Revised P^{3}IEI Methodology for Organizational Process Reengineering in Complex Environment

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Abstract : **Recently due to the significant attention that is paid to the importance of rigid relationship between organizations and their customers, in one hand, and suppliers at the other hand, there is an urgent incentive to the producing of products and services that expand organization fitness and its co-evolution with its environment. Chiefly organizations with given goals and grand strategies have processes that each of them satisfy one of the parameters of operational goals; and getting the desired performances of these processes, guarantees the achieving of organizational grant goals.**

For the sake of having organizations as complex adaptive systems with high fitness and ability to self organize themselves it ought to pay attention to the adaptation process and co-evolution between organization and environment in order to choose appropriate strategies. Thus as a result, this action improve the organizational fitness in one hand and then using businesses processes reengineering, according to the environmental changes (and therefore Schemas of the processes) on the other hand can end in continuous process management and rectification of schemas that change in CAS for the purpose of sustaining the adaptability and durability of these kinds of CASs. In this article we attempt to propose a business processes reengineering methodology based on P3IEI methodology (Shirazi and Mahdyar, 2004) in the context of complexity so that we would be able to fulfill the high fitness and survive in competitive environment.

Index Terms— business process reengineering, complexity science, complex adaptive system (CAS), rugged landscape, fitness landscape theory.

I- INTRODUCTION

Now-a-day, there are a lot of BPR methodologies in the literature that make it difficult to choose between them. Furthermore because of the process difference in various industries, it is difficult getting one of them because the candidate methodology should be appropriate with that industry and processes. Our purpose in this article is to propose a BPR methodology in complex context, in regard to organizations as CASs in this environment that co-evolve mutually; an expression that has not been attended any more before.

In this article we have not gotten through the conventional literature in BPR, its principles, key aspects, its methods and techniques and also its challenge. For more information about this related topics refer to more references in BPR field. We first introduce a methodology of BPR that result from twenty two methodologies that previously rendered by authors and researchers in BPR field. Afterward to render our methodology we will amend earlier version by means of a complexity measure for process selection criteria. To propose the process selection criteria, we will first discuss the concept of complex adaptive systems and then the significant importance of operationalizing organizations as complex adaptive systems will be discussed. Then by use of fitness landscape theory and related concept, we will analyze the organizations and their co-evolution process with their environment. To find a BPR methodology that be consistent with organization strategies and internal and external circumstances in order to directing disparate elements of an organization in a coherent, self-reinforcing direction, it is required to present a process selection criteria according to the nature of the schemas that are present in organization processes. In fact we define organizational complexity and its rolls on agents that populate organizational processes. This processes management or in other words this kind of BPR cause to have great variety, beside that, the emergent behavior will be manageable.

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II- EARLIER VERSION OF P^{3}IEI METHODOLOGY For BPR

We first introduce earlier version of P^{3}IEI methodology for BPR that derived from twenty two methodologies that previously rendered by authors and researchers in BPR field. Subsequently, these candidate methodologies are scrutinized for their shortages and advantages and then prepare a collection of activities that was sent to experts to get their opinions about them. These activities are such as project preparation, strategic planning, stockholders analysis, the process performance indicators clarification, business process modeling, recognition of IT advantages and opportunities, process performance measurement, benchmarking, redesigning, change planning, implementation, evaluation and continuous improvement, and etc which are anticipated that presence of them in BPR methodologies are logical.

These logical activities were attended by experts with a set of questionnaires. These questionnaires have sent to experts and researchers in BPR fields; so in that questionnaire, experts had been asked to mention the importance of each of these activities in scale between 0 and 10. Then by factor analysis and using statistical analysis of expertise, we could propose the earlier version of our methodology.

In this section, the earlier version of P^{3}IEI methodology has been presented briefly (Shirazi and Mahdyar, 2004).

1- PROCESS DESIGN STRATEGIES

This stage is concern about project feasibility (its prerequisite) and drawing up the BPR strategies.

2- PROCESS ANALYSIS

In regard to strategies that were set in former stage, the customer requirements should be recognized to settle as the criterion for prioritizing and selecting process in BPR project. Afterwards, the processes will be modeled and based on the selected performance indicators, they are to be measured.

3- PROCESS REDESIGN

In order to redesign the processes, it is indispensable to investigate the hardware and software infrastructures, information systems capabilities and also benchmarking in similar processes in world class organizations, or even other industries; in addition, restrictions and advantages of processes should be determined in this stage.

4- IMPLEMENTATION

To fulfill the performed changes, the project team should exert methods of change management in both dimensions of cultural and tactical.

5- EVALUATION

In this stage the BPR team evaluates the improved processes to assess their effects on customer requirements.

6- IMPROVEMENT

On account of changes in customer/ supplier needs and turbulence in environment, it is necessary to modify processes that satisfy goals of organization and customer requirements.

The P^{3}IEI methodology is applied in Fars Custom Organization. Measuring performance indicators showed that organization performance in cost, quality and delivery parameters have improved (Mahdyar, 2004).

III- BPR IN COMPLEX ENVIRONMENT

Complex adaptive systems describe as systems that exhibit complex, adaptive, and emergent behaviors because they are made up of multiple interacting agents. Modern theories and models of CAS focus on the interplay between a system and its environment and the co-evolution of both the system and the environment.

Complex adaptive systems theory has enjoyed much interest in management and organizational circles during the last decade.

The basic elements of a CAS are agents. Agents are semi-autonomous units that seek to maximize their fitness by evolving over time. Agents scan their environment and develop schema. These agents behave in a manner so as to increase “fitness” of the system that they belong to either locally or globally. Schema are mental templates that define how reality is interpreted and what are appropriate response for a given stimuli. These Schemas differ across agents. Within an agent, schemas exist in multitudes and compete for survival via a selection-enactment-retention process (Dooley, 1996). Schema can change through random or purposeful mutation, and/or combination with other schema. The fitness of the agent is a complex aggregate of many factors, both local

and global. Unfit agents are more likely to investigate schema change (Dooley, 1996). Schemas define how a given agent interacts with other agents surrounding it. Actions between agents involve the exchange of information and/or resources. Therefore processes in a CAS define in the form of "a collection of actions have been done by one or a group of agents that lead to either flow of information or/and resources between agents, or schemas change in order to be able to heighten the organizational fitness".

These flows may be nonlinear. Information and resources can undergo multiplier effects based on the nature of interconnectedness in the system. In the following, with regard to the above characteristics of schemas, we will precede the necessity of BPR projects in organization.

The basis of this study is to consider the organization as a CAS that consists of a number of processes; each of them has several agents interact with other agents in own process or in the other processes, in order to reach the given operational objectives. Some of these strategic processes are correlated to an operational objective, corresponding to a grant goal in higher level. In other words, an organization is a collection of processes that by satisfying their performance indicators, organization can reach to its goals. The most fundamental property of these processes is their complexity; so that, the process without this property cannot get its performance or satisfy their performance evaluation indicators. Without processes complexity, the information and resource flows in organization would cease and process agents will miss their improvement opportunities for revising and reorganizing its agents as experience is gained from past interactions, and thus the system is likely to face extinction. Therefore to manage an organization, processes should conceive as the basis of decisions and their amount of complexity should be managed so that be able to handle the mutual interdependencies of internal or external agents and subsequently the causal emergent behaviors. This management on one hand ought to satisfy diversity in organization while sustaining some complexity (Backlund, 2003) and also on the other hands, by increasing the amount of complexity organizations can still not meet every situation that might arise, and they might also be less flexible, so that they do not have the right kind of variety and cannot be easily adapted. Therefore, it is not necessarily the best course to strive for greater and greater complexity. Simplicity—combined with vigilance and readiness to change—might be preferable (Backlund, 2003).

According to Dooley (2002), we get organizational complexity as the amount of differentiation that exists within different elements constituting the organization. Complexity increase, leads to diversity and interaction not to be understandable, and also complexity increase leads to increase in mutual interdependency between agents that cause to emergent structures and behavior in CAS. This at the end brings opportunity about schemas changes. That is, processes with higher complexity have been affected by higher emergent patterns. Furthermore higher density or diversity of interdependency cause more and more complex landscape that this also drives to emergence of behavioral and structural patterns. Thus it is necessary to revise and re-organize schemas that have change in CAS, so organization as a CAS would be able to search actively for co-evolution and could get high fitness in adapting with its environment without any constraints between agents. Codification and abstraction that decrease process complexity, also vigorously caused to dimensionality decrease. On the other hand, when dimensionality increase or when individual agents have high degree of freedom to make decisions locally, then allow outcomes to emerge in a deviation-amplifying way or through positive feedback. Many of the creative activities found in firms emerge in this fashion (Dooley, Ven, 1999). Thus the more complex the process is, the more dimensional the agents are and the more process engineering is needed. Thus as a result we select those processes that have structure with higher complexity.

IV- REVISED P3IEI METHODOLOGY

The revised version of BPR methodology, with a distinctive measurement for process selection in complexity environment is presented below. The purpose of this methodology is to engineer the processes that constitute an organization as a CAS, and while declining the process complexity to be able to decrease in

emergent behavior in processes and control these patterns, at the same time by means of exploring organizational landscape and investigating customer/supplier needs that have not been satisfied, do the required changes in process to get high organizational fitness and both co-evolution and co-adaptation with its environment, so it will be able to answer to customers/suppliers need and its goals constantly.

1- PROCESS DESIGN STRATEGIES

This stage is concern about project feasibility (its prerequisite) and drawing up the BPR strategies. These strategies help for managing business process redesign in a way that more adaptation between internal process and environmental changes will be achieved. For performing an operational configuration and design landscape we use fitness landscape concepts. In fitness landscape concept, we study organizational landscape as a starting point, analyze organization as a CAS, peruse the existing configuration (point in landscape), its fitness and value of the elements that influence current fitness, the amount of expectation that has been satisfied with current configuration; in order to get direction across BPR project. Furthermore in this stage, by means of analyzing the new customers/ suppliers need, the evolution trajectory in landscape (adaptive search process) has been determined and therefore organization new strategy elements will be realized.

Sub-activities of this stage have present below:

- Secure top management sponsorship.
- Analyze organizational strategy plan.
- Analyze current organization landscape, the existing point, and its element value.
- Determine the elements that affect in organizational strategy and design organizational strategy landscape.
- Determine customer/ supplier requirements and corresponding organizational goals in order to shape fitness function.
- Identify internal/ external customer/ supplier and prioritize them.
- Identify internal/ external customer/ supplier's need and prioritize them.
- Determine optimum configuration (point in landscape) and find strategy configuration (strategy element value).
- Determine organization strategy in how to respond to environmental complexity (complexity reduction or complexity absorption), according to its cultural, political, historical circumstances (Boist, Child, 1999).

2- PROCESS ANALYSIS

Taking the strategies which have been recognized in previous stage, the consequent landscape, its peaks (solutions) and their fitness, into consideration, customer/ supplier requirements should be analyzed. Meanwhile, in this stage existing processes should be identified and modeled and thus the requirements that could not satisfy with current processes will have been defined. After that new processes or strategic activities for compensating these new requirements should be supplemented. Then model and measure process performance, by using predetermined performance indicators.

Complexity measuring allows organization to reengineer processes that are more complex than the others. By virtue of that in process with more complex interactions, more interdependence schemas emerge, then to having organization with high fitness that evolve with its environment, it is necessary to accommodate agents and schemas with environment, by reengineering.

As a result, however a process be adaptable then would be able to co-evolve in CAS with its environment and therefore would be more agile and could sensitively respond to environmental changes.

Output of this stage is a processes priority set for BPR project. The sub-activities of this stage are as follow:

- Identify processes that are needed to satisfy customer/ supplier needs.
- Measure the complexity of these processes.
- Arrange processes by their value of complexity.
- Measure processes performance.
- Rank all process based on their suitable response to organizational performance.

3- PROCESS REDESIGN

For the sake of well redesigning, BPR project team should investigate the hardware and software infrastructures, information systems capabilities and also benchmarking in similar

processes in other organizations or even other industries.

In this stage according to new organization state in landscape (new configuration), its strategy to respond to environmental complexity and the indicators that affect process complexity (to identify these processes indicators is based on four proposed levels that measure processes complexity), BPR team should get through redesigning of the processes. Outputs of this stage are improved processes with lower complexity that are used to perform business. As a result, new organization, as a CAS, is one with higher fitness, more agile and more capable in surviving or being pursued with its competitors.

Sub-activities of this stage are as follow:

- Identify infrastructures and opportunities for IT.
- Benchmarking.
- Identify the indicators that affect processes complexity (according to proposed measure).
- Draw up and perform improvement process.
- Determine fundamental reasons of problematic factors, according to determined indicators.
- Implement improvement solution.

4- IMPLEMENTATION

To fulfill the performed changes, the project team should exert methods of change management in both dimensions of cultural and tactical.

In order to implement the exerted changes, it is vital using the methods of change management. Change is not an event, despite our many attempts to call folks together and have a meeting to make change happen. Change management is the discipline of managing change as a process, with due consideration that we are people, not programmable machines. It is about leadership with open, honest and frequent communication. These methods are in two dimensions, tactical and cultural. Sub-processes of this stage are as follow:

- Change management with tactical methods
- Develop cross functional teams for planning and implementing BPR project.
- State transition team, to manage BPR plans.
- Coordination team to coordinate the necessary operations and set the necessary connections with cultural methods
- Subdue from resistance of those whom implementers believe will benefit the most, by appropriate incentives.
- Create and intensify the current discontent situation.
- Stimulate for getting desired results.
- Use prototype implementation.
- Develop staff training course for new professions.
- Implementation.

5- EVALUATION

In this stage BPR project team should evaluate improved processes and assess their effect on organization dimensionality (as a CAS), its landscape and also on customer/ supplier needs. For doing so, use landscape, whose axes determine processes performance indicators and its fitness function (topography of landscape) determines organizational agility in satisfying customer/ supplier needs and also the amount of organizational goals that have been obtained, to assess the amount of satisfied customer/ supplier requirements. The outputs or results of processes improvement (changes) and subsequently change in organization cause to environmental changes or competitor reactions. These environment or competitors' actions, again, lead to effects in organization landscape topography, the interdependencies of actors in landscape and the current organizational fitness.

Sub-processes of this stage are as follow:

- Evaluate the effects of process improvement.
- Acquire feedback from customer, suppliers, external environment, and competitors in periods of implementation, by means of designed landscape.
- Survey, determine and investigate.

6- IMPROVEMENT

Revise the improvement and changes in processes if necessary. On account of changes in customer/ supplier needs and turbulence in environment, it is necessary to modify processes that satisfy goals of organization and customer requirements. Define projects and activities for performance improvement in this step.

V- CONCLUSION

In this article we get through a methodology for BPR project that consider organizations as systems that according to their environment circumstances, learn, adapt and evolve over time. These systems have known as CAS.

In order to have organization with high fitness and co-adaptation with its environment, at first it is necessary to notice the significant importance of processes and their agents in their intensive interactions, to have diversity and could get high fitness; afterward, from these interactions and therefore organizational complexity, so many schemas appear that have high potential for emergent structures and behavior, that should be managed.

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