How to disable mortal loops of ERP implementation: A System Dynamics analysis

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Abstract

Despite the fact that ERP system are introduced more than two decades ago, their implementation failure rate is still high. Such high risk in ERP implementation failure is the most important challenge for organizations to accept the risks or to eliminate ERP solutions and deal with the lack of process integrity problems in competitive e-business environment. Successful ERP implementation depends on various factors known as critical success factors (CSFs) which are mainly focused by both ERP researchers and practitioners. Questions which may arise is why ERP implementation failure risk is still high while there are lots of comprehensive analysis on CSFs and how organizations are able to reduce the failure risk through focusing on CSFs. To answer above questions this study developed a proposition system dynamic model of ERP implementation based on CSFs to discuss ERP implementation complexities, which identifies CSFs causal feedback loops and effects of those loops on different aspects of failure. The model is able to completely cover risk management cycle and illustrate impacts of applied policies on CSFs behavior change, cause implementation failure. Consequently it can be used to compare performance of different policies to achieve the best tradeoff on different ERP implementation success indicators.

Key words: Enterprise Resource Planning (ERP), Critical Success Factor (CSF), System Dynamics Simulation, Implementation Strategies, Causal loops, Implementation dynamics

1. Introduction

ERP projects have a high failure rate. According to a recent International investigation by Panorama Consulting Group, 72% of ERP projects run late; Panorama's study of 192 recent ERP projects showed that 54% were over budget, 66% have received less than 50% of measurable expected benefits and more than half of the respondent organizations found "organizational issues" as the most important issue in ERP implementation which cause spending 0-25% of project budget on organizational change and business process management(Panorama 2014) .

IT project success can be categorized by assessing the resulting system against the planned objectives, user expectations, project budget and goals by obtaining user's consensus on the differences. A successful ERP implementation project can meet user's expectations while completed on time and on budget (Aloini, Dulmin et al. 2007). Although there are lots of benefits associated with ERP implementation, its high failure risk still is an important issue for organization. In order to control such high failure risk, different groups of researchers and practitioners have studied ERP implementation which eventuate introducing ERP implementation Critical Success Factors (CSFs) (Dezdar and Sulaiman 2009, Hakim and Hakim 2010, Salmeron and Lopez 2010, Amid, Moalagh et al. 2012). There are lots of CSFs with different classification, but some CSFs have more importance which are mentioned by most researchers. All of these important CSFs contribute in three ways to figure out final experience of ERP implementation as an incomparable success or irrecoverable failure. These three ways are project time, cost and achieved expected benefits. However a common point in ERP implementation CSFs analysis research is most of these researches have discussed effects of CSFs on project success aspects distinctly while not only CSFs are interdependent and have complex interrelations which include lots of causal loops dependencies but also project overall time, cost and achieved expected benefits as ERP's success aspects are linked together. In classic project management, time and cost performance have the most importance, and most project managers' decisions are based on time and cost performance. Unfortunately inadvertency of output system performance and focus on time and cost performance cause most ERP projects to fail meeting expected benefits and goals, even though the implementation process took much more than the planned time and cost. Although project time and cost are two different factors but they are integrated because project time overrun cause more cost overrun. Also trying to decrease project time overrun through increasing project resources cause more cost overrun too. Consequently ERP implementation success analysis has two different aspects which are time and cost performance that is called Schedule Performance Index (SPI) and also the abilities of the implemented system to meet expected benefits which is called system reliability in which the SPI indicates a ratio for project planned progress to actual progress in time axis. In the case of system reliability success, project SPI plays an important role too. As an illustration when an implemented ERP package is unable to provide expected benefits, project will be faced to some rework cycles which means more time overrun.

Relying on complexities in ERP risk management which are mentioned above ,effective ERP implementation risk management include more aspects and project managers need effective tools in ERP implementation to achieve the best tradeoff between Project SPI and output system abilities to meet expected ERP implementation benefits. System Dynamics is a useful tool in such complex cases. System Dynamics is a methodology for analyzing complex systems and problems with the aid of computer simulation software. The methodology is appropriate for any dynamic system characterized by interdependence, mutual interaction, information feedback, and circular causality. System Dynamics is a way of analyzing the behavior of complex systems to show how they are structured and how policies used in decision making govern their behavior (Forrester 1961, Forrester and Senge 1980). In this regard, ERP implementation has been developed as a system dynamics model in this research based on system thinking theory to analyze ERP implementation dynamics as a common IT-based solution for Business process reengineering. Developed System Dynamics model of ERP implementation relies on ERP projects' most important critical success factor as system ingredients which are frequently repeated in ERP risk analysis researches. The model discusses ERP implementation dynamic structure through identifying the system's core causal loops, mortal loops which impact the core structure and cause failure and also causal structure of systemic policies for successful ERP implementation. Also ERP projects' critical success factors effect on the implementation time performances and the exploited system operational performances are examined by using this system dynamics simulation. The analysis of ERP implementation CSFs effects on project overall success has been done through mirroring all ERP implementation CSFs effects on project SPI which enables Project managers to examine effect of different policies on CSFs' behavior.

2. BPR as the most important CSF in ERP implementation

ERP implementation is associated with Business Process Re-engineering (BPR). As mentioned above a recent study by Panorama Consulting implies that more than half of the respondent organizations in Panorama study found “organizational issues” as the most important issue in ERP implementation which cause spending 0-25% of project budget on organizational change and business process management (Panorama 2014). BPR is the fundamental rethinking and the radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed; Suresh believes that the radical redesigning of a process is easily achieved by involving information technology (IT) in business processes and hence the prominence of IT in BPR (Subramoniam, Tounsi et al. 2009). So IT is accepted as an essential enabler of BPR(Davenport and Short 1998). As ERP systems achieve seamless integration through information flow across the various functional areas of an organization, this technology tool enables BPR. Thus, ERP system qualifies as a potential candidate for IT based BPR in organizations (Subramoniam, Tounsi et al. 2009). But what makes attaining BPR benefits through ERP implementation complex is the software package basis of ERP and its customization complexities. To elucidate ERP developers would like to provide a general solution for all organizations with every level of business process complexity; while organizations require a specific package that is as customized as possible to meet all their business process requirements. Consequently attaining BPR benefits through ERP implementation would be possible through a combination of business processes changes and ERP package provider’s customization. Even in the best case scenario, ERP implementation is able to meet about 80% of adopter organization requirements (Subramoniam, Tounsi et al. 2009). To shed more light for the importance of both BPR and ERP customization in implementation success Panorama Consulting states that “Organizations that do not clearly define their business processes before software selection will most likely find that their chosen ERP system requires heavy customization to meet business requirements and found cost of customization a shock for implementation”. The results of their study shows 1-25% of customization for more than half of the respondent organizations (Panorama 2014). In fact, the risk is consequences of simultaneous implementation of ERP implementation as a software package, which its customization is so expensive and organizational process reengineering leads to high risk levels of implementation success. BPR as the most complex CSFs of ERP implementation discussed above. But still there are lots of other CSFs which mentioned frequently by ERP researcher based on table (1). These CSFs also used in the research simulation model and will be discussed during the model development.

Table 1: ERP CSFs Review of Literatures

	References									
CSF	(Zhang, Lee et al. 2005)	(Finney and Corbett 2007)	(Amid, Moalagh et al. 2012)	(Aloini, Dulmin et al. 2012)	(Hakim and Hakim 2010)	(Salmeron and Lopez 2010)	(Dezdar and Sulaiman 2009)	(Bharathi, Pramod et al. 2012)	(Venugopal 2010)	(Salmeron and Lopez 2010)
Education & Training	✓	✓	✓	✓	✓	✓	✓		✓	✓
User Involvement	✓		✓	✓	✓	✓	✓			✓
Employees' Motivation		✓	✓			✓				✓
Poor Project Team		✓	✓	✓	✓	✓	✓			✓
Lack of cross-functional project team				✓	✓	✓	✓			✓
Project Management	✓	✓	✓	✓	✓	✓	✓		✓	✓
Change Management		✓	✓	✓			✓			✓
Project Delay	✓		✓							
Project cost planning and management	✓	✓	✓	✓				✓		
Business Process Re-engineering	✓	✓	✓	✓	✓		✓		✓	✓
Communications	✓	✓	✓	✓			✓	✓		✓
Inadequate Legacy System Management		✓		✓					✓	✓
Absence of readiness			✓		✓			✓		
Internal conflict between departments			✓		✓				✓	✓
Wrong ERP Modules Selection		✓		✓		✓	✓		✓	
High rate of system customization			✓	✓	✓		✓			
Poor Vendor Support	✓		✓	✓	✓		✓		✓	
Consultant Poor			✓						✓	✓

The ERP implementation project's life cycle starts when an organization decides to implement an ERP package. At first, the organization selects an ERP package based on its own requirements and defines a time scope for the project (Umble, Haft et al. 2003). Even though picking the best ERP package is critical for ERP implementation success, but it's not enough to start running on the bumpy road of ERP implementation. Organization's readiness for such fundamental changes that are highly associated with business process reengineering is critical for successful implementation. To go into the depth of implementation readiness and it aspects, (Shafaei and Dabiri 2008) have developed a methodology by establishing an adaption between ERP implementation CSFs and EFQM model indicators in assessing organizational readiness for those, that have decided to implement ERP system. On the same path, (Lien and Chan 2007) have developed a hybrid model based on fuzzy logic and AHP methodology, that introduces important factors of a successful EPR selection from both product perspective and managerial solution perspective of ERP implementation. Finally, when ERP implementation starts, the organization will be in a way that its readiness as its initial situation has an important effect on how the organization will complete the way. As mentioned before, ERP is a best practice oriented software package that most of the organizations pick it as an IT-based BPR. As mentioned, an important factor for a successful ERP implementation is the required level of BPR for adopting the selected ERP package. Consequently, the larger gap between the organization's maturity process level and what ERP produce as a best practice, the more BPR required. Needless to say in the case of more BPR required for utilizing ERP, the organization has to travel farther and complete more implementation tasks in a limited time, because time performance is very important for the investment return, and implementation time could not extend consumedly. But the question is, although most implementation processes take much more than the planned time, why do organizations fail to improve ERP implementation performance and implementation outcomes are not satisfying, even though organizations are aware of the importance of the project time performance and spend their whole effort to improve attained results performance?

3- System dynamics approach to what happens during ERP implementation

Figure (1) represents the dynamic hypothesis about ERP implementation as a casual diagram.

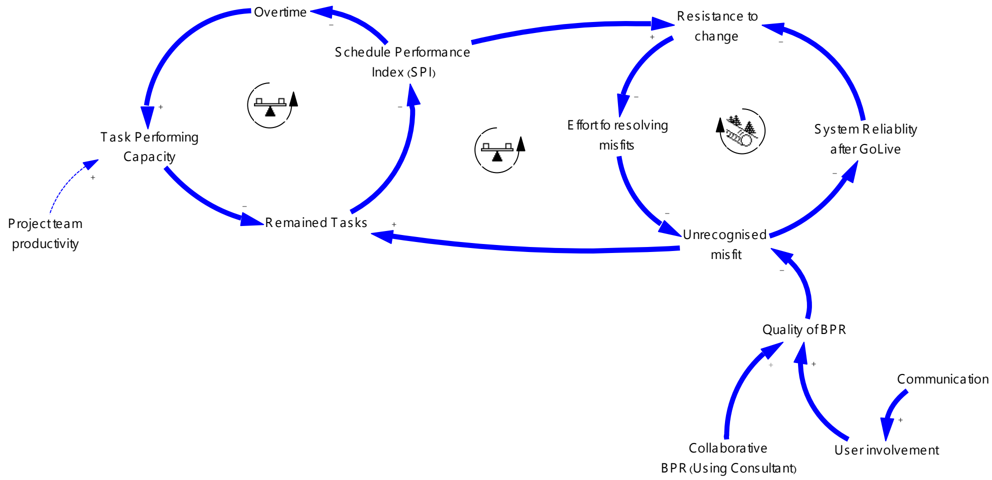

Figure 1: ERP implementation casual diagram

Practically, ERP systems are integrated process-oriented systems and are best practices based and also generally have a software package in the business front. From this point of view, ERP systems are wide ranged software packages that have numerous parameters that make them strongly complex to configure adaptive organization's processes in the best performance level that is necessary to run the system; Nevertheless there are some Exclusive processes that ERP is unable to cover (Botta-Genoulaz and Millet 2005). In this respect, (Shields 2001) believes that sufficient technical knowledge on ERP vendor package details is essential for implementation. Because ERP packages have thousands of parameters that delimit processes and enables the project team to establish its own processes between lots of available solutions that ERP provides for a single purpose. That being so, a cross-functional team who not only are fluent in the selected ERP package details, but also are experts in the organization's process requirement details are required. Based on what was mentioned about the ERP implementation complexities and the required knowledge, an ERP critical success/failure factor called "project team" and its productivity will emerge. In fact, the "project team" is responsible for business process reengineering based on the final goals and the ERP package capabilities. Hence vendor support and the quality of vendor training programs for the project team as two other ERP implementation CSF, play important roles in determining the project team's productivity. After finishing the vendor training programs on how to configure processes in an ERP package, implementation process would transmit to a phase that the project team's capability in the progression of the implementation project based on the planned schedule would be measured frequently throughout the schedule performance index (SPI) until the official end of the implementation process and the feedback on the SPI project would have important effects on decisions during the project's life cycle.

A question that may arise in the ERP implementation is, how does ERP implementation dynamics cause such a severe challenge for organizations and eclipse the project time performance? To elucidate on this matter, as a comprehensive solution for all organizations in all industries, ERP packages are greatly complex to understand all of their details. Consequently most of firms perform business process reengineering in partnership of expert ERP consultants to enhance the implementation and also BPR quality to reduce the implementation time (Wang and Chen 2006). Also in the point of critical roles in ERP project's life cycle, (Somers and Nelson 2004) emphasized on the role of a consultant and expressed that most of ERP adoptive firms use expert consultants because they provide comprehensive and optimized solutions whose necessity would appear when systems go operational. The role of expert consultants support as a frequently mentioned ERP critical success factor interprets to the ratio of implementation tasks that have been done in collaboration with a consultant and those tasks have been done internally. More collaborative tasks improves BPR quality that decrease the probability of new implemented process misfits.

After process reengineering and ERP package configuration based on the reengineered processes, it’s time for implementing those processes. Needless to say, beside process reengineering, ERP would change roles and responsibilities; so new roles and responsibility-designing and their level of intervention in new processes are essential. As already noted, the ERP project team completes BPR tasks aided by ERP consultants; consequently the project team structure plays a key role in their organizational processes requirements conversancy. Shields also believes that one of the most important CSFs in ERP implementation is user participation. He Emphasizes that all ERP stakeholders should be involved in designing the process and system performance tests. In other words, ERP implementation from Shields' point of view is formed by a core team who works on the implementation project full time, and a support team that includes all stakeholders who are not a core team member and provide essential information about the process requirements, suitable test scenarios, training requirements and etc. (Shields 2001). Therefore it can be concluded that even professional project teams don’t know the different processes and roles and details. This knowledge is achievable only through permanent interaction between the project team and process owners and also their involvement in the processes and role re-designs (King and Burgess 2006). The importance of “communication” and “user participation” could be understood as two critical success factors. Therefore, the frequency of the project team's interaction with others is used in this study's simulation that has a significant effect on BPR quality, or in other words, whole roles and processes requirement will gain coverage.

Based on what was said about the project team's productivity and the quality of BPR, it can be concluded that reengineered process that is designed and implemented by the project team is rarely able to cover the whole organization's process requirements and some level of rework is needed because of probable misfits between what the organization requires and what ERP provides (Al-Mashari and Al-Mudimigh 2003, Kumar, Maheshwari et al. 2003, Loh and Koh * 2004). Such reworks increase implementation remained task which has adverse effects on “SPI”. Most organizations compensate project lag is caused by recognized rework through increasing overtime which will bring more task performing capacity. If these rework that are caused by the process misfits would be identified in the go live phase after the legacy system abundance, the firm would be facing a serious crisis and would have to solve the identified misfits simultaneous to the system's live use. In such situations, the performance of the in-use ERP is not as expected; and the system reliability which is a critical factor for a successful ERP implementation, causes some levels of resistance to change. The greater the misfits, the higher level of resistance to change and increased efforts to leave ERP and return to the legacy system. However if there is a tight link between ERP and the legacy system to cover those requirements that ERP is unable to provide, and also the project's time performance is unsatisfactory, it would be even more difficult to convince users to spend their efforts on solving ERP problems instead of returning to the legacy system (Shields 2001). Obviously, these misfits will eclipse the project's time performance and will postpone the project's end in addition to the project's time performance before going live.

4- ERP implementation's hidden dynamics

The causal diagram in figure (1), illustrates the ERP implementation's dynamics core. But what intensifies the ERP implementation's failure risk are the hidden mortal dynamic loops that, overshadow the core dynamic's structure and change the consequence of the efforts for a successful implementation to an unexpected accelerated movement to a more formidable failure. This study is going to introduce and analyze these hidden mortal loops. Figure (2) represents the ERP implementation's causal diagram, including the hidden mortal loops.

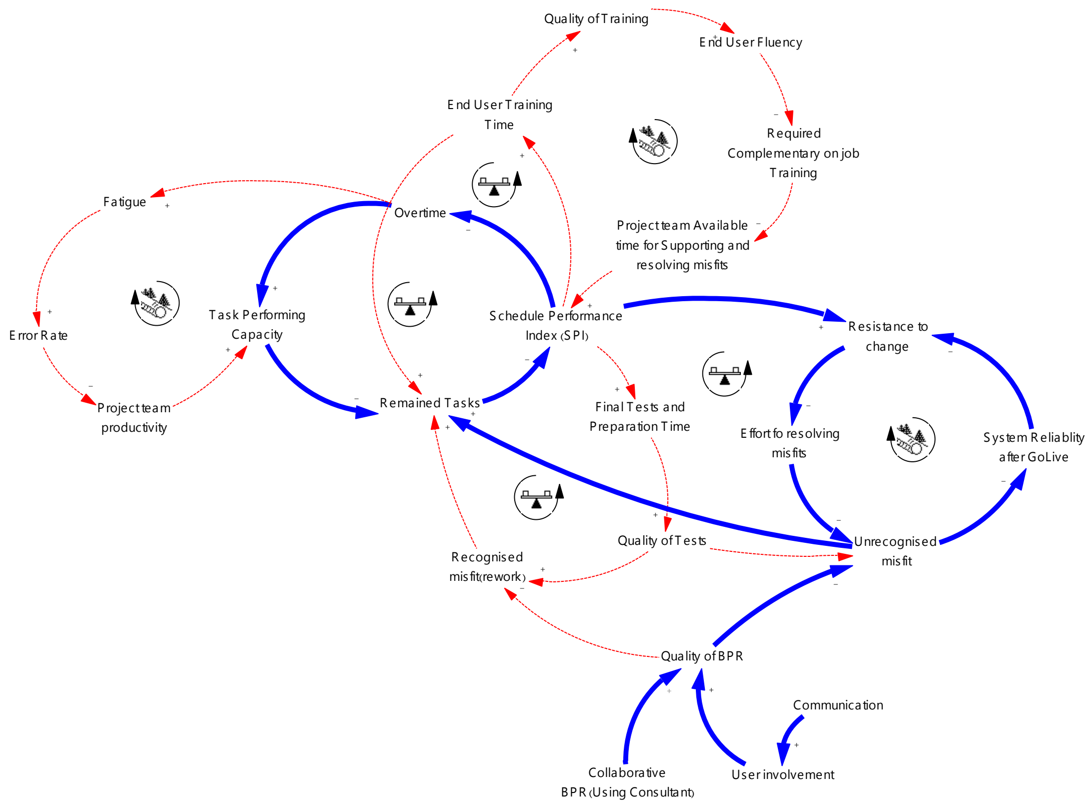

Figure 2: ERP implementation mortal loops causal diagram

In most cases, organizations try to compensate for projects falling behind the scheduled progress through increasing overtime. But most project managers miss the point of overtime effectiveness slippage in longtime. However increasing overtime may look effective, but especially in ERP implementation projects, it is not an efficient policy to enhance project schedule performance in long term. Because increasing overtime cause fatigue in the project team which leads to a slip in the project team's performance which will lead to more errors in completing the implementation tasks. Consequently, future overdoes will be increased as a result of long-term use of higher levels of overtime policy (Sterman 2000, King and Burgess 2006). In the case of overtime policy incompetency, if the firm attempts to enhance the ERP implementation schedule performance through eliminating those project tasks which are scheduled for implementation in the last days, the project's overall performance will deteriorate much more, because most of the implementation tasks which are planned for the last days are those who examine the implemented system's reliability and also user training which bear great importance (Markus, Axline et al. 2000). System reliability tests in ERP implementation mainly consist of the implemented system's cross functional performance, which can be performed just at the end days of the project after all involved processes completion. Note that eliminating such important tests may increase risk of incompatibility between the implemented system and the expected performance in an irreversible way. In fact, it’s essential to examine the implemented system's performance accuracy in providing all of the firm’s process requirements through precise test scenarios before leaving the legacy system and switching to a ERP system in order to solve them. These tests require profound knowledge in the field of adoptive firm business that the ERP system is implemented to respond to its requirements. Therefore, using various users' experience who are responsible for different roles in the organization and have full knowledge about the organization's requirements can be useful in planning test scenarios for the implemented ERP system's misfit recognition in the integrated performance tests; any weakness in recognizing the implemented system's misfits before going to the live phase, will face the organization with serious problems (Shields 2001). Some system misfits are recognized during the system's overall performance tests and enter the redo cycle to be solved; but some misfits are not recognized because of the tests’ reduced quality as a result of eliminated test tasks planned in the end days. These unrecognized misfits which are the main reason for the system's weakness in providing the expected benefits will impair the organization's performance and should be resolved simultaneously with using the ERP system which will cause a serious performance crisis for the organization. As mentioned before, most organizations leave the ERP system and return to their legacy system in such performance crisis situations or in other words, the ERP project fails to be implemented.

About reducing the final users' training tasks it should be noted that their fluency on their new roles and responsibilities will be decreased as a result of decreasing the required training programs which cause further required on-job training in the go-live phase. Umble in expression to the importance of the final users' training notes that if the final users aren't unable to use the ERP system perfectly, the ERP's expected benefits could not be realized. So the project team should ensure that the final users are able to work with the ERP system fluently and give them on-job complementary training if necessary (Umble, Haft et al. 2003). It is important to have in mind that increasing on-job complementary training leads to the project team's less available time to support and resolve the recognized misfits after the go-live phase which will postpone the actual project end.

5- Strategies preventing ERP implementation's failure

As is evident in figure (2), the ERP implementation's dynamic structure consists of some mortal loops that the core structure's interaction with those mortal loops is like a cotton and a match's interaction; so a wrong spark can transform ERP to a hill that, the project team's efforts to improve the implementation results would be inverted to the effort in intensifying the flames of the hill. How organizations are able to reduce the ERP implementation's risk through relying on the described structure for ERP implementation as a dynamic system still remains a question. The answer firstly lies in the firms' motivation for ERP implementation, and secondly in their reactions to the upcoming challenges in effect of starting an ERP implementation. As it was mentioned before, most of the organizations select ERP implementation as an IT-based solution for their firm's business process reengineering, while customizing ERP as a software package in order to fit it to the organization's unique processes that create the organization's core competencies is strongly time consuming and requires lots of financial and human resources. So increasing the number and monopolization of the firm's unique processes requires more customization, and it not only will increase the implementation tasks, but also will increase the probability of misfits between what ERP is able to provide and what the adaptive organization expects from the ERP implementation that can cause a serious challenge for the organization in leaving the legacy system. On the other hand, by increasing the gap between the adaptive organization's current processes and what ERP proposes as a best practice, the level of BPR required will increase. In higher levels of the required BPR, not only the implementation tasks will increase, but also the probability of misfits between the implementation results and the organization's requirements will increase. Figure (3) represents the ERP implementation system’s causal diagram after applying factors which are able to control the mortal loops and neutralize their adverse effects as much as possible.

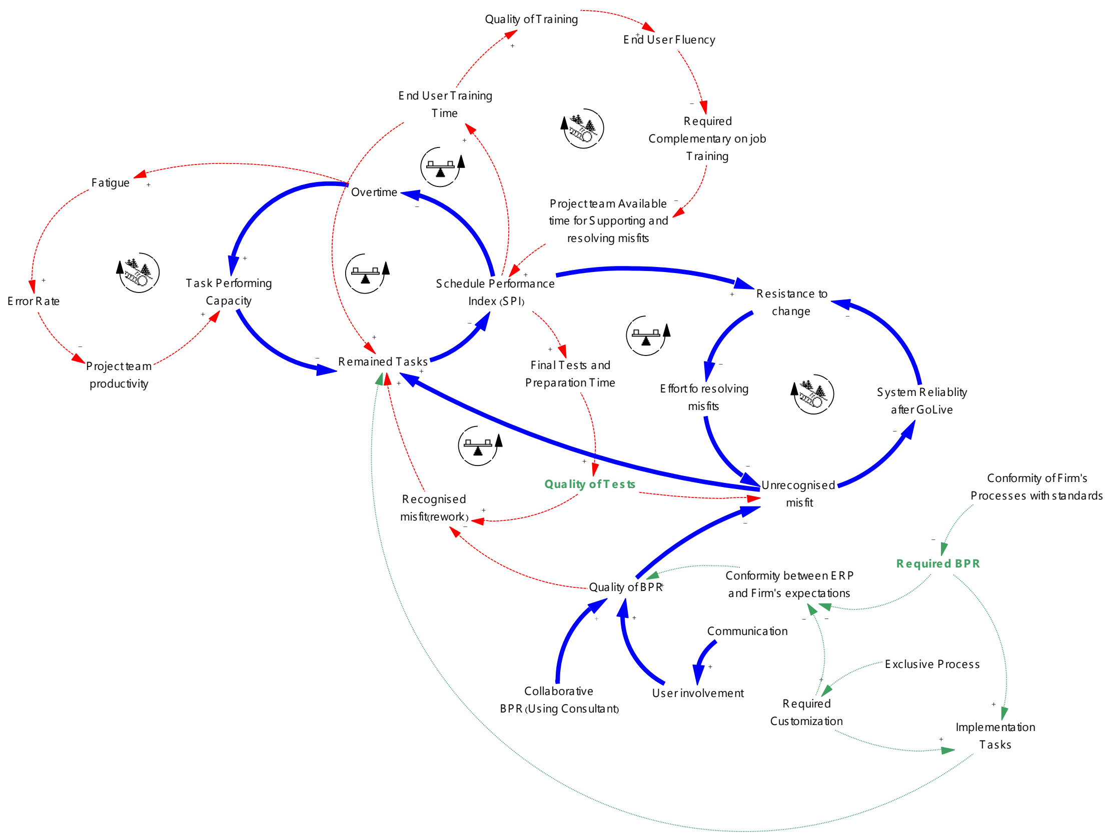

Figure 3: ERP implementation risk controller causal diagram

According to the causal loop diagram in figure (3), one of the possible solutions for reducing the ERP implementation risk is performing BPR before ERP implementation, in order to provide a suitable conformity between the firm's processes and the ERP available processes. As Panorama research results admits, organization that do not performed some levels of BPR before ERP implementation, are those require more customization in their ERP Package (Panorama 2014). Also performing BPR before ERP implementation also provides an insight about the firm's processes that is a useful facilitator for selecting the best ERP package which has the most conformity to the firm's requirements.

Even though performing BPR before ERP implementation reduces implementation tasks, there are some other factors that interfere with implementation on the scheduled progress; so project management policies play an important role in a successful implementation. As mentioned before, when an ERP implementation project falls behind the schedule, two wrong policies are increasing overtime and eliminating some end days' tasks including the systems' cross-functional reliability tests and final users' trainings that have important roles in the implemented system's conformity with the organization's expected benefits. In other words, every misfit that is unrecognized in effect of the decrease in the tests' qualities will not only face the firm with a serious crisis but also impairs the project's schedule performance and resource usage will be more than usual. So the policy of concentrating on the quality of the results and refusing to do actions that have adverse impacts on the results' quality is more efficient in long term from both time and results points of view, even though it may cause the performance to slip in short time. The Panorama consulting research results admits that organization should emphasize on business process management through allocating budget toward organizational changes with strong third party consultant (Panorama 2014). Consequently concentrating on reducing the level of required BPR during implementation through performing some level of BPR before attempting to implement an ERP package and simultaneous focus on keeping quality of performed task, especially final test task high through refusing elimination of end days tasks and collaborating with both expert consultants and all roles during implementation, can have inconceivable effects on reducing ERP implementation failure risk.

6- Simulation results

This study has developed a computer-based simulation proposition model of the ERP implementation as a System dynamics in order to analyze its failure from the System dynamics point of view. Also, the effectiveness of two of the recommended policies for decreasing ERP implementation risks based on adjusting the existing structure is examined in a simulation environment. All model parameters has been set based on simple and logic relations as a proof of concept. They should be replaced by more accurate ones based on practical functions in future studies.

The first requirement for the System dynamics simulation of the discussed hypothesizes is a flow diagram. Flow diagrams are able to perform system accumulations. Accumulations in system dynamics simulation exhibit the system's status in different sections of time and are a source of the system's disequilibrium. They also give some information of what the system's decisions are based on. There are lots of examples for accumulations. As a case account balance is an accumulation. Accumulations are altered by the difference of inflows and outflows and also have historical memory. In the account balance case, a deposit is the inflow, and a withdrawal is the outflow (Sterman 2000). Figure (4) shows the ERP implementation flow diagram based on the discussed dynamics hypothesizes.

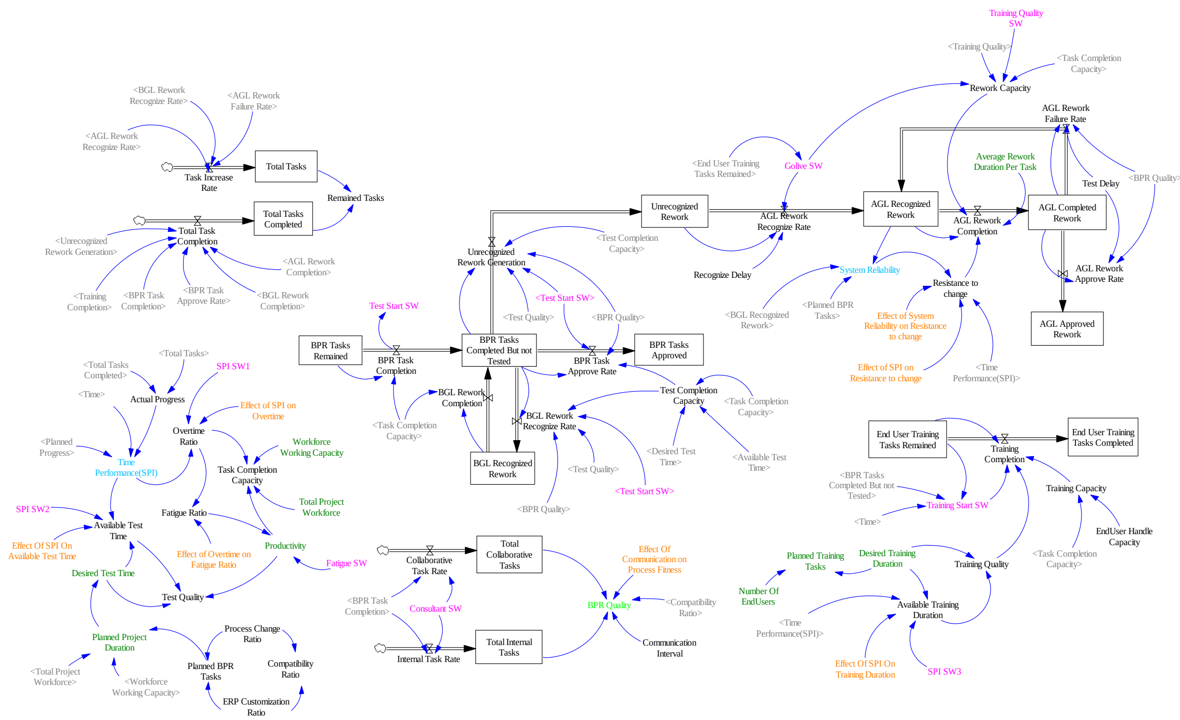

Figure 4: ERP implementation flow diagram

6-1- Results of examining policy (1)

In order to examining effectiveness of "performing BPR before ERP implementation to provide a suitable conformance between ERP processes and the adoptive firm's processes" policy, the simulated model is run 3 times with different settings. At the first run, the model has been set to a little customization requirement level and performing BPR tasks during the ERP implementation. For the second run, the model has been set to perform BPR tasks during the ERP implementation without any customization. Finally for the third run, not only BPR tasks has been performed before the ERP implementation, but also there isn't any customization during implementation. Figure (5) represents the project's schedule performance through "SPI" variable for these 3 runs.

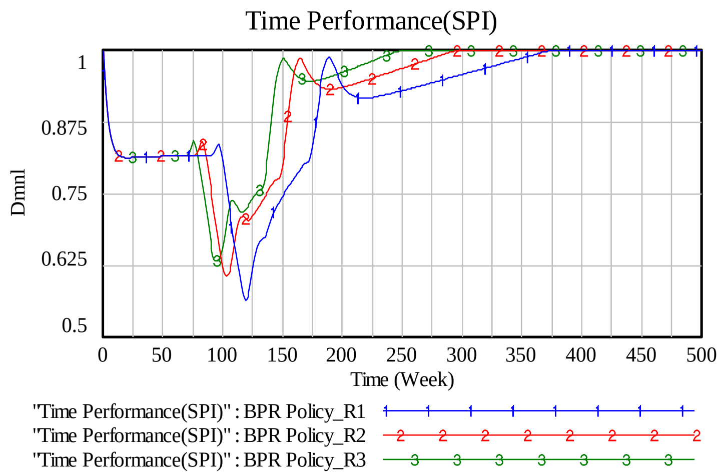

Figure 5: SPI behavior in effect of applying policy (1)
(1): First Run (2): Second Run (3): Third Run

As is evident in figure (5), less BPR tasks required during the implementation and also less customization levels cause better schedule performance for ERP implementation projects.

6-2- Results of examining policy (2)

In order to examine the effectiveness of " concentrating on the quality of the results and refusing actions that impact the results' quality" policy, the simulated model is run 3 times with different settings too. For the first run, the model has been set to perform all BPR tasks with the collaboration of expert consultants in an isolated environment, and there isn't any interaction between the project team and the process owners. Also the project team's productivity has been set to 80%. For the second run, the model has been set to use only the overtime policy to compensate for the project falling behind schedule. Finally, for the third run, the model has been set to use eliminating end days tasks including final users' trainings and the system's cross-functional reliability tests in addition to the overtime policy. Figure (6) represents the project's schedule performance through the "SPI" variable for these 3 runs.

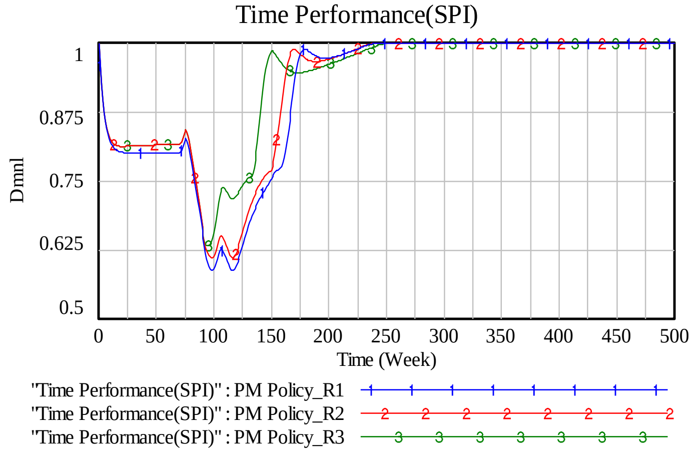

Figure 6: SPI behavior in effect of applying policy (2)
(1): First Run (2): Second Run (3): Third Run

As is evident in figure (6), in both first and second runs of the model, there is a schedule lag because of the project team's productivity. However, both runs tried to compensate their schedule lag through overtime; simulation results reveal that the overtime policy is not efficient in long term, because the project's schedule performance enhanced slightly after applying overtime, but in the long run it fell again to a lower level than it was before applying this policy. Simulation results also reveal that eliminating final tests and training tasks acts the same as the overtime policy. Even though eliminating final tests and training tasks may improve schedule performance but this improvement is temporary. Once the project goes to the go-live phase, complementary on-job training and identified misfits put the project behind the schedule again and cause a later end for the project in comparison to the project end before applying this policy. To elucidate, these two policies make system adjustments more complex through transferring required reworks for fixing the existing misfits and the identified reworks before the system goes live to unrecognized reworks that should be performed simultaneously using the system after it goes live.

6-3- results of examining the combination of policies (1, 2)

Finally, according to what simulation results reveal in figure (7), organizations would be able to achieve the best schedule performance level through applying both “performing BPR before ERP implementation to provide a suitable conformance between ERP processes and the adoptive firm’s processes” and “concentrating on the quality of the results and refusing actions that impact the results' quality” at the same time.

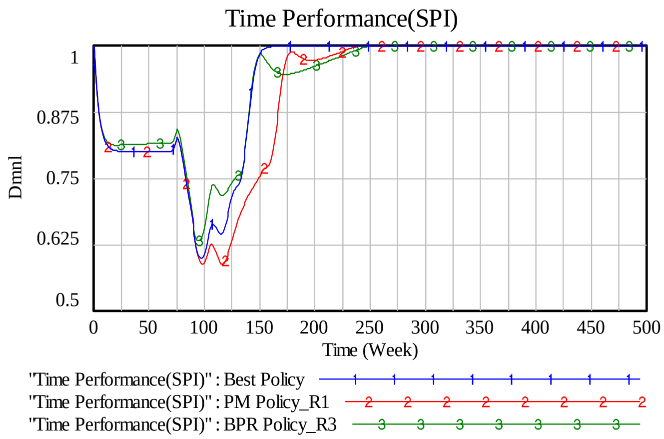

Figure 7: SPI behavior for simultaneous applying of both policies
(1): applying both policies simultaneously (2): First Run of Second Policy (3): Third Run of First Policy

Concentrating on the quality of the results and refusing actions that impact the results' quality through refusing elimination of end days tasks enable firms to find out misfits before systems goes live and have enough time to correct them. When a firms leave its legacy system in go live phase and start using ERP it has to correct recognized misfits while it's using the imperfective ERP system for handling its daily tasks which cause lots of crisis for the firm and load more pressure to solve the problems. In case of serious problems users may attempt to resist solving recognized misfits and leave ERP which cause project failure. Regarding to importance of using expert consultant and communicate with all roles during the implementation, it reduces the probability of misfit between expectations and what has been developed through ERP implementation. Finally performing BPR before ERP implementation would provide a suitable conformance between ERP processes and the adoptive firm's processes which not only reduce implementation tasks but also increase conformity of the Firm's processes with standards which cause less probable misfit between ERP outcomes and expectations.

7- Conclusion

According to the simulation results, it could be understood that ERP implementation has lots of dynamics and a parameter's behavior can change quite the contrary to the organization's expectation. Such different behavior is because of the organization and the project team's misunderstanding caused by a lack of a holistic and systemic view on ERP implementation. The important point in the ERP risk management is exactly such misunderstandings which are the basis of most decisions that their consensus would be irreversible and determine the project's success or failure. For instance, in examining the effects of eliminating final tests and final training tasks on the schedule's performance, simulation results illustrate that despite the project team's expectation in compacting these tasks in ERP implementation, not only it was unable to enhance the project's schedule performance, but also it caused serious challenges for the firm after the system went live. Also in examining the effects of performing BPR before ERP implementation, the simulation results illustrate that there is little risk in implementing ERP as a software package, and the main risks in ERP implementation are the required changes in the organization's processes, unique procedures, roles and managing these changes during the implementation. It can be understood from the simulation results is that a holistic and systemic view on the ERP implementation and considering causal loops play a significant role in successful outcomes of the decisions during the project. Since simulation results demonstrate, without a holistic view and considering systemic effect of a decision, any effort for improving the implementation result may cause more fatal failure. System dynamics simulations such as what was discussed in this study can provide a valuable insight about complex projects such as ERP implementation and the importance of long term thinking about the effects of decisions on attaining the best tradeoff between the project's outcome performance and other factors. Although alluded system dynamics model and policies are not the best solution for ERP implementation risk reduction. The developed model for ERP implementation dynamics in this study is just a proposition one and the model’s equations should be replace by more accurate equations, it is able to proof the concept of System Dynamics application in ERP implementation risk analysis and answer the questions why ERP project failed and how organizations are able to reduce risk of implementation failure through making systemic decisions.

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