An approach for the management of the risk factors impacting the model-based engineering methods in ERP projects

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Abstract: A consistent alignment is one of the most critical issues influencing the ERP project’s success. We propose, in this paper, a risk factor management approach that contrary to existing ones, links a set of risk factors to their impacts on the misalignment management performed during the business blueprint stage of an ERP project. The proposed approach is composed of three steps: (1) the identification of the risk factors occurring while managing the misalignment; (2) the mitigation of these risk factors; (3) and the treatment of the impact the occurred risk factors have on the misalignment management. The use of the proposed approach is illustrated on a case study in a French small and medium-sized enterprise.

Keywords: Enterprise Resource Planning (ERP), Business Process Modeling, Risk Management, ERP project, Business Process Management

1. INTRODUCTION

In the current context of fierce competition, manufacturing companies’ information systems (IS) are increasingly based on ‘off-the-shelf’ products such as Enterprise Resource Planning (ERP) systems (Aloini et al., 2007). This kind of system is designed to increase task automation and to improve the company’s efficiency (Saade et al., 2016; Wu et al., 2007). However, ERP projects are risky (Aloini et al., 2007). One of the most critical issues to be managed to ensure the success of an ERP project is the alignment of the ERP standard package to the company’s real needs (Millet, 2013; Sumner, 2009). The alignment problem has gained a lot of interest in the past years (Sumner, 2009).

In order to define appropriate measures to address it, we put the misalignment management in the context of the ERP project life cycle. An ERP project consists of three phases (pre-implementation, implementation and post-implementation phases) that can be split into the five ASAP (Accelerated Systems Application and Products) stages (SAP AG, 1999). The pre-implementation phase consists of the “project preparation” stage and ends with the selection of the ERP package. The implementation phase corresponds to the “business blueprint”, the “realization”, and the “final preparation” stages. Finally, the post-implementation phase covers the “GoLive and support” stage.

While an initial misalignment analysis must be carried out in order to select an ERP package that best suits to the specific needs of a company, a detailed misalignment management needs also to be performed during the business blueprint stage (Soffer et al., 2005). The inability, during this stage, to achieve a ‘fit’ between the standards functionalities and the specific requirements of the company leads to the occurrence of the misalignment during the post-implementation phase, while the ERP system is used (Wei et al., 2005).

So as to manage the misalignment, during this particular stage, the model-based engineering methods (Mamoghli et al., 2015; Millet, 2013; Rolland et al., 2001; Wu et al., 2007; Zoukar, 2005) can be used – see Fig. 1. They allow one to identify and remove the misalignment that exists between the ERP standard package and the specific requirements of a given company. The related misalignments concern the business processes detailed in the form of activity sequencing, as well as, the inputs and outputs of these activities (like the reports or the data flow). These methods basically consist of three activities: design, matching and decision-making. Indeed, the model representing the business processes wished by the company and the model representing the standard business processes embedded in the ERP system (respectively AS-WISHED and MIGHT-BE models) are designed and matched, allowing to identify the misalignments. Then, the decision-making activity tackles the alignment and misalignment situations identified between the two matched models. Depending on the identified situations, the following decisions, allowing the misalignment to be removed, can be made: configuration of the ERP system, specific development of the system, addition of an applicative component to the system, giving up or manual support. The decision-making activity allows one the step-by-step working out of the TO-BE model corresponding to the business processes as they will be implemented within the ERP system (Mamoghli et al., 2015; Soffer et al., 2005).
In other words, an efficient misalignment management requires an efficient use of the model based engineering methods. This use can be harmed by many factors including the risk factors (RFs) occurring during the business blueprint stage of an ERP project. For example, the RF related to a lack of involvement of the key-users can lead to an incomplete design of the AS-WISHED model, which will not encompass all the business processes wished by the company. By consequence, the business processes missing in the AS-WISHED model will not be supported by the ERP system.

Therefore, we focus, in this paper, on the management of the impact the ERP project RFs can have, during the business blueprint stage, on the use of the model-based engineering methods.

This paper is structured as follows. Section 2 aims at reviewing the works dealing with RF management. Section 3 presents the proposed RF management approach. Then, in section 4, the approach proposed is applied to the Customer Service module of the ERP system from a French SME. Finally, section 5 concludes and proposes some research perspectives.

2. RELATED WORKS

In this section, we focus on the works related to risk factors (RFs) management in ERP projects. These are analysed according to their ability both to link the ERP project RFs to their impact on the implementation of the model-based engineering methods activities (design, matching and decision-making activities) and to manage this impact. The contributions related to SF (Success Factors) management are also included. Indeed, SF management is the opposite of RF management: while the RFs must not occur (for example: “Inadequate selection of the ERP package”), the SFs must occur (for example: “Careful ERP package selection”).

RF management is part of the risk management process that classically consists of the following steps (Aloini et al., 2007; Aloini, 2012; ISO 31000, 2015): (i) Context analysis with the definition of the risk management’s boundaries; (ii) Risk identification with the identification of the RFs and their impact on the project success; (iii) Risk quantification enabling to prioritize the RFs; (iv) Risk treatment enabling to mitigate the risk. There are two main strategies: either reducing the risk circumstances, or treating the risk after its outbreak, by treating the RFs or reducing the effect of the risk. Each of these steps are milestones to monitor and review the risk by reporting, reviewing and taking action to manage it (Aloini et al., 2012).

Here, the risk that is considered is the misalignment between the ERP system and the company’s expectations, induced by an inadequate use of the model-based engineering methods. While the risk circumstances reduction is the best scenario, one has to react if the risk appears. Thus, this paper deals with this scenario through the management of the related RFs.

Taking into account our objective, we focus on the management of the RFs of the business blueprint stage. Relying on the RF typology proposed in (Mamoghli et al., 2011), we consider that there are two kinds of RFs: (i) the “vertical” RFs having a direct impact on a specific activity (design, matching or decision-making) of the model-based engineering methods. Such RFs concern aspects like the reengineering of the processes, the amount of customization, or the inadequate management of integration of the ERP system (Aloini et al., 2007; Amid et al., 2012; Saade et al., 2016; Somers et al., 2001). As such, they can directly be linked to a specific activity and be managed in a “classical” way; (ii) the “horizontal” RFs having an impact on all the three activities. Such RFs are generally related to top management support, composition of the project team, project management techniques used, users involvement, or skills of the project champion (Aloini et al., 2007; Motwani et al., 2005; Saade et al., 2016; Shatat et al., 2016). These require a specific management enabling to link them to the three alignment management activities.

2.1 Link between the RFs and the three alignment management activities

The impact of the “horizontal” RFs on the alignment management activities is generally not explicitly highlighted in the literature.

Most of these RFs are considered, in the works we analysed, as impacting the success of the project in general and are not linked to a specific activity of the project. Thus, for example, the authors use the following expressions: “critical issues affecting successful ERP implementation”, “success of any project depends critically”, “issues to ensure successful implementation of ERP systems”, “are vitally important to successful ERP projects” (Ehie et al., 2005; Motwani et al., 2005; Ram et al., 2013; Somers et al., 2001).

Only few RF management approaches (Aloini, 2012; Somers et al., 2001; Summer, 2000; Umble et al., 2003; Velcu, 2010) link these RFs to their impact on specific activities performed during the project’s stages. If so, this is generally implicitly stated through either the definition of the RF itself or through causal influences defined between the factors. For example, in (Somers et al., 2001), it is stated in the definition of the RF related to the external consultants competencies that consultants may impact the “requirements analysis”.

![Fig. 1. Model-based engineering methods influenced by the RF management](image-url)
Besides, some works describe the causal influences between the “horizontal” RFs and the “vertical” ones. For example, according to (Aloini, 2012), the RF related to the use of inadequate management techniques can influence the RF related to the processes reengineering. Such causal influences are a first step to understand the potential impact of the “horizontal” RFs on the three alignment management activities.

2.2 Treatment of the RFs’ impacts

The studied approaches generally recommend to treat the occurred RFs by removing them. For example, the RF related to the absence of a project champion will lead to the selection of a new project champion. However, when a RF is identified as occurred, it may already have impacted the way some activities of the project have been implemented. Generally, the studied approaches do not take the treatment of this impact into account.

To conclude, to the best of our knowledge, no approaches propose to treat the ERP project RFs according to their impact on the three activities of the model-based engineering methods.

3. RISK FACTOR MANAGEMENT APPROACH

In this section, we propose a RF management approach, which is composed of three steps (see Fig. 2).

Based on the analysis of the RFs listed in the literature, we propose the following “horizontal” RFs check-list to be managed through the approach:

- Lack of involvement and support of top management
- Inappropriate use of consulting services
- Lack of support of the vendor
- Low users involvement
- Unsuitable project champion or absence of project champion
- Lack of communication between the departments
- Ineffective project management techniques
- Poor composition of the project team and teamwork difficulties

3.1 Risk factors identification (STEP 1)

The objective of this step is to identify the potential RFs that have occurred while implementing the three alignment management activities (design, matching, decision-making) for a given ERP system module. This RFs identification is performed qualitatively with the help of the “horizontal” RF check-list. To identify if RFs have occurred among this list, we advise to attend to the business blueprint meetings, to examine the reports of these meetings and to interview the members of the project team.

If occurred, these RFs have a twofold influence:

- If these RFs are not adequately treated, they can affect the misalignment management for the rest of the ERP project. This aspect is worked out through the STEP 2.
- In addition, they have potentially impacted the implementation of the design, matching and decision-making activities for the current module. This potential impact is treated through the STEP 3 of the approach.

3.2 Risk factors treatment (STEP 2)

The objective of this step is to treat the RFs that have been identified as occurred in the STEP 1. This treatment consists of identifying and applying the adequate management practices. For example, if no project champion has been affected to the project, the corresponding management practice would be to select a project champion, based on its legitimacy, charisma and skills. This step can serve to implement, in good conditions, both the STEP 3 of the approach, and the model-based engineering method for the next handled module.

3.3 Occurred risk factors’ impact treatment (STEP 3)

This step is applied if one or several RFs have been identified as occurred in the first step of the approach. If so, it means that the alignment management activities (design, matching, decision-making) have potentially been inadequately implemented for the current handled module. This, in turn, would imply an inefficient alignment management for this module. Thus, the objective of this step is to treat this potential impact.
To do so, we recommend to verify: (a) if the misalignment has been adequately identified by reviewing the design and matching activities for the current handled module, and (b) if the misalignment has been adequately removed by reviewing the decision-making activity.

To review these activities, we establish a check-list of potential impacts. This check-list is completed with a set of recommendations allowing one to treat these impacts. The check-list and related recommendations stem from the best practices provided by the model-based engineering methods (Mamoghli et al., 2015; Millet, 2013; Rolland et al., 2001; Wu et al., 2007; Zoukar, 2005). To exploit the check-list, we recommend to use the documentation from the business blueprint meetings of the current module (AS-WISHED, MIGHT-BE, and TO-BE models), to interview the persons involved in the project (such as the key-users, integrator, consultants etc.), to confront them with the way they designed and matched the models and they made the decisions to face misalignment. The check-list is the following:

(a) Review the design and matching of the AS-WISHED and MIGHT-BE models:
- Forgotten modelling constructs in the model(s): adjust the model(s) with the forgotten constructs and match them.
- Lack of accuracy of the model(s): adjust the models accordingly and match the new version of the model(s).
- Vocabulary misfit between the two models: align the vocabulary and match the constructs for which the vocabulary has been adjusted.

(b) Review the decision-making activity:
- Forgotten critical criteria while making decisions: adjust the decisions according to the right criteria - such as: Cost implied by the decision in terms of time, money or resources, Competitive advantage for the company, Potential disruption of the native ERP system integration integrity.

If new misalignment situations are identified after the review of the design and matching activities, it is necessary to make decisions to face them.

4. CASE STUDY

The case study concerns a French SME of 120 persons. This SME is specialized in the manufacturing and marketing of height access and personal safety equipment for the building and manufacturing industries. Since its legacy system reached its end-of-life, the company selected a new ERP package, at the end of 2008.

The ERP project sequencing was the following: the pre-implementation phase began in April 2008. Then, the business blueprint stage took place, for all the modules, from February to June 2009. The realization, final preparation and goLive and support stages took place according to three functional domain bundles. First, the Commercial, Accounting, Finance, Inventory, Purchase and Shipment modules were implemented between June 2009 and December 2012. Then, the Production module was implemented between March 2011 and February 2013. Finally, the Maintenance and Customer Service modules were implemented between October 2011 and April 2013.

We applied the 3 steps of the proposed approach after the implementation, by the company, of the 3 alignment management activities for the Customer Service module. The application of these 3 activities lead the company to design and match the AS-WISHED and MIGHT-BE models and to build the TO-BE one. The models concerned the following business processes: the creation of the guaranty contract; the creation of the customer service demand; the planning of a customer service intervention; the forecast of the costs and material resources related to a customer service intervention; the booking of the resources for a customer service intervention; the time monitoring of a customer service intervention; the closing of the intervention; the management of the billing; the management of orders related to a customer service intervention; and the recording of the solution associated to a customer service intervention.

4.1 Approach application and results

Application of STEP 1 and STEP 2 (Risk factors identification and treatment)

For the RF identification, we exploited the proposed “horizontal” RFs check-list. We analysed it on the base of our attending to the business blueprint meeting of the Customer Service module and our examination of the report produced after this meeting. By this way, we identified the occurred RFs for this module.

On this base, we applied the STEPS 1 and 2 of the approach. For STEP 2, we identified the following management practices to be implemented:

- Ineffective project management techniques: identify and use adequate tools and techniques to support the business blueprint meetings; establish clearer objectives for each meeting; plan more precisely the course of each meeting and respect this planning.
- Poor composition of the project team and teamwork difficulties: determine, in writing, the roles and responsibilities of each project team member; apply the project team retrospective by taking a break during the operating activities to talk about the team itself.
- Unsuitable project champion or absence of project champion: select a project champion, based on legitimacy, charisma and skills (because there were no project champion).
- Inappropriate use of consulting services: select external consultant(s), based on their experience and skills (because there were no external consultant).
- Low users involvement: select key-users, based on experience, skills, integration, adaptation and motivation; establish a training plan for key-users; officially release the key-users of their daily tasks.
Application of STEP 3 (Occurred risk factors’ impact treatment)

(a) Review of the design and matching activities

To identify the impacts and recommendations, by exploiting the corresponding check-list, we analysed the AS-WISHED and MIGHT-BE models that were produced for the Customer Service module and interviewed the concerned key-user and the ERP package integrator. These interviews enabled us to assess the accuracy of the models, as well as the vocabulary used to design them, and their ability to encompass all the requirements of the company or the functionalities embedded in the ERP system. Both the key-user and the ERP package integrator were interviewed twice for the data collection and the validation. Thus, we identified the following impact, among the three potential impacts: “Forgotten modelling constructs in the model(s)”, particularly in the AS-WISHED one. For example, the following constructs were missing:

- Business processes not mentioned, by the company, in its AS-WISHED model: the in-depth quality analysis management of the product that is the request of the customer service demand; the automatic identification and management of late interventions; the monitoring of the real costs of a customer service intervention.
- Activities not mentioned in the AS-WISHED model, for example: concerning the business process related to the planning of an intervention (process that was designed in the AS-WISHED model), the company wanted not only the affect the right human resources to each intervention, but also to specify the actions these human resources had to accomplish. This activity (about the mention of the actions) was not included in the AS-WISHED model.

The identification of these impacts lead us to advise the following recommendations: adjust the models with the forgotten constructs (for example, add the forgotten business processes into the AS-WISHED model), match these constructs and make decisions for them.

(b) Review of the decision-making activity

To identify the impacts on the decision-making activity, we analysed the TO-BE model and interviewed the members of the project. These interviews served to verify that the adequate criteria were taken into account while the company made decisions about the Customer Service module. Generally, the company seemed to use the right criteria, unless for the business process related to the time monitoring of a customer service intervention. This process was not designed in the AS-WISHED model, but was present in the MIGHT-BE one. When matching this process, the company discovered the possibility to estimate and record the time taken for its interventions, and decided to not configure it. No real criterion was taken into account to make this decision.

Thus, we suggested that the criterion concerning the competitive advantage should have been examined, for this process. The company would have benefited from evaluating the time taken for each intervention. Thus, we advised the following recommendation concerning this business process: adjust the decision according to the right criteria.

4.2 Discussion

The occurred RFs that we identified (STEP 1) helped us to highlight the inadequate implementation of the alignment management activities for the Customer Service module. Indeed, the RFs related to the project team, to the users involvement, to the project champion and to the external consultants impacted the AS-WISHED model design, that was incomplete. This was due to a lack of competencies, involvement or absence of these persons. The ineffective project management techniques, that were used, seemed also to have an influence on this design activity. Indeed, the company particularly did not manage well the business blueprint meetings by not using the right tools to elicit the business processes needed by the company and by not planning and organizing correctly the course of these meetings. This RF influenced not only the design of the AS-WISHED model, but also the decision-making.

The check-list of impacts and recommendations (STEP 3) served well to highlight precisely which kind of impacts the occurred RFs had on the three alignment management activities: constructs missing in the models and inadequate criteria used for the decision-making. The identification of these impacts meant an inadequate identification and removing of the misalignment during the business blueprint stage of the Customer Service module. The check-list of impacts and recommendations also helped to identify right recommendations to remedy to this inadequate misalignment management, so as to not let this misalignment occurs while the ERP system is used, in the post-implementation phase.

Overall, the proposed approach was found to be a useful mean to ensure an efficient use of the model-based engineering methods and thus a consistent misalignment management.

5. CONCLUSION AND PERSPECTIVES

In this paper, we propose an approach for the treatment of the ERP project risk factors’ impact on the use of the model-based engineering methods. Contrary to existing RF management approaches, this approach links the management of the “horizontal” RFs to their influence on the implementation of the three alignment management activities (design, matching and decision-making) of the model-based engineering methods. This approach is composed by three steps that must be applied repeatedly, during the business blueprint meetings, for each ERP system module that the company wants to implement. More precisely, (1) the first step consists of identifying the RFs that occurred and that can impact the implementation of the alignment management activities for the current handled module; (2) the second step recommends the identification and application of management practices allowing these RFs to be treated; (3) and the third step leads both to the identification of the impacts the RFs had on the implementation of the three alignment management activities, and to the treatment of this impact.

From an academic point of view, the proposed approach represents a progress in the understanding of the causes of an
inadequate misalignment management in ERP project. Apart from research implication, this approach guides the decision-makers through the ERP project to ensure the misalignment to be adequately identified and removed.

While we applied the proposed approach to the case of a French SME, its application to other ERP system modules from other companies’ ERP projects would allow its enhancement.

The proposed approach could also be enriched by refining the links between each RF and its impact on the alignment management activities (constructs missing in the models, inadequate criteria used to make the decisions etc.). Besides, this approach does not take into account the evolution of the company’s needs during the ERP project. This can, in turn, influence the design of the AS-WISHED model. Thus, the design of this model proves to be a challenge, and could be the subject of future works to better frame its elicitation and accuracy.

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