values of the tables and choose the concerned processes	Does not change the identity of the ERP (at the same time synonym of configure)
Extension/service supply to the user		Program an additional software in an open interface	Implement the local solutions	Fill the gap between the functionalities of the ERP and the needs of the organization

maturity of the organization, maturity of the ERP, and the changes due to the needs of the final users.

Rothenberger and Srite (2009) have studied how the customization of an ERP can be produce at a high level. These studied have explored the interrelations between many factors that lead to customization of an ERP. The results showed that high customization can intervene because of the resistance to change, based upon the weak agreement of the ERP project because of the cultural organization or also because of the fear of individual disadvantages linked to change. Moreover, a non-necessary re-development of the functionalities of the innate ERP can lead to the customization of an ERP. This can be linked to the experience of the implementation team or to the misreading of the ERP documentation at the beginning of the project. Moreover, the weak quantity of recommendation done to the implementation team or lack of opposition done to the requests of customization of this team can affect the level of customization applied to the ERP (Light 2005).

To ensure the successful implementation and customization project of an ERP is to explore those activities that guarantee it (Bullen and Rockart 1981; Sherry Finney 2007).

Critical factors of success for the implementation and the customization of ERPs

According to Bullen and Rockart (1981), the critical success factors (CSFs) in information systems are key activities to which the success of their execution is absolutely necessary for the manager of the project warrants the fulfilment of goals. For it to be done, managers that succeed have to concentrate on their most important resource, their most precious, their time, “upon things that make the difference between success and failure”. The CSFs of the implementation of an ERP are conditions that need to be fulfilled, so that the settlement should be done with success (Sherry Finney 2007).

Holland et al. (1999) have divided the critical factors of success according to strategic and tactical frames. The strategic frame gives precision about the necessity of the project, the engagement of the board, and a schedule describing the sequences of individual actions for implementation. The tactical frame concerns communication with all the concerned parties, the recruitment of a staff, the acquisition of technology, and of the expertise necessary for technical actions.

Esteves and Pastor (2000) propose a model grouping the CSFs according to four perspectives: strategic, tactical, organizational, and technological. The organizational perspective is related to organizational concerns such as organizational structure, culture, and business processes. The technological perspective focuses on aspects related to the ERP product, considerations, and related technical aspects such as basic hardware and software requirements. The strategic perspective is linked to core competencies fulfilling the organization's long-term missions and objectives, while the tactical perspective affects short-term activities and objectives. Tactical and strategic perspectives are sub-perspectives of organizational and technological perspectives, and this gives us four perspectives: an organizational–tactical perspective, an organizational–strategic perspective, a technological–tactical perspective, and a strategic–technological perspective.

In the literature, many CSFs of implementation of an ERP were rediscovered in (Bullen and Rockart 1981; Sherry Finney 2007; Holland et al. 1999; Esteves and Pastor 2000;

Moon 2007; Dezdard and Sulaiman 2009; Saade and Nijher 2016; Shaul and Tauber 2013; Arvidsson and Kojic 2017), their number and sense varying from one author to the other. The following board (Table 2) does a transversal of the literature and proposes a categorization of CSFs, the authors who worked on it and the terminology that is linked.

CSFs such as management commitment, user involvement, change management, project support, business process reengineering, quality, and risk management are CSFs

Table 2 Critical factors of success of implementation of an ERP, bibliographical terminologies and reference in the literature (Arvidsson and Kojic 2017)

Critical success factors	Used terminology and bibliographical references
Engagement of the direction	Engagement and support of the direction (Sherry Finney 2007; Badewi and Shehab 2015); the implication of the direction (Moon 2007); support and engagement of the direction (Dezdard and Sulaiman 2009; Saade and Nijher 2016); support of the direction (Shaul and Tauber 2013); experience project manager leadership (Osman and Abd-El-Kader 2018)
Users involvement	Return of the usage by the users (Saade and Nijher 2016); implication of users (Dezdard and Sulaiman 2009; Shaul and Tauber 2013); end user rendering (Osman and Abd-El-Kader 2018)
Management of change	Management of cultural change (Sherry Finney 2007; Osman and Abd-El-Kader 2018); balanced and acquired company settings (Moon 2007); management of organizational change (Moon 2007); program to manage change (Dezdard and Sulaiman 2009); experience of a major organizational change (Shaul and Tauber 2013); preparation atmosphere for the organizational change (Saade and Nijher 2016)
Support to the project	Support for the project (Moon 2007; Ahmed and Mohamad 2014); support to the sellers (Dezdard and Sulaiman 2009); local partnership to the sellers. (Saade and Nijher 2016)
Reengineering of the business process	Reengineering of the business process and software configuration (Sherry Finney 2007); alignment of the business process (Moon 2007); process reengineering and minimal customization (Dezdard and Sulaiman 2009); reengineering of the business process (Saade and Nijher 2016; Osman and Abd-El-Kader 2018)
Communication	Communication plan (Sherry Finney 2007); communication (Moon 2007; Osman and Abd-El-Kader 2018); communication and communication at the level of the enterprise (Dezdard and Sulaiman 2009); transparency opened communication (Saade and Nijher 2016)
Training and education	Users training and education (Dezdard and Sulaiman 2009); training and education (Moon 2007; Shaul and Tauber 2013)
Implementation team	Balanced team (Sherry Finney 2007); composition of the ERP team, competences and compensation (Dezdard and Sulaiman 2009; Osman and Abd-El-Kader 2018); competence of the team project (Shaul and Tauber 2013); champion of the project (Sherry Finney 2007); skilful decider (Sherry Finney 2007); small internal team of the best employees (Saade and Nijher 2016)
Usage of consultants	Selection of consultants and relation (Sherry Finney 2007); support to the existing system (Saade and Nijher 2016); usage of consultants (Dezdard and Sulaiman 2009; Osman and Abd-El-Kader 2018)
Implementation strategy	Deadline and strategic implementation (Sherry Finney 2007); software process of implementation (Moon 2007); emergency plan (Saade and Nijher 2016); implementation strategy (Shaul and Tauber 2013)
Selection of the ERP	Selection of the ERP (Sherry Finney 2007); prudent selection of the software (Dezdard and Sulaiman 2009); process of selection of the system (Shaul and Tauber 2013); ERP adapted to the organization
Management of the project	Management project and evaluation (Dezdard and Sulaiman 2009); project follow (Shaul and Tauber 2013); project management (Sherry Finney 2007; Moon 2007; Badewi and Shehab 2015; Osman and Abd-El-Kader 2018)
Quality management	System test (Sherry Finney 2007); quality of the system (Shaul and Tauber 2013); management of the quality (Saade and Nijher 2016; Badewi and Shehab 2015; Osman and Abd-El-Kader 2018)
Risks management	Management of crisis and anomaly (Sherry Finney 2007); analysis and test of software and the detection of anomalies (Dezdard and Sulaiman 2009); software maintenance (Shaul and Tauber 2013); management of risks (Saade and Nijher 2016; Badewi and Shehab 2015; Osman and Abd-El-Kader 2018)

that are focused business process and organizational structure to achieve long-term goals and objectives. Moreover, the composition of an implementation team, communication, the use of consultants, is also focused organizational structure, but aim to ensure short-term goals. The implementation strategy and the selection of the ERP are aimed at the final ERP and all requirements to implement it. It is necessary to note that these factors are dependent significance of the life cycle, models, methods, and techniques used for customization.

Types, approaches, life cycle, models, methods, and techniques of customization of ERPs driven requirements engineering

To have an adequacy between the business process of the organization and the ERP, authors have proposed many typologies of customization of an ERP (Luo 2004; Davenport 1998; Brehm et al. 2001). There is much coherence between these typologies and several inconsistencies that contrast their interpretation. For example, the Brehm typology (Light 2001) includes the programming of the workflow. To implement the workflow of an organization, it requires modification of the source code of the ERP that is a particular category in the typology presented by Luo (Rohde and Zhong 2014), what can bring a confuse. The following shape presents in a summarized way the typologies mentioned above (Fig. 1).

In general, there are only two families of approach prepared to assure the adequacy between the innate ERP and the business process (Davenport 1998; Zoukar et al. 2004), one guided by the requirements of the organization and the other by ERP functionalities. The one guided by the requirements of the organization is, one wished by the work actors to install a system that answers exactly their needs. One guided by the functionalities of the ERP is wished by the editor and the integrators who wish to install standard functions of the ERP for the complexity burdens of customization. Zoukar et al. (2004) proposes an approach that combines the two preceding by trying to find a balance between the requirements of the organization and the solutions proposed by the ERP.

Many life cycles of an ERP have been indexed in the literature and the famous and mostly used by organizations is one proposed by Markus and Tanis (2000) who declines itself into six steps:

- *The decision of adoption* to satisfy their work needs and techniques, organizations start questioning about the necessity of an ERP system. Actually, the literature on

[9] (Davenport, 1998)	[6] (Luo, 2004)	[10] (Brehm and Markus, 2001)
1. Modules configuration	1. Modules customization	1. configuration
2. Tables configuration	2. Table customization	2. Securization
	3. Source code customization	3. Screen masks
		4. Wide reportage
		5. Workflow programming
		6. Users exits
		7. ERP programming
		8. Interface development
		9. Module code modification

Fig. 1 Typologies of ERP's customization

ERPs touches many aspects linked to the adoption of the ERP in a context and the environment of small and medium enterprises;

- *Acquisition* it refers here to the selection of suppliers and the acquisition of the ERP. This is subsequent to the evaluation of requirements of the organization, of modules of the ERPs and of the suppliers;
- *Implementation* concerns the real settlement of the ERP system. This step has many activities, like the customization of the system to conform itself to the needs of the organization, the reengineering of the work process, the migration of data, the formation of the final user, etc.
- *Use and maintenance* the final user starts using the system daily, which implies a daily maintenance;
- *Evolution* implies the extension and the integration of the ERP system with the other systems as the management of customer relation, of supply chain, etc. It is a non-trivial operation that requires the stability and the maturity of the ERP;
- *The withdrawal* corresponds to the step, where the system is abandoned or replaced by another system of Information.

This lifecycle has also been found in the work of Esteves and Pastor (2000). For Law and Chen (2010), the ERP project lifecycle could consist of four phases—adaptation, acceptance, routinization, and infusion.

In practice, it is the requirements engineering those acquirers, models, and validates the functional and non-functional needs of an information system based on the requirement of users (Rolland and Prakash 2000). To do an ERP implementation-driven requirements engineering, it is necessary to consider many parameters, as:

- A selection of an ERP to minimize the needs of customization for answering already to most of the needs of the organization;
- The flexibility of the ERP to adapt itself to the evolution of the needs of the organization.

In the research, Rolland and Prakash (2001, 2001) proposed an oriented approach for needs of implementation of an ERP that consists in:

- doing an abstraction of the existing functionalities of an ERP, create a link between the awaited functionalities and the existing ERP;
- effectuate an alignment at the level of needs;
- deduce the aligned functionalities, adaptation and extensions of functionalities chosen using the awaited functionalities of the ERP and the functional links.

Conclusion

This document has presented a survey on ERP's implementation by evoking the aspect of its customization based on requirements engineering.

The customization of an ERP has ensured the adequacy between it and the business process of the organization (Rolland and Prakash 2001). This is the subject of many researches and controversies, and the very first point of controversy being the meaning

linking the term itself to the actions it refers to. Therefore, configuration, modification, adaptation, and extension are terms of the literature with purpose to express the vision and the understanding of each author concerning this term. The impact of this lack of harmonization causes the difference between the approaches, the implantation steps, and the gathered methodologies in the literature. The reasons of an ERP customization are subject to many disputes. Be it technician or decider, the point of view upon this subject is different from one author to the other, implying a differentiation on the critical points for the success of the implementation and customization of an ERP.

Unfortunately, they exist many limits in research on the subject, be it the customization, the management of risks linked to this activity, the formalism of the proposed methods, of the efficient perception of user's requirements, etc. Talking about the proposed typologies, they cannot stay without presenting the sophistication of a process or the internal architecture of an ERP (Usman et al. 2012). Concerning the choice of customization of an ERP and the tools referred to in the literature, they suffer from lack of formalism for not disposing a formal proof, instead of practical cases of usage (Luo 2004). The perception process of the user's requirements and corresponding these with the capacities of the ERP is a weight problem and that of criteria change following the project environment (Zoukar et al. 2004). A proposed solution consists in using help techniques to the decision or the process of analytical hierarchy. For Brehm et al. (2001), the customization options presented do not allow the reduction of risks to link to the implementation of an ERP.

Being aware of these limitations, future researches will be broadly harnessed to correct and contribute to have a formal framework allowing them capture in an optimal way the whole user's needs by considering the innate possibilities and propose optimal execution schemes and algorithms for the usual processes implementing the organization's business process.

Authors' contributions

FE designed the study, collected the information about the previous studies, performed the analysis, and wrote the manuscript. RA participated in revising the article, its critic for important intellectual content, and gave the final approval of the version to be submitted and any revised version. All authors read and approved the final manuscript.

Acknowledgements

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Availability of data and materials

Not applicable.

Declarations

This document has presented a survey on ERP's implementation by evoking the aspect of its customization based on requirements engineering.

Ethics approval and consent to participate

Not applicable.

Funding

Not applicable.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Received: 20 March 2018 Accepted: 18 May 2018

Published online: 04 June 2018

References

- Ahmed R, Mohamad ABN (2014) Effect of multidimensional top management support on project success: an empirical investigation. Springer, Berlin
- Arvidsson J, Kojic D (2017) Critical success factors in ERP implementation the perspective of the procurement system user. Université de Jönköping, Jönköping
- Badewi A, Shehab E (2015) The impact of organizational project benefits management. *Int J Project Manag* 34:412–428
- Brehm L, Heinz A, Markus LM (2001) Tailoring ERP systems: a spectrum of choices and their implications. In: Proc. 34th Annual Hawaii, HI, USA
- Bullen VC, Rockart FJ (1981) A primer on critical success factors. Massachusetts Institute of Technology, Cambridge
- Davenport TH (1998) Putting the enterprise into enterprise system. *Harvard Bus Rev* 3:121–131
- Dezdar S, Sulaiman A (2009) Successful enterprise resource planning implementation: taxonomy of critical factors. *Indust Manag Data Syst* 109(8):1037–1052
- Esteves J, Pastor JA (2000) Towards a unified ERP implementation critical success factors. In: Towards a unified ERP implementation critical success factors, Portugal
- Glass R (1998) Enterprise resource planning: breakthrough and/or term. *ACM SIGMIS Database* 29(2):13–16
- Holland C, Kelly S, Light B, Willis K (1999) Best of breed IT strategy: an alternative. In: Proceedings of the seventh European conference on information, Copenhagen
- Hong K, Kim Y (2002) The critical success factors for ERP implementation: an organizational fit perspective. *Inf Manag* 40(1):25–40
- Kumar V, Maheshwaria B, Kumara U (2002) ERP systems implementation: best practices in Canadian government organizations. *Govern Inf Q* 19(2):147–172
- Law C, Chen C (2010) Managing the full ERP life-cycle: considerations of maintenance and support requirements and IT governance practice as integral elements of the formula for successful ERP adoption. *Comput Ind* 61(3):297–308
- Light B (2001) The maintenance implications of the customization of ERP software. *J Softw Maint Evol* 13:415–430
- Light B (2005) Going beyond 'misfit' as a reason for ERP package customisation. *Comput Industry* 56:606–619
- Luo AS (2004) A framework for evaluating ERP implementation choice. *IEEE Trans Eng Manag* 51:3
- Markus ML, Tanis C (2000) The enterprise systems experience—from adoption to success. In: Framing the domain of IT research: glimpsing the future through the past, Cincinnati
- Moon BY (2007) Enterprise resource planning (ERP): a review of the literature. *Int J Manag Enterprise Develop* 4(3):235–264
- Osman N, Abd-El-Kader S (2018) From PLM to ERP: a software systems engineering integration. *Int J Softw Eng Appl (IJSEA)* 9(1):11–27
- Parthasarathy S, Sharma S (2016) Efficiency analysis of ERP packages—a customization perspective. *Comput Indus* 82:19–27
- Pérotin P (2004) Les Progiciels de gestion intégrés, instrument de l'intégration organisationnelle?. Université de Montpellier II, France, pp 1–114
- Purohit N, Jaiswal MP, Pandey S (2012) Challenges involved in implementation of ERP on demand. *IJCSI Int J Comput Sci Issues* 9(4):481–489
- Rohde ME, Zhong F (2014) Cloud computing and ERP: a framework of promises and challenges. In: 25th Australasian conference on information systems, Auckland, New Zealand
- Rolland C, Prakash N (2000) Bridging the gap between organisational needs and ERP functionality. *Require Eng* 5(3):180–193
- Rolland C, Prakash N (2001) Matching ERP system functionality to customer requirements. In: International symposium on requirements engineering, Canada
- Rothenberger MA, Srite M (2009) An investigation of customization in ERP system. *IEEE Trans Eng Manag* 56:663–676
- Saade RG, Nijher H (2016) Critical success factors in enterprise resource planning system—a review of case studies. *J Enterp Inf Manag* 1:72–96
- Shaul L, Tauber D (2013) Critical success factors in enterprise resource planning systems: review of the last decade. *J ACM Comput Surveys (CSUR)* 45(4):55
- Sherry Finney MC (2007) ERP implementation: a compilation and analysis of critical success factors. *Business Process Manag J* 13(3):329–347
- Tasanen J (2018) Customisation as a solution to misalignment between ERP system and business processes in SME context. <http://urn.fi/URN:NBN:fijyu-201801081089>. Accessed 8 Jan 2018
- Tobie AM, Zoa J, Atsa RE (2016) A literature review of erp implementation in african countries. *Elect J Inf Syst Dev Ctries (EJISDC)* 76(4):1–20
- Usman A, Comms C, Neils D (2012) Benefits realization from ERP systems: the role of customization. In: ECIS 2012 proceedings. p. 142
- Zoukar I, Salinesi C, Rolland C (2004) Evolution du système d'information par l'implantation d'un Progiciel de Gestion Intégrée—Systématiser la mise en correspondance entre le système et l'organisation. *Informatique des Organisations et Systèmes d'Information et de Décision*