An Algorithm for Reengineering

M.Rasoulian[1*],H.Bazrafshan[1],M.R.Shabani[1]

[1]Department of Management, Islamic Azad University, Naragh Branch, Naragh,Iran
m_rsl@yahoo.com

Abstract:-This article is based on a 2011 investigation conducted in one of industrial and research organizations in the field of Iran's Aviation Industry. Research projects conducted in this organization lack a certain pattern in managing research processes to the extent that most projects are not clearly accounted for based on price, time, and expected results. As a result, the present paper tries to introduce a proper pattern for reengineering management process to be used in research projects by examining reengineering methods and patterns, and key project indicators, in addition to making a contrastive analysis of such patterns.
Given the results of the study, a modified Kettinger's pattern has been selected as a new algorithm in processes reengineering to be used for managing research projects which is going to be analyzed and discussed through this article.

Key-Words: - Reengineering- Research projects- Algorithm- Modified Kettinger's Pattern- Research Methodology- Business Processes Reengineering

1 Introduction

Business processes reengineering is a procedure in which organization's current tasks are replaced by main business processes, resulting in accelerating business procedures, cutting costs, and consequently making the organization more competitive.

Processes reengineering is a new starting point to restore processes and recreate working methods based on phased studies, fundamental perceptions, and elimination of outdated regulations that paves the way for current business operations.

Business Processes Reengineering (BPR) is a procedure in which organization's current tasks are replaced by main business processes, causing a task-oriented organization to move to a process-oriented organization, resulting in accelerating business procedures, cutting costs, and consequently making the organization more competitive.

Since the reengineering theory is a fairly new theory introduced to improve business, its methods and approaches are still under development. Business reengineering, as a method, helps to make some changes in the organization and introduces new processes and new working techniques. To do so, certain elements are required in order to make changes in the organization. These elements known as facilitators, act as instruments in changing processes. Information Technology (IT) helps to make changes in organizations, mainly including changes in the nature of work, merger of organizational tasks, and changing competitive forces. Since IT can help the reengineering to create changes, it can be considered a facilitator in the process of business reengineering.

2 Statement of the problem and significance of the study

The organization under study lacks a definite pattern for management of processes used in research projects. Consequently, most projects are clearly estimated based on price, time, and expected results. Therefore, the present study, investigating methods and patterns related to process reengineering, aims at introducing a proper pattern for process reengineering management of research projects.

Research projects conducted in this organization are highly significant in terms of time, cost, and risk. However, the current methods have not been able to reduce time, clarify and control

costs, and to assess and minimize various risk associated with research projects. Considering the bulk of financial, human, and scientific resources employed in conducting these projects, it is indispensable that work processes in this field are engineered using an appropriate pattern.

3 Research questions

A number of questions are posed within this research's domain, the most important of which are as follows:

1. How business reengineering processes patterns can be compared and assessed (and with what indicators)?
2. What are the fundamental indicators and requirements of research projects?
3. Is there a processes reengineering pattern appropriate to the management of business research projects? (the main research question)

4 Research methodology

Research methodology is an approach adopted by a researcher to investigate a given problem. Different methods may be used in different studies depending on the type of research conducted. The present study has been carried out in three major stages:

1. Review of related literature through library studies
2. Conducting a survey on the current situation of Research methodology used in research projects to understand experts' views and opinions about the existing problems and the necessity of reengineering research processes
3. Data analysis and selection of an appropriate pattern

In the first stage i.e. library studies, processes reengineering, existing patterns, and project management standard PMBOK[1] were examined. In the surveying stage, to understand the problems, limitations, present conditions, and reengineering indicators, a questionnaire was developed and distributed among experts in the organization and affiliations as part of the research population.

Given the method used for data collection, the present study can be considered as a survey-descriptive research as it describes characteristics of the population under study, including nature, conditions, and the way they communicate to each other in order to propose an appropriate pattern for reengineering research processes through collecting data and surveying managers and practitioners. Based on research objectives, this study can be regarded as a developmental research with the aim of extending knowledge in a specific area of activity.

5 Time and place of the study

In the present study, due to the various limitations in data collection at the organizational level, on one hand, and the similarities in the staffing structure in various industries affiliated with the organization on the other hand, and accessibility of managers and executives, one of the subsidiary groups of the organization was selected as the pilot sample and the place of the study. The study was conducted from early 2006 to late 2007 and the required data was collected in this time period.

6 Research population

Research population is a group of people or units having at least one quality or characteristic in common. Obviously, to define the population, comprehensiveness and representativeness principle should be observed. In the present study, 160 project managers and experts working in the Research Department were chosen as the research population.

7 Research sample and the sampling procedure

[1] Project Management Body of Knowledge

The required data in this study were collected through questionnaires and surveying a sample of the organization's research experts, scholars, and project managers selected randomly. Of 160 members of the population, a sample of 30 persons was selected based on Morgan's Table. Then, a questionnaire was administered to the sample and the fill-in questionnaires were collected after the respondents were interviewed. 20 questionnaires were filled in by top managers and project managers while the remaining 10 questionnaires were completed by experts working on research projects in the organization. The number of project managers was twice more than the number of research experts and this was due to the fact that project managers had greater dominance and knowledge on structural issues and project management reengineering than the research experts. Participants' level of education and their job experience are described in tables 1 and 2, respectively.

Table 1: Frequency distribution of the respondents' level of education

Education	Frequency	Relative frequency
BA	8	26.7
MA	17	56.7
PhD	5	16.6

Table 2: Frequency distribution of the research samples' job experience (years)

Job experience	Frequency	Relative frequency
Less than 8 years	5	16.6
8-16 years	14	46.7
Over 16 years	11	26.7

8 Instruments

Oral interviews and questionnaires were employed as instruments to collect data in the present study.

To make all participants understand the questions posed by the questionnaire consistently, each participant was presented personally with a verbal explanation before they completed the questionnaire.

Questions in the questionnaire were designed based on a five-point Likert's scale, in the three graded aspects as shown in Table 3.

Table 3: issued examined by questionnaire

Problems explored by questions
Management of research projects
Processes reengineering indicators
The quality of processes reengineering indicators in research projects

9 Data analysis

Data analysis in this study was performed through techniques of inferential statistics. To describe some of the sample's characteristics, usual methods of descriptive statistics such as frequency tables, estimation of means indices, and bar charts have been employed.

10 Validity of the instrument

To increase the content validity of the questionnaire in this study, opinions of the supervising professor, advisors, and the industrial advisor were asked similar questionnaires in dissertations, articles, books, and pilot administration of questionnaire among some colleagues were used to apply their guidelines in reforming the questionnaire.

11 Reliability of the instrument

Reliability refers the extent to which the instrument produces consistent results in similar conditions. Generally, the validity coefficient ranges from zero (no correlation) to +1 (full correlation). Different methods are used to measure the reliability coefficient of instruments. Cronbach's Alpha was used in the present study to measure the reliability of the questionnaire. The value of Cronbach's Alpha for all the items in the questionnaire was 0.79, indicating the adequate reliability of the questionnaire.

12 Review of the literature

Reengineering dates back to the implementation of a management research project in the 1990s at the Massachusetts Institute of Technology (MIT). Michael Hammer is the first theorist who introduced the concept of reengineering. He introduced the concept in his study in 1990 under the title of "Reengineering works: Don't Automate, Obliterate"" (1991), Harvard Business Review. Later on, in 1993 he coauthored a book with James Champy: "Reengineering: a manifesto for business revolution", and explained reengineering concept in the form of a theory.

Reengineering has been the most famous and the most controversial theory in management during the recent years. Reengineering simply put an end on Adam Smith's Work Division Principle. Prior to 1991, management theorists were obsessed with number of issues such as Organization Improvement, Changing Management, Kayzen, Total Quality Management, Innovation etc. However, what made a distinction between reengineering and previous management methods and made it popular as a revolutionary theory in organizations and management discussions was its creative reengineering approach which is based on examination and revision of the planning process.

Reengineering studies during recent years in Iran have been conducted by some Iranian companies such as Iran Khodro, Ministry of Commerce, Ministry of Science, and other corporations. But more recently, no other studies have been done in this field but some discussions of reengineering have recently been considered in the Ministry of Defense.

13 A history of Business Processes Reengineering (BPR)

Approximately two hundred years, people established many companies based on Adam Smith's discovery that in industry, work has to be divided into its simplest and most basic tasks. Moreover, Taylor building upon his engineering perspective started to improve Smith's theory. He introduced the concept of work measurement into the workplace. What Taylor started is known, at present, as Industrial Engineering. Although these models seemed to be based on 18^{th}, 19^{th}, and early 20^{th} century assumptions, they cannot continue to function under the rational classification of expertise, control tasks within professional circles, and management vertical hierarchy levels. To survive and stay competitive in the global arena, companies have to be transformed and adopt the most up-to-date technologies. In organizations founded on Adam Smith's theory, since there is not enough supervision over the whole processes, and the staff is simply working according to their own

task divisions, the process is vulnerable against mistakes [1].

After the Second World War, the existence of three forces directed companies to a path, unfamiliar for managers and executives. These forces included: *customers*, *competition*, and *change*.

A company that had a better performance would be regarded as successful. Taylor's system was no longer efficient, so new techniques such as Total Quality Management, Z theory, Downsizing, Automation, and Kayzen, each was considered ad a topical issue for some time, were often used for gradual improvement, no matter the current situation was right or wrong [1 & 2].

Davenport, in his book "Process Innovation" elaborated on the role of IT in RE success. World renowned journals such as Financial Times and Fortune discussed RE as the most prominent managerial subject around the globe in a number of articles [3].

13 Reengineering logic

Reengineering linked different braches like quality, IT, organizational change, innovation, and redesign and the emergence of reengineering created a shift from hierarchical and task-based thinking to process-based thinking. Since in the hierarchical point of view, companies were increasing their daily production without a drop or reduction in consumer market, and as a result, consumers had to follow the rules adopted by companies. Consumer market did not undergo rapid changes and, ultimately, no attention was paid to product quality and improvement of services. Table 4 presents a comparison between reengineering and other instruments used for improvement.

Table 4: A comparison between reengineering and other instruments of improvement

Factors	Reengineering	TQM	Automation	Restructuring	Proper organizing adjustment
1. Assumed question	Basic and fundamental	Customer's needs	Technology usage	Report relations	Staff
2. Span of changes	Fundamental and general changes in the organizations' inventory	Bottom up improvement in most sectors	Systems	Organizing	Staff, job responsibilities
3. Orientation	Processes	Processes	Procedures	Functional	Functional
4. The role of IT	Key(main)	Secondary	To accelerate existing systems	Little and seldom	Mostly incomplete and partial
5. Improvement target	Noticeable and meaningful	Continuous	Continuous	Usually continuous	Usually continuous
6. Frequency	Usually once	Constant	Periodic	Usually once	Usually once

With the creation of new horizons in business, outdated theories were not adequately accountable. Sharp changes in the market along with the intense competition between suppliers and flexibility and variety of goods challenged the manufacturers. New factors were directly related to the result of work and the final products. As a result, process-based thinking has been embedded in new approaches and different

principles of task simplification and elimination of sectors and tasks that created no added value were adopted to reduce costs and provide better and faster services.

Nine principles of process development employed in line with the requirements of the new world are as follows:

1. Waste omission
2. Waste minimization
3. Simplification
4. Combination of different processes
5. Creation of multiple business processes
6. Parallel work-flow thinking
7. Creation of data concentration in the desired sources
8. Application of technology to improve processes
9. Permitting the customer to facilitate the processes

14 Application of IT in BPR

Conceptually, reengineering should be possible without the help of IT, but most reengineering successes have been achieved with help of IT. To apply IT correctly, a correct understanding of changes seems essential. Reduction of parallel works can be done by data sources in the form of data bases. With the help of IT, it is possible to eliminate many tasks in the middle sector of the organization and to create task Independence in different processes through an integrated notification system. For instance, in Ford Company, three tasks of purchase, stock control, and accounting the accounts payable were carried out through multiple stages. But implementation of a database reduced 75% of staff's parallel work and instead of using 500 employees, 125 performed these three tasks efficiently.

Sharing data resources can enhance coordination and prevent conflicts caused by physical data exchanges. This can be done through technological communications such as local networks and different administrative working systems, generally called "group work in the form of a network".

By using IT, it is possible to improve working relations and coordination among different tasks in the processes. Currently, linking IT including workflow software to Computer Aided Design/ Computer Aided Manufacturing (CAD/CAM) systems has contributed greatly to the creation of a shared workplace for different working groups. Through a workflow system it is possible to make parallel various processes to design products and also to identify and eliminate unnecessary sections and redundant stages, thus, to reduce physical volume of processes. With the connecting CAD/CAM system to Global Communication Network, business processes have undergone significant changes [8].

Development of IT has paved the way for development of Information Systems (IS), leading to emergence of new views and attitudes about IS. The results of various studies indicate that with the introduction of IT into BPR projects, the possibility of failure increases. Although IT is the primary element in the BPR methodology, less attention has been paid to it than the emphasis put on technology (Willcoks 1995); in spite of the fact reengineering principle pays attention to human issues, keeps away from technology-orientation, and moves towards new ideas and thoughts.

15 Main reengineering methodologies

As reengineering is a fairly new theory for business improvement, its methodologies and approaches are still under development and since the application of reengineering concepts can take different forms, its methods are also distinct from one another as the emphasis on some factors in a given reengineering project will be different from the attention paid to factors in another project.

Different methodologies and approaches have been suggested by researchers for reengineering which can be put in various classifications. One way to classify reengineering projects is the way

factors such as information technology, strategy, quality management, operations, and human resources are emphasized. Another classification is dependent on the way different methodologies view innovative nature of reengineering and its innateness. As an example, Humer and Champy consider the degree of reengineering dependency on creativity, innovation, and new thinking is much higher than its dependency on past and present experiences, to the extent that they believe an organization has to turn a new page for reengineering. With such view, defining a structured approach for reengineering is impossible. On the other hand, researchers such as Davenport, Shourt, Harison, and Furey believe in a certain framework for reengineering and consider the use of experiences in reengineering is essential. They also believe that to carry out a reengineering project, suggesting working plans and programs along with the staff's training and motivation are indispensable. Numerous structured reengineering methodologies have been examined in the present study, including methodologies suggested by Kelien (1994), Furey (1993), Guha (1993), Johansson (1993), Stepper and Petrozzo (1994), Davenport and Short (1990), Harisson and Pratt (1993), Barrett (1994), Coopers and Lybrand (1994), Texas Instruments, Business Transition (1994), Condore (1994), Obolenesky (1994), Process Improvement, Hum and Li (1994), and Kettinger (1997).

Kettinger's reengineering methodology mostly utilized in the present study includes the following steps:

1. **Perspective:** Establishment of management commitment and vision; discovery of reengineering opportunities; identification of IT leverage; selection of redesign processes
2. **Initiation:** Raising awareness of organizational elements; organization of reengineering team; project planning; identification of external customers of the process; need analysis; setting performance goals
3. **identification:** documentation of current processes; analysis of reprocesses
4. **Redesign:** identification and analysis of new processes, prototyping and designing details of new processes; designing human resources structure; designing and analysis of information systems
5. **Reconstruction:** reorganizing human resources rules; implementing components of information systems; users' training
6. **Evaluation:** performance evaluation of processes; continuous improvement programs

Table 5 below, presents a comparison of the mentioned reengineering methodologies.

Table 5: A comparison of different BPR methodologies

BPR Methodologies\Indexes	Setting the goals and vision	Modeling and analysis	Identification of Reengineering Processes	Identifying IT's Leverages	Organization	Planning	Implementation of Reengineering	Design and Analysis of Information Systems	Documentation	Control and Evaluation	Testing	Continuous Improvement	Number of Indexes
1. Kelien	*		*		*	*	*						5
2. Furey	*	*	*				*			*			5
3. Guha	*	*	*	*	*		*		*	*		*	9
4. Johansson	*		*	*	*		*			*			6
5. Stepper and Petrozzo	*		*	*	*		*		*				6
6. Davenport and Short	*	*	*	*									4
7. Harisson and Pratt	*		*			*	*			*		*	6
8. Barrett			*	*	*		*				*		5
9. Kettinger	*	*	*	*	*	*	*	*	*	*		*	11
10. Coopers and Lybrand		*	*				*						3
11. Texas Instruments		*	*				*						3
12. Rassman	*		*		*		*						4
13. Condore	*		*	*			*			*		*	6
14. Obolenesky	*		*			*	*			*		*	6
15. PI		*	*				*			*			4
16. Hum and Li	*	*	*		*	*	*			*			6

16 Indicators and basic requirements of research projects

Considering the project definition and the nine fields of knowledge in project management, the following four cases are the Indicators and fundamental requirements of any project and the rest can be used depending on the type and conditions of the project.

1-Management of the project domain, 2-Management of the project time, 3- Management of the project time cost, and 4- Management of the project quality

17 Data analysis

This section deals with the responses collected through the questionnaire about reengineering on three issues of research project management, processes reengineering indexes, and the quality of processes reengineering indexes in the project in the Aviation Industry Organization.

18.1- Project management

A summary of the information obtained the questionnaire regarding the conditions of project management indexes in the organization are as follows:

Based on the collected data, 83.3% of the respondents believe that project teams are connected to the micro and macro objectives of the organization and these objectives are comprehensible to them. Besides, 60% of the participants believed that projects conducted in the organization have clear and assessable objectives in addition to time, cost, and quality. Moreover, 60% of participants believed that the organization imposes some policies for standardization, continuous control, and improvement of project management processes, whereas the remaining 40% were against it.

On the other hand, 86.7% of the respondents assumed that the organization does not apply project management techniques and processes adequately and efficiently. The percentages of those who agreed or disagreed with defining a clear role for the project manager in all projects were equal.

Generally speaking, most respondents' opinions with regard to the following cases were positive:

- The organization has introduced some measures for the projects initial processes and currently applies them.
- The organization has introduced some measures for the main planning processes and currently applies them.
- The organization has introduced some measures for the main processes needed for implementing the projects and currently applies them.
- The organization has introduced some measures for control facilitating processes and currently applies them.
- And finally, there are procedures for analyzing schedules and deviation causes in projects.

The majority of respondents had a positive view regarding the above cases; however, they expressed a negative view regarding other cases, especially the following items:

- Establishment of documented standard processes for control facilitating processes in the projects.
- Introduction and application of measures for control facilitating processes in the projects.
- Development and application of documented standard processes for planning.
- Development of measures for main planning processes.
- Introducing documented standard processes for risk control and application of measures in facilitator processes of risk control.

17.2- Processes Reengineering Indexes

The information obtained based on the respondents' opinions on the reengineering indexes indicated that:

- 90% of participants believed that the effects of setting goals and visions on the reengineering of research processes are high or very high and 70% expressed the same opinion about the effects of modeling.
- 93.3% of the participants expressed similar opinions regarding the understanding and recognition of processes in reengineering (i.e. these factors are highly influential).
- The importance of identification of IT leverages, according to 60% of the participants, is high or very high.

Of course, concerning other items including implementation of reengineering, designing and analysis of information system, control and

evaluation, testing and experimentation, and continuous Improvement, again, utmost, 5% of participants chose the item "low" and no one chose the item "very low" in the questionnaire.

18.3- Prioritization of Indexes based on the respondents' opinion

Reengineering indexes were first prioritized based on the differences in the means scores obtained. But in cases that the means were very similar, the ration of standard deviations to the means were also incorporated and prioritization was performed based on the smallest dispersion coefficient. As a result, based on respondents' opinions, the indexes were ranked in order of importance and effectiveness (from the highest to the lowest) as follows:

1- Understanding and recognition of processes involved in reengineering
2- Senior management's support
3- Determination of goals and visions
4- Culture and spirits of personnel involved in research projects
5- Execution of reengineering
6- Control and evaluation
7- Documentation
8- Planning
9- Designing and analysis of information systems
10- Testing and experimentation
11- Modeling and analysis
12- Organization
13- Continuous improvement
14- IT leverages

17.4- Current conditions of Processes Reengineering Indicators

Based on information collected about the position of processes reengineering indexes in organizational projects, the following results are obtained:

- 36.7% of the participants considered the significance of setting goals and visions in projects is high and very high, however other participants ranked this importance at a middle position.
- Understanding and identification of processes in organization's projects, based on most participants' opinions, was not very high, but 66.7% of respondents believed that the utilization of Information Technology leverages in projects is low.
- 46.7% of participants believed that matrix organization is performed at a medium level, but the majority of them regarded coherent planning in projects were high.
- 90% of respondents believed that execution of reengineering is very effective in their projects, whereas the same number of participants considered the use of designing and analysis of information systems was at a medium level or low.
- All respondents believed that documentation in organization's projects is medium and high.
- According to 83.4% of participants, continuous improvement of project processes in organization was performed at medium and low level.
- All respondents believed that personnel's culture and spirits are highly effective on the advancement of organizational projects goals and that the projects are in line with the organization's objectives more than an average level.
- 83.3% of the participants believed that progress of projects does not comply with the programs and the rate of IT utilization is low.
- The use of databases, based on 60% of the participants, is low but members of project teams have an average access to the internet.
- Finally, 83.3% of the respondents believed that the rate of IT services in the progress of projects objectives is medium and above the medium level.

18 An overview of methodologies and presenting the proposed procedure

An overview of different methodologies shows the reasons for success or failure of reengineering projects and also competitive atmosphere dominating the organization, mainly resulting from the noncompetitive market conditions.

Methodologies introduced by Gaha, Davenport and Short, Harison and Prat, Kettinger, and Kondor are among those paying a special attention to the organizational vision. But the important point is that of these methodologies, only those which consider the determination, improvement, and creation of vision within the organization as a whole should be utilized. In addition, utilization of IT leverages and the factor of continuous improvement are also vital to reengineering processes.

As a result, Kittinger's methodology because of its particular emphasis on the personnel's expectations, culture and spirits and for its support of Top management can be used with some minor modifications as the most appropriate methodology for the execution of reengineering processes in the Research Department of the Aviation Industry Organization.

19 Steps to be taken by the proposed pattern

Regarding the mentioned points and summing up the findings obtained from questionnaire and given the importance of indexes and steps priority, the following pattern is suggested as the most suitable one for reengineering the management of research projects in the organization. The following pattern is compatible with the personnel's culture and spirits, in addition to supporting Top management which plays a vital role in the success of processes reengineering.

1- Determination of goals and visions
2- Understanding and identification of processes in reengineering
3- Modeling and analysis
4- Information technology leverages
5- Organizing
6- Planning
7- Execution of reengineering
8- Designing and analysis of information systems
9- Documentation
10- Control and evaluation
11- Testing and experimentation
12- Continuous improvement

20 Conclusion

Selection of an appropriate reengineering approach, with a focus on organizational conditions, can be one of the factors that increase the success of reengineering projects. Reengineering is considered as one of the appropriate solutions for keeping an organizational superiority over other organizations. Organizations which are not willing to undergo fundamental changes have no other way but to leave the competition and in this field, the role of human resources, from minor staff to senior management levels, bears great significance.

Information Technology, as an empowering tool, plays a major role in the reengineering of processes. Technology, as a lonely and abstract entity, is not able to create changes. Nevertheless, technology can make a very strong and extensive effect, especially when it is appropriately and correctly combined with a radical reengineering program. Information technology, as a facilitator, is the most important factor in strengthening the reengineering department. The use of information technology can play a significant role in achieving the objectives in different research projects conducted in the organization such as theoretical research, modeling, project execution stages, cost and time control, documentation, project supervision, and performance evaluation. In the analysis stage, project management processes, reengineering indicators, and their conditions in

the organization's research projects were identified and examined and with understanding the problems and needs, an appropriate reengineering method for organizational research processes was provided.

Resources

1. Humer, M. and Champy, J. *A new plan in management, corporate reengineering, charter of organizational revolution*. 1998.

2. Humer, M. and Champy, J. *Comprehensive reengineering*. 2005.

3. Project Management Association. Body of Knowledge on Project Management. Translated by Nejabat Osuli, *Journal of National Company of Petrochemical Industries*. 2005.

4. Bestanchi, M. (N.d.). An appropriate method for reengineering in Iran. *Journal of Tadbir*, No. 183.

5. Zeidabadi, A. Introducing an appropriate model for reengineering (based on IT). Management of Research Projects in Aviation Industries. MA Thesis in IT Management: Industrial University of Malek Ashtar. 2007.

6. Yousefi Moayed, HR. A systematic procedure for business processes reengineering. MA Thesis: Industrial University of Amir Kabir. 2001.

7. British Standard- 6079, ISO 10006- 10007, APMI 2000, PMBOK 2004

8. Grover, .V & Malhotra, M. Business process reengineering: a tutorial on the concept, evolution, method, technology and application. *Journal of Operation Management*, 1997 15, 193-213.

9. Hahm, J., Lee, M.W. A systematic approach to business process reengineering. Computers Ind. Engng., Vol. 27, Nos. 1-4, 1994 pp.327-330

10. Hunt,D. V . Process Mapping, How To Reengineer Your Business Processes. (John Wiley & Sons. Inc.) 1996.

11. Shuzou, Ravi Patanayakun. Analysis of IT strategic Alignment & Infrastructure Capability in BPR Implementation. 2003.

12. Davenport, T.H., and Short, J.E. The New Industrial Engineering: Information Technology and Business Process Redesign. *IEEE Engineering Management Review*, 1998.

13. Rotabkhan, M.R. Business process reengineering of an air cargo handling process. International *Journal of Production Economics*, 2000 Vol. 63, 99-08.

14. Hammer, M.. Reengineering work Don t Automate Obliterate. *Harvard Business Review* 1990

15. http://theweb.badam.se.edu/bpr/fig2map.htm

16. http://web.pref.hyogo.jp/

17. Valiris,G .Glykas, M.Critical review of existing BPR methodologies, the need for a holistic approach. *Business management Journal,* . 1999 Vol. 5,No.1,65-85