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MODELING THE DYSFUNCTIONS OF SKILLS MANAGEMENT IN ERP PROJECTS

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ABSTRACT: *The causes of failure of ERP projects are widely recognized and have been the subject of numerous publications. This paper aims to detect new weaknesses explaining frequent drifts in skills management in these projects. It is a question of better understanding the dysfunctions of the current mechanisms of management and of studying their impact on the performance of the projects. A few studies have looked at phenomena that cause cycle breaks and which are the source of instabilities in the skills management causing additional delays and costs. From this conceptual representation based on Forrester's dynamics system, we developed a simulation model for this dynamic behaviors study.*

KEYWORDS: Dynamic system, project management, ERP, skills management, dysfunctions.

INTRODUCTION

Most large-scale information systems implementation projects have significantly lower success rates than small and medium-sized projects due to budget surpassing and almost systematic delays in comparison with their initial planning (Corovic, 2016). In the context of ERP projects implementation, the failures observed are numerous and directly impact the performance of companies (Mitra and Mishra, 2016; Wong et al., 2005).

Indeed, several works dealing with the performance of information systems, and ERP in particular, insist on the need for the presence of a certain number of skills (Mezghani, 2011). Nevertheless, some authors find that poor skills management can influence the success of ERP investments (Totla et al., 2016; Vandaie, 2008). Worou (2008) also believes that project managers should be able to identify and optimize the abilities and skills needed to successfully align their staff with their strategy.

These findings have already allowed to reveal a need to improve the understanding of skills management in this type of major projects. The central question of this research is: how do dysfunctional mechanisms affect the skill management in the context of ERP implementation? Consequently, the paper's main objective is to study the competences management dysfunctions within the framework of the ERP projects from cybernetic mechanisms ensuring the readjustment and the global control of the project. To identify these failures, we have chosen to rely on the Forrester's systems dynamics, which seemed to us the most relevant to address our issue.

LITERATURE/THEORETICAL UNDERPINNING

DYSFUNCTIONS OF SKILLS MANAGEMENT IN THE ERP IMPLEMENTATION

Improving business performance depends on successfully implementing and re-engineering integration projects such as ERP (Lemaire, 2002).

A lot of research has been conducted on the failure causes of ERP implementation in organizations. This research has highlighted the complexity of ERP, to show that its implementation in organizations presents both technological and organizational challenges and causes the resistance of actors and even errors in its management mode. It is within this

framework that key success factors for ERP implementation have been identified (Grabski and Leech, 2007; Sommers and Nelson, 2004). After synthesizing these various studies, many other researchers (Elmeziane and Elmeziane, 2012; Sumner,2000) emphasize the significant influence of human resources skills management practices on ERP performance since the ERP system often requires its users to change the way they work (Worley et al., 2005). As a result, it leads to new employment relationships, information sharing, decision-making and changes on the level of procedures etc. (Yang et al., 2006).

In fact, there is a significant staff requirement for ERP implementation (El Amrani and Saint Leger, 2011; Trott and Hoecht, 2004). The coexistence between the tasks fragmentation and versatility depends on the company's policy regarding the management of workers' skills and qualifications (Lemaire, 2002). The ERP implementation also requires the recourse to system integrators, software package publishers, suppliers of hardware and database and network management systems and finally subcontractors. Each category of people must be highly qualified, hence the need to be trained in these management software packages, and to have a good knowledge of the company, its needs and its environment (Skok and Legge, 2002).

Cailland (2006) showed that the ERP project creates favorable conditions for the acquisition and development of new skills and knowledge. Also, according to Fourati (2006), the ERP project contributes to improving staff knowledge. Worou (2008) required that the ERP project manager should be able to count on qualified, competent, motivated and interested human resources to participate in the deployment of the ERP system in order to increase its performance. In view of the above, we can conclude that an ERP project manager should have a competence management policy through an adjustment of skills and qualifications and a division of tasks. Thus, he has a strong chance of increasing the efficiency level of the project team members during the ERP implementation (Worou, 2008). The development of a project with controlled profitability of a certain scale such as the ERP project appears as a mixture of everything that a company lives over a few decades: it is necessary to recruit collaborators, train and structure a team, manage its growth then its decrease, mobilize and stabilize external networks, manage periods of crisis... (Garel et al., 2001).

The literature on ERP has not failed in these recent years to highlight the difficulties encountered by a large number of companies that have never achieved the desired levels of performance, because of the dysfunctions in skills management within the framework of the project (Lotfi and Halawi, 2015).

To identify these causes, a literature review led us to synthesize them and which can be summarized as follows:

- lack of training (Sumner, 2000; Ouadahi and Guerin, 2007): Training can be considered to develop the employee's skills, based on his or her level of education and experience, thus preparing him or her to use the information system while developing self-confidence and a sense of personal effectiveness (Ouadahi and Guerin, 2007).

- the user’s dissatisfaction (Kerzner, 2001; Guimareas and Bond, 1996); The importance that the literature attaches to the user’s dissatisfaction as a cause of ERP implementation dysfunction focuses on the need to manage organizational transformation not only in terms of structure, technology and tasks, but also in terms of the individual beliefs, attitudes, intentions and behaviours of the organization's staff in order to overcome social inertia (Maaloul and Mezghani, 2003). The user’s dissatisfaction can result in reduced productivity. This can be exacerbated if the organization significantly reduces its workforce as a result of process re-engineering.

- Lack of expertise (Huang et al., 2009 ; Aubert et al., 2002 ; Rowe, 1999) ; IT projects require significant expertise and any deficiency can lead to disastrous consequences (Huang et al., 2009). The inherent complexity of software package implementations makes this expertise critical. Appropriate mitigation mechanisms will aim to reduce the gap between the required expertise and that of the team members and will include training, the recruitment of additional resources and the reference to external experts.

- The lack of cooperation and communication between the members of the project team (Wee, 2000); The involvement of each actor in the ERP project is presented as one of the driving elements of the project. To this end, it has been established that the actor applies his skills on a regular basis in cooperation with his team [30]. The lack of cooperation between the project manager and the team members can cause a lack of communication, which is the only way to inform the project actors and those of the organisation of any progress of the project, of the modifications made and to allow them consequently to express their opinions.

- The failure to anticipate risks when implementing the ERP system (Keil et al., 2000 ; Kale, 2000; Davenport, 1998); An ERP project manager and his project team should be able to identify the risks that are most likely to influence the project progress and plan how to eliminate or mitigate these risks by assigning the task of developing contingency plans (Keil et al., 2000).

- The inability to identify the required skills (Wee, 2000 ; Stefanou, 1999) ; skills management generally refers to aspects of job definition and, in doing so, work organization, as well as the anticipated management of skills requirements, job classifications and working conditions (Bouteiller and Gilbert, 2005). It consists in providing effective and efficient answers to questions such as: what contributions does the project need, within what time, where, in relation to whom, for how long, what knowledge, know-how required, what staff for each procedure, what working conditions, what hierarchy of jobs or skills? The answers to these questions help to better identify the skills needed.

- The need to rebalance between current and future skills (Levy-Leboyer, 1997; Le Boterf, 1995). Rebalancing consists in analyzing the gap between skill needs and availability (Le Boulaire and Retour, 2008). The analysis will then determine whether it is a quantitative or qualitative gap. This is a quantitative gap when the manager notices a lack or surplus of skills, and a qualitative gap when staff lack the skills and abilities to fill in vacancies or when staff are overqualified for the positions to be filled (Le Boterf, 1995). When the gap is well established, it is easier to choose the best actions to take to fill the gap.

This list, which comes from a review of the "classical" literature in management science, has allowed us to observe that the dynamics of the relations between these different causes of failure have been studied very little, as Santos et al. (2005) indicate, pointing out that the success or failure of a project may depend on the interaction of certain key factors. In addition, this interaction can emphasize the need to create complementarity between these different causes to ensure sustained performance. Furthermore, Fryling (2007) argues that complementarity explains how one cause affects another and how two causes interact to affect performance. This complementarity is illustrated in the case of ERP by the fact that these causes of dysfunction in skills management affect performance only indirectly through interaction between them.

To do this, we have chosen to understand the mechanisms of skills management in a systemic way and to understand their fragility. Indeed, these different mechanisms modelled continuously in the literature are in fact experiencing ruptures, discontinuities and it is these characteristics that have interested our research. In the following section, we present the systemic approach of project management, an approach which we felt was the most relevant for addressing our research problems.

SYSTEMIC MODELLING IN PROJECT MANAGEMENT

The complexity and uncertainty in systems, as ERP are, show that large scale non-linear models and dynamic feedbacks are overly complex to be understood and analyzed by our natural intuition. It is therefore relevant to use cybernetic and the systemic approach to study the general mechanisms of control and interaction in systems. The literature has shown that, in particular, the dynamics of systems seem adapted to tackle this complexity and encourage the reduction of uncertainty.

The basic principle of this technique is that the behaviour of a system is characterized, at a given moment, by the level of independent resources that make it up and by their rate of change (Le Moigne, 1974). However, the delays and cost surpassing have become the rule, not an exception, in project management in several areas (software development, construction, aerospace, research and development, etc.) (Rodrigues et Bowers, 1996). For this, the system dynamics is often useful in the analysis of such problems (Sterman, 1992). Rodrigues and Bowers (1996) cite four main objectives for the use of systems dynamics in project management:

- The need for a holistic approach;
- The need to understand non-linear behavior;
- The need for a learning tool;
- The desire to try new and more effective techniques.

In addition, Bilodeau (2008) explains that the main reason for the widespread use of systems dynamics in project management is its ability to go beyond the limited rationality of the manager. He also states that this method has proven to be effective in developing reasons for project failure and providing guidance on best practices in project management. In project management, Wolstenholme (1994) proposes Forrester systems dynamics (1975) as a method for describing, exploring scenarios and analyzing complex projects. It promotes systemic understanding and visualizes counter-intuitive behaviours of decisions over time.Many models have been developed to improve project management (Cooper and Lee, 2009 ; Lyneis and Ford, 2007 ; Toole, 2005 ; Howick, 2003 ; Ford and Sterman, 1998 ; Abdel Hamid, 1984). In their work, Lyneis and Ford (2007) and Taylor and Ford (2006, 2008) have shown that using systems dynamics to understand and improve project management is a great success. For example, cost surpassing and scheduling problems can be explained by the use of traditional methods based on the intuition of decision makers who prefer to rely on their own experience and short-sighted vision of these problems.

While, little research has addressed the main reasons for malfunctioning ERP projects using systems dynamics. Fryling (2007) has attempted in his work, on the one hand, to provide an insight into the dynamics of ERP system implementation through modeling and on the other hand to explore theories on the causes of ERP failure/success. In his model, he analyzed the causes of budget and cost surpassing. However, it did not discuss the balance between different potentially conflicting objectives such as reducing costs and delays. In addition, King and Burgess (2006) presented a dynamic model of key success factors (KSFs) for ERP projects where they showed that these KSFs were interrelated. However, this model has not been empirically validated with companies that have implemented an ERP system. On the other hand, Santos et al. (2005) developed a generic model to identify the relationships between the main FCS (resistance to change, training and adjustment to different processes). This model was validated from a single case study in Spain thus reducing the scope of his work.

With regard to our research problem, we found that no study using causal models, to our knowledge, approached the management of skills during the implementation of an ERP by focusing on its failures and malfunctions. In other words, how do these failures work in the ERP project?

This question pushes us to explore further by developing a model that presents the functioning mechanisms of skills management.

METHODOLOGY

Based on the systems dynamics approach and by adopting a constructivist posture, we opted for the experimental-inductive approach presented in figure 1: Starting from observations in reality, we established a causal representation from a pre-survey and a qualitative survey among Tunisian companies. We then validated our perception of this representation by returning to the subjects interviewed. In addition, we developed an analytical representation based on a stock flow model derived from the causal representation. This representation consisting of finite difference equations allowed us to understand reality. The various simulations performed have yielded results that can improve the understanding of the phenomena emerging from a non-linear model corresponding to a complex system that is the case of ERP project management. These same simulations made it possible to propose a short-term policy for regulating skills management. This research is composed of two phases. The first consists of a pre-survey conducted among some information systems managers belonging to Tunisian companies having implemented the ERP system, which enabled us to build the second phase which is a questionnaire survey on cybernetic mechanisms.

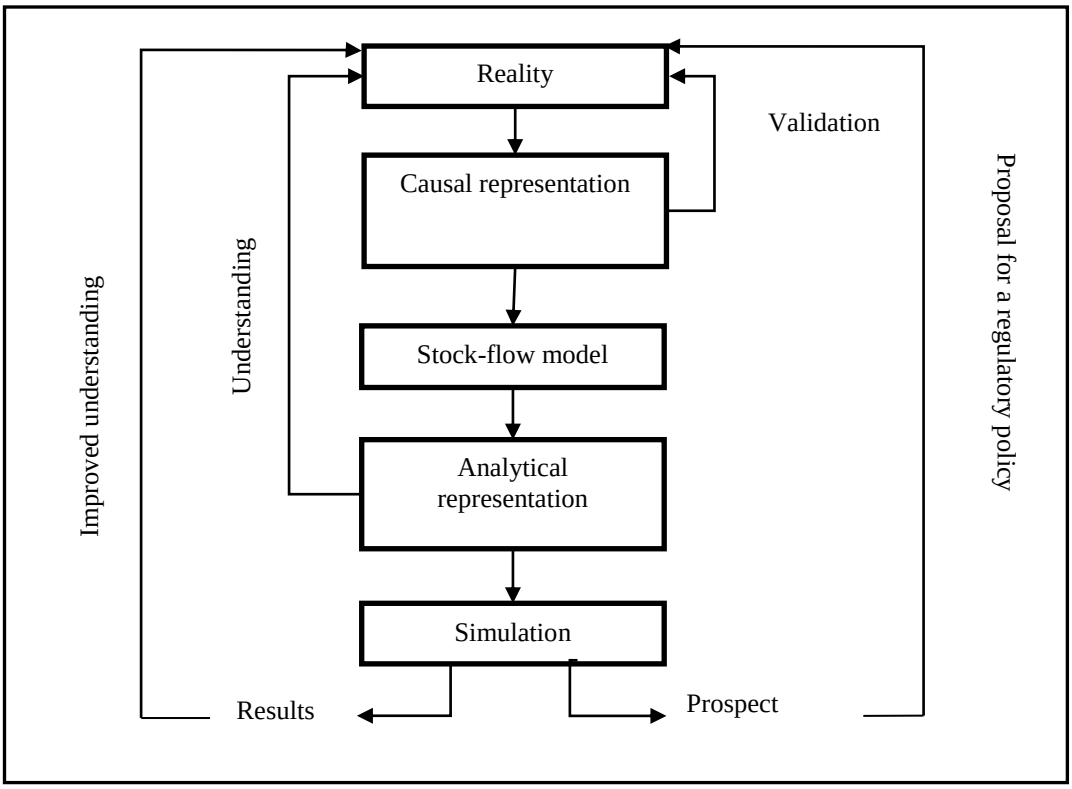

Figure 1. Representation of the research methodology

PRE-INVESTIGATION

In this exploratory phase, we collected data through a semi-directive interviews. The latter were intended for IT/IS managers who are usually ERP project managers, in order to understand in depth the dysfunctions of skills management in the ERP project.

The information was collected from eight Tunisian companies that had implemented the ERP system. These companies represented a small sample of the population. We chose companies

of different sizes and sectors. Thus, we have tried to choose companies that have installed ERP from different publishers, among the current market leaders, though.

A thematic analysis of the interviews content was carried out for the exploration purpose and to avoid a very strong influence of an initial personal orientation.

During these interviews, the interviewees spoke freely about the problems they encountered during the implementation of the ERP system. The comments collected allowed us to deepen our understanding of the ERP project failure reasons.

This pre-survey enabled us to identify the skills management decisions and then serve as a basis for the construction of our questionnaire.

QUESTIONNAIRE SURVEY

Based on the decisions taken following the pre-survey, a questionnaire survey was conducted. We chose the questionnaire as the data collection technique. This method helped us to ask specific questions about the problem of skills management failure to a sample of Tunisian companies that had implemented the ERP system.

We have drawn up a list of 150 Tunisian companies adopting ERP (more than 3 modules implemented). This list is not exhaustive as it has been proved difficult to contact some integrators directly. Even the websites of these integrators do not indicate the names of client companies. As a result, the use of probabilistic methods is difficult to use or an exhaustive list of Tunisian companies adopting ERP is difficult to obtain. In this study, a survey by reasoned choice seems preferable. Finally, 31 companies responded to our questionnaire, representing approximately 20% of the total population.

Starting from the paradigm that all decisions are made within a feedback loop (Forrester, 1969), we associate decision-making mechanisms in skills management with the main activity control indicators. The questionnaire we administered led us to conceptualize the mechanisms for steering skills in six different "disturbing" situations that we dealt with in Jlaiel and Thiel (2013) and which are presented in Table 1.

Table 1. Representation of the various disturbing situations

Variables (control indicators)	Disturbing situations (malfunctions)
Cooperation	*Situation 1:* dysfunction in cooperation between project team members
Experience	*Situation 2:* Lack of expertise among project team members
Risk	*Situation 3:* Malfunction in risk forecasting (budget surpassing and/or delay)
Skills	*Situation 4:* finding of insufficient or unsuitable skills
Re-balancing skills	*Situation 5:* In case of need to rebalance current skills with future skills
Productivity	*Situation 6:* a drop in staff productivity

To readjust their way of managing skills, we were able to identify seven corrective actions to the disruptive situations corresponding to the companies' responses such as: meetings organization, tasks reorganization, accountability, documentation, motivation, awareness, control and follow-up.

4. RESULTS/FINDINGS

SHORT-TERM SKILLS MANAGEMENT MODELLING

Our modelling objective is to highlight the dynamic behavior and control loops facing fluctuations and various short-term hazards.

Figure 2 then represents the short-term skills management model. This diagram is elaborated from the decision loops fusion of each disturbing situation. The control variables are shown in frames. Whereas, performance is defined by confirmation between objectives previously set and the result achieved. It is a concept that measures the degree achieved by objectives then consider performance as the progress of the project in terms of on-time delivery and budget. For that, it is represented, in our model, as an objective variable.

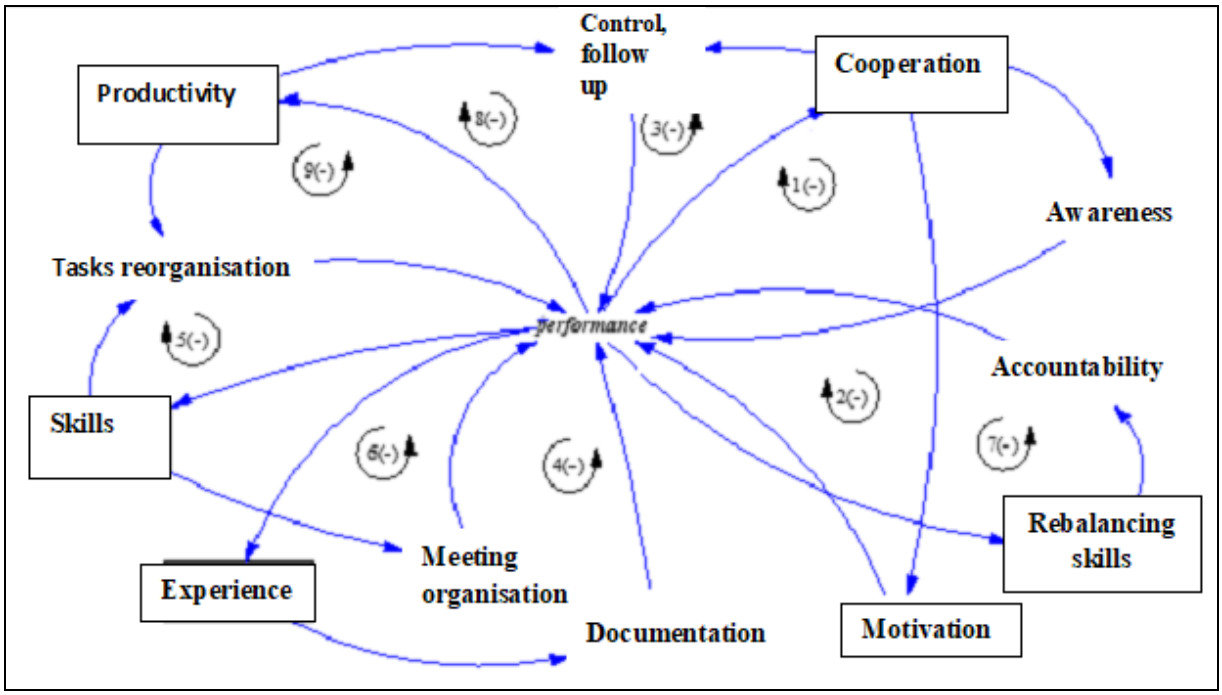

Figure 2. Short-term skills management model

This causal diagram shown in figure 2 allows us to perceive and understand the system in its complexity and in relation to its purpose, to better grasp it in its dynamism and evolution. Thus, it permits to improve the understanding of ERP project manager's behavior and better understand the project performance stability when facing unpredictable situations.

STABILITY ANALYSIS

After developing the causality diagram, we were able to build, on the one hand, a simulation flow-stock model of skills management using the dynamic simulation software *Ithink*.

On the other hand, the survey conducted among IT managers belonging to Tunisian companies made it possible to identify the main decision-making mechanisms following unbalanced fluctuations in skills management.

The simulation has allowed us to improve our knowledge overall behavior of this complex system, by trying to identify pre-eminent or useless feedback loops.

To analyze the stability of our model, we subjected it to realistic scenarios corresponding to plausible activities in companies. This allowed us to disrupt all the inter-connected mechanisms of this model.

Skills management is influenced by disturbances in its five control variables: "productivity", "cooperation", "skills", "skill rebalancing", "experience" (experience cannot be disturbed, in our case).

We examined the effects of fluctuations different degrees of these variables on model behavior according to two types (Table 2).

Table 2. The Description of fluctuations on control variables

Types of evolution	Description	Model behavior
Exceptional and repetitive variations	-A very significant and occasional decrease in control variables -Only a negative Pulse is selected that lowers the control variables values	-Individual disturbance of each variable: the delay increases to 6 days. -Simultaneous disruption of all variables: the delay is zero.
Random Variations	-Variables fluctuate according to uniform distribution between (-alpha) and 0 (Random) -We could have chosen a binomial law generating negative value perturbations (-alpha) with a given probability	-Individual perturbation of each variable: the delay increases to 60 days. -Simultaneous disruption of all variables: the delay is zero.

We notice that the model behaves better when its loops react simultaneously; they have sufficient strength to cancel the delay when facing random variations and exceptional and repetitive variations. However, an individual loop is not strong enough to meet the ERP project deadline.

SENSITIVITY STUDY OF THE DIFFERENT CONTROL LOOPS

Starting from the definition of the analysis dynamic system sensitivity which consists in studying the effects produced by parameters and initial conditions on its own behaviour [58], our study of the decision mechanisms sensitivity to their control variable, made it possible to verify the individual efficiency of each loop. The inhibition of some of them has also made it possible to measure their effectiveness and explain their contribution to the system overall behavior.

It is therefore necessary to study the model sensitivity to simultaneous appeal of all the control variables. In this case and from what we have shown previously, the model behaves during disturbances since the delay is eliminated. Therefore, there are one or more mechanisms that react sufficiently to guarantee a project within its deadline.

In the short term, we see that the model is capable of reacting to disturbances and leads to eliminating the delay. However, the difficulties lie at the level of efficiency of the different

loops. Indeed, we also notice that some control loops are useless for low appeal to their control variable. It allowed us to identify five pre-eminent control loops among the 96 loops, controlled by: “staff motivation”, “tasks reorganization”, “the multiplicity of controls and execution of orders and information”.

DISCUSSION

In the context of an ERP project, team motivation is the satisfaction of a number of conscious and unconscious needs (Amghar, 2001). It is the key ingredient in the effective management of the project team. This skill involves building a team of the right size and composition for the ERP implementation project by creating a favorable climate for creativity and

collaboration among team members (Brandel, 2006). This involves motivating these members and authorizing them to carry out the project in order to increase their productivity (Zimmerer and Yasin, 1998). The control loop conservation controlled by "motivation" in our sensitivity study is explained by the motivation importance, which is the engine that drives the individual to work hard. This result is similar to that of Indelicato (2005) and Brandel (2006). These authors showed that given the long duration of large projects such as ERP, it is understandable that it is very difficult to keep project team members motivated throughout a project that can last a few years. This results in either the departure of key people or a significant drop in the team's productivity. Thus, Amghar (2001) states that the discovery of each team member motivations allows the manager to place each person in a situation where they will be both happy to do their work and effective in achieving it. This justifies that the human factor, which accounts for approximately 80% of large-scale costs IS projects such as ERP, is the determining factor of a project's success.

As shown in the sensitivity study, the control loop controlled by "task reorganization" is important. Corovic (2016) states that this action has a significant impact on the progress of the project in addition to wasting energy and time. He also adds that due to the specificities of ERP projects, the learning curve for new project team members can be much longer than in most other projects. Moreover, the loss of one of the key members can disrupt production without taking into account the adaptation period required for each new recruit. Since ERP projects require a significant implementation time, they usually experience a somewhat high rate of reorganization of personnel tasks. This includes being able to find the right place for each team member where they will be most effective, which has a direct impact on project performance. This is the case with the departure of key people, which can have very negative impacts on project productivity. Since these projects take a long time to complete, they usually have a somewhat high rate of staff tasks reorganization, which has a direct impact on project performance.

Like any other project, the implementation of large-scale information systems implies the personnel disaffection, where the compartmentalization between several groups can only slow down the information flow and the strategic data updating (Meysonnier and Pourtier, 2004). In addition to the reports given to him by his employees, the manager should also obtain information from all possible sources and in particular by gathering information in the field. This action corresponds to the multiplicity of order and information controls. In several ERP system implementation situations, significant resistance is evident, sometimes blocking even information that jeopardizes the project team members, their efficiency and the progress of the project (Bernard et al., 2002). The project manager is required to check whether information and orders are shared with all project stakeholders to promote their commitments. The timely dissemination of information greatly assists in managing changes that may occur during the project. Moreover, the mechanism pre-eminence study monitored by the multiple controls, executing the orders and information" is justified by the work of Meysonnier and Pourtier (2004). These authors have always revealed a control of actions and support to the person to whom the work has been entrusted; two essential tasks for the day-to-day work of the manager. The control and follow-up of orders and information implies a good knowledge and awareness of reality. This action helps a lot in managing the changes that could occur during the project.

In addition, this study allowed us to identify the regulatory loops deemed useless and controlled by "documentation", "meeting organization", "awareness and staff accountability".

We also note that we were able to propose a simplified model consisting of effective control mechanisms allows to eliminate the delay and implement the ERP system without exceeding the deadline and achieve an acceptable level of performance which is a primary objective for the project manager and his team. This simplified model consists of complementary actions

controlled by “motivation”, “tasks reorganization”, “multiple controls and executing of orders and information”.

IMPLICATION TO RESEARCH AND PRACTICE

In the research paper, we have proposed an assessment framework of ERP project malfunction that can be useful for companies that are implementing an ERP system.

This framework justifies this investment by assessing its impact and anticipating the problems they may encounter.

In addition, companies considering acquiring and implementing such a tool can benefit from our study which proposes an improvement of the project's performance

CONCLUSION

This research paper has enabled us to apply systems dynamics in short-term skills management. In other words, our model could approach differently the complex problems that project managers must solve through the use of system dynamics.

In addition, the results of this study revealed that skills management is quite sensitive to disruptions. These results showed that “staff motivation” (boosting cooperation between project team members), “multiple controls and executing of orders and information” (boosting staff productivity and cooperation), and “task reorganization” (boosting staff skills and productivity) are the most effective mechanisms in the short-term skills management model. These action mechanisms are complementary to guarantee sustained performance.

This strategy should be adopted to effectively minimize delays and unexpected costs accordingly. As a result, we conclude that our short-term skills management model is capable of reacting to hazards and fluctuations thanks to a policy based on three actions such as “staff motivation”, “task reorganization” and “multiple controls, executing of orders and information” tracking.

FUTURE RESEARCH

In the future, we plan to propose structural improvements our systems dynamics model in the short term, taking into account other dysfunctional situations, then to perform simulations on the medium-term model and study the interactions between the two hierarchical levels.

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