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Evaluation of the effect of using Information Technology Infrastructure for Business Process Reengineering in Small and Medium sized Enterprises of Kermanshah Province

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Abstract

Business process reengineering is an approach to improving organizational performance that focuses on business processes and their efficiency. This paper provides a model interconnecting ICT adoption, ICT-enabled business process re-engineering (BPR), and performance with a balanced score card approach. A relevant literature review, which investigates critical indicators in ICT adoption and its impact on BPR is carried out. To this end, 9 hypotheses were made, research method is descriptive correlation and obviously based on structural equations (AMOS) model, being an applied one in terms of its goal. Statistical population consisted of small and medium sized enterprises of Kermanshah province, sample were taken classifiably and observation related to the questionnaire and variables of each hypothesis's items on the scale of likkert were provided. This paper provides empirical evidence to examine how intra- and extra-organizational factors influence ICT adoption, how ICT shapes BPR, and business performance. These findings will be valuable in understanding various motivations of ICT adoption, and predicting outcome of business performance stemming from ICT-enabled BPR. This condition leads to a high resistance and finally the failure of the changes in corporation. The results showed that the adoption of information and communication technologies can improve business process reengineering.

Keywords: Information and Communications technologies, Business process reengineering

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1. Introduction

Advanced information and communications technology (ICT) changes the ways in which production, coordination activities, and data processing are carried out (Uhlenbruck et al., 2003). ICT also reshapes business practices in ways of gathering and analyzing information, developing strategic visions, finding the best approach for process redesign, and allowing collaborative teamwork (Akhavan et al., 2006;Attaran, 2004). Information and communication technology (ICT) sector companies nowadays are under increasing pressure to adapt their business processes to persistent technological, organizational, political and other changes (Davenport and Perez-Guardado, 1999).A group of process innovation techniques known collectively as business process reengineering (BPR) has emerged to address this challenge (Colin and Rowland, 1996;Davenport and Short, 1990; Grover and Kettinger, 1995; Hammer, 1993; Kubeck, 1995;Kettinger et al, 1997). Reengineering is not about fine-tuning or marginal changes, rather it is for ambitious companies willing to make substantial changes to achieve major performance improvements. BPR is an organizational initiative to fundamentally re-examine and redesign business processes with the objectives of achieving competitive breakthrough in quality, responsiveness, cost, satisfaction and other critical process performance measures. Despite, the widespread use of BPR tools and methodologies, however, significant process innovation initiatives fall short of delivering the expected results. While they typically aim for dramatic or radical change, they often result in only incremental improvements (Jaarvenpaa and Stoddard, 1998).Despite the importance of ICT, several issues have yet to be adequately addressed in the literature. Previous studies either focus on theoretical discussion of successful factors of business process re-engineering (BPR) or employ a case study approach that offers concrete lessons for ICT implementation strategies based on a specific firm's experience (Pan and Jang, 2008; Shin, 2006).Lastly, the literature also fails to offer a complete picture concerning the relationship between the motivation to adopt ICT, ICT-enabled BPR, and related performance measurements. As contemporary enterprises constantly evolve within a dynamic environment of increasing complexity, heightened market pressure, and growing intensity, it is valuable to assess these inter-relationships.

This study therefore attempts to investigate motivation to adopt ICT; examine how ICT shapes the business re-engineering process; evaluate performance of ICT and ICT-enabled BPR and find associations among ICT adoption, BPR and performance.

2. Literature review

2.1. Business process reengineering (BPR)

In BPR, large-scale "radical redesign" is considered to gain "dramatic improvements" (Ranganathan and Dhaliwal, 2001; Schniederjans and Kim, 2003). Therefore, BPR is defined as: total transformation of a business, an unconstrained reshaping of all business processes, technologies and management systems, as well as organizational structure and values, to achieve quantum leaps in performance throughout the business (Crowe et al., 2002). A comprehensive survey (Kettinger et al., 1997) of current BPR techniques identified the following categories of tools relevant to the redesign stage of process innovation: integration definition (IDEF) modelling, data modelling, including data flow diagramming, flow charting, case-based information, engineering tools, process simulation, creativity techniques, including brainstorming, out-of-the-box thinking, nominal group and visioning.

Most BPR methodologies share common phases and features, but they also differ in the way they approach reengineering. Their main differences are, whether or not they recommend detail modelling and analysis of current situation; whether they support incremental or radical changes to business processes and; whether they suggest the study of successful organisations before embarking a BPR project. Consolidated methodology for reengineering provide a structured approach and to facilitate understanding. A handful of researchers call attention to issues of organizational re-engineering attempting to incorporate ICT (Buckby et al., 2008; Henderson and Venkatraman, 1991, 1993). These researchers developed models and frameworks to bridge the gap between business and ICT (e.g. the strategic alignment model by Henderson and Venkatraman (1991, 1993), the strategic alignment framework by Luftman et al. (1993), and the four-layer model of process, information, services, and technology integration by Strandl (2006).

Making fundamental change through reengineering is considerably different from other managerial approaches. Various companies in developed countries, such as Wal-Mart, CIGNA, and Ford Motor which were about to collapse or lose their contribution in global markets managed to basically change their companies' structure by a new process reengineering approach. As a result, they were able to acquire more market share and now they are endeavoring to gain better positions by applying continuous modifications (Currie, 1999). However, BPR is a complex and difficult task and has a high-failure rate. Thus, organizations should not try the BPR before meticulous examination of all phases and stages of the project (Dennis et al., 2003; Schniederjans and Kim, 2003; Terziovski etal., 2003). These should include the process activities, peoples' jobs and reward system, the management system performers and managers, the management system, and tools and technologies. Moreover, it is necessary to investigate the underlying corporate culture that holds the beliefs and values influencing everyone's behavior and expectations (Albano et al., 2001; Guimaraes, 1999; Mertins and Jochem, 2005).

2.2. BPR and the adoption of information and communication technology

Lee (2009) proposed a three-layer framework to investigate the impacts of ICT on BPR from intra- and extra-organizational perspectives (Lee et al., 2009). BPR is associated with measures such as costs saving, quality breakthrough, better customer services, time reduction, and revenue increases (Morris and Brandon, 1993). Many experts find that ICT is an important enabler of BPR because ICT permits "the distribution of power, function, and control to wherever they are most effective, given the mission and objectives of the organization and the culture it enjoys" (Morton, 1996).

The literature suggests that ICT changes BPR in three ways: the first is organizational structure changes. Using ICT, organizational hierarchies become more flat (Pan and Jang, 2008) and the degree of decision-making centralization is lowered.

The second way ICT affects BPR is changes of workplace. In many cases, ICT permits changes to the economics and functionality of the coordination process (Morton, 1996). It shrinks distance and relaxes time restraints to allow organizational members in different time zones and locations to work together on the same tasks more conveniently (Dube et al., 2007; Morton, 1996).

The third way is workforce changes. ICT reduces the number of workers, production workers in particular, as a result of automation in many business practices, such as supply chain management, order management, and customer service management.

ICT is introduced as a critical component and even a natural partner of BPR, which has a continuous and important role in BPR projects (Attaran, 2003; Vidovic and Vuhic, 2003). Many authors have described that successful application of ICT is effective in BPR success. Contrarily, overlooking the role of ICT can result in failure (Motwani et al., 2005; Shin and Jemella, 2002).ICT covers the areas of hardware, information system, and communication technology, which provide individuals with the required information (Al-Mashari and Zairi, 2000; Attaran, 2003). These bring effectiveness in realizing the critical success factors by pulling human, business, and organization together (Grant, 2002; Motwani et al., 2005). For example, "communication technology" is to make open communication, share information, and create collaborative team working (Attaran,
2003; Tatsiopoulos and Panayiotou, 2000).

2.3. Balanced score card approach

To manage and deploy organizational resources in such a way as to deliver and fulfill organizational objectives is a vital role of senior finance and management professionals. Many tools, techniques and frameworks have evolved to assist managers in this: value-based management, total quality management, the performance prism, and more. One of these frameworks is balanced scored. The balanced scorecard is a management framework which, since its inception by Kaplan and Norton in the early 1990s, has been adopted, modified and applied by hundreds of organizations worldwide. If understood thoroughly and implemented appropriately, its potential contribution to organizational success – however measured – is fundamental. The balanced scorecard of the tools designed to improve corporate performance, the balanced scorecard has probably been the most popular. Originally developed as a performance measurement tool, the scorecard is now associated increasingly with strategy implementation. It acts as a management framework with the potential to identify and exploit organizations' key value drivers to their best strategic advantage.

The score card has been used successfully by organizations (public, private and not-for-profit) to realize and integrate the strategic contribution of all relevant organizational value drivers for two key reasons: First, it helps to ensure consistency and alignment between the non-financial and the financial measures, (this helps to facilitate the alignment of the measures and strategy). Second, it helps to identify and measure the specific value drivers that underpin performance. This allows managers to test their hypotheses on what is driving organizational outcomes.

The scorecard translates vision and strategy into four notional quadrants. In the original offering from Kaplan and Norton, these quadrants reflected the following perspectives and implications of the strategy:

- Financial
- Customer
- Internal business processes
- Organizational learning and growth (Kaplan and Norton, 1993).

2.4. Hypotheses

Based on the literature review, we thus develop the following hypotheses:

Major hypotheses - ICT adoption has significant positive impacts on busines process re-engineering

H1a - Internal process performance has significant positive impacts on organizational learning and growth.

H1b - Internal process performance has significant positive impacts on customer satisfaction.

H1c - Organizational learning and growth in turn has significant impacts on customer satisfaction.

H1d - Customer satisfaction has significant impacts on financial performance.

H2a - Business process re-engineering (BPR) has significant positive impacts on internal process performance.

H2b - Business process re-engineering (BPR) has significant positive impacts on financial performance.

H3a - ICT adoption has significant positive impacts on internal process performance.

H3b - ICT adoption has significant positive impacts on organizational learning and growth.

H3c - ICT adoption has significant positive impacts on customer satisfaction.

Theoretical framework is a conceptual model based on theoretical relationship among a number of factors which are considered important in relation to problems under study. This theoretical framework is circulated by reviewing research records in the subject reasonably. Figure 1 shows the ICT-BPR model proposed by this study.

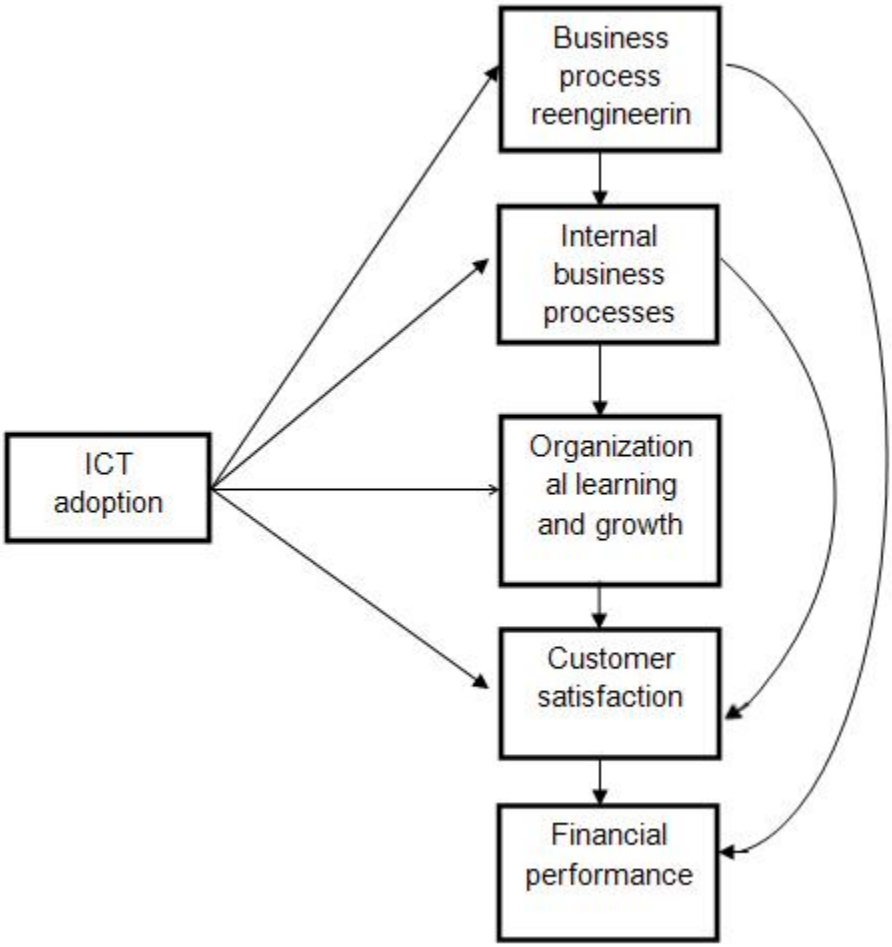

Figure1. Conceptual model of the research

3. Research methodology

This research is an applied one in terms of its aim and descriptive- survey in terms of the type of data, in which relationship by using correlation test and especially based on structural equations model. Using SPSS software, Spearman's correlation coefficient was used to examine relationships between independent and dependent variables and to test research hypothesis. Multiple regression models were used to test the set of cause-and-effect relationships between variables and components studied. And, finally, in order to identify optimal model, the relationships between variables were modeled by structural equations AMOS software. In order to know how well a model performs, especially in comparison with other possible models, in terms of explaining a set of observed data, values of normalized fitness index (NFI), relative fitness index(RFI), increasing fitness index(IFI) and comparative fitness index (CFI) were used.

The survey method was employed in this study. Since the required information and the method of evaluating the desired factors had been specified for the researcher, the questionnaire could be used as a useful tool for data collection in this research. Tools utilized included questionnaire and interviews with managers and experts. Questionnaire validity was confirmed by sampling opinions from several experts. Also, in order to test reliability, one primary sample including 30

questionnaires was pre-tested and then the degree of confidence coefficient by method of Cronbach's alpha, which was 0/887 totally for this questionnaire. For separated variables of ICT adoption, business process reengineering, internal process performance, organizational learning and growth, customer satisfaction and financial performance Cronbach's alpha was obtained at 66%, 75%, 74%, 68%, 85% and 90% respectively.

In this research, statistical population consists of small and medium sized enterprises from Kermanshah province. In order to select sample size of each class, we used appropriate allocation method. In present research, we classified this population into nine classes of machinery industry, contacts industry, chemical industry, packaging industry, food industry, wood industry, manufacturer, production of raw materials and other industries for each of which 15,6,8,8,21,6,31,10 and 27 questionnaires, totally 132 ones were distributed to chief managers of short and medium sized enterprises from Kermanshah province, respectively.

4.1. Research findings

In present research, respondents indicated their sex, education, job status, job background, type of company and finally number of staff, which was provided in the form of closed responses. In relation to 132 questionnaires distributed, results indicated that majority of respondents were males (77.3%), having M.A degrees (45.4%), with full time jobs (77.6%), with more than 7 years of experience (44.8%), from other industries (25.8%) and having 10-20 staffs in their companies (33.3%) on the average.

4.2. Data analysis

Spearman's correlation coefficient was used to test hypotheses. Results shown in table 1 suggest that at signification level (0.000), correlation coefficient between business process reengineering and information and communication technology adoption is 0.293 for which calculated significance level is less than 0.05, therefore, there is a significantly positive correlation between these 2 variables, that is, in small and medium sized enterprises, business process reengineering increases as ICT adoption increases. Results obtained from the H1a and H1b hypotheses show that, at significance level (0.000). Coefficient of correlation among variables ranges from 0.230 to 0.306. Therefore there is a significantly positive correlation between internal business performance and organizational learning and growth and job satisfaction, that is, increased actions of internal business process performance lead to an increase in organizational learning and growth and customer satisfaction. Results from the H1c hypothesis show that, at significance level (0.000), coefficient of correlation among variables is less than 0.626 that is as customer satisfaction increases, organizational learning and growth increases, too. The H1d hypotheses indicate that, at significance levels (0.007), coefficients of correlation between variables are 0.233, respectively, so there is a significantly positive correlation between customer satisfaction and organizational learning and growth, that is, increased customer satisfaction results in an increase in organizational learning and growth. Results obtained from the H2a and H2b hypotheses shows that, at significance level (0.000), coefficient of correlation among variables are 0.410 and 0.338 respectively, and since the significance level is less than 0.05, it is concluded that business process reengineering is related significantly, with internal process performance and financial performance. Results obtained

from the H3a, H3b and H3c hypotheses shows that, at significance level (0.000), coefficient of correlation among variables are 0.358, 0.404 and 0.371, respectively. In general, results and finding obtained from the research hypotheses testing are summarized in table1.

Table1.Results of testing research hypotheses

Hypotheses	Research hypotheses text	sig	The correlation coefficient	Results
Major Hypothesis	ICT adoption has significant positive impacts on business process reengineering	0.000	0.293	Confirmed
H1a	Internal process performance has significant positive impacts on organizational learning and growth	0.000	0.230	Confirmed
H1b	Internal process performance has significant positive impacts on customer satisfaction.	0.000	0.366	Confirmed
H1c	Organizational learning and growth in turn has significant impacts on customer satisfaction.	0.000	0.626	Confirmed
H1d	Customer satisfaction has significant impacts on financial performance	0.007	0.233	Confirmed
H 2a	Business process re-engineering (BPR) has significant positive impacts on internal process performance.	0.000	0.410	Confirmed
H2b	Business process re-engineering (BPR) has significant positive impacts on financial performance.	0.000	0.338	Confirmed
H3a	ICT adoption has significant positive impacts on internal process	0.000	0.358	Confirmed
H3b	ICT adoption has significant positive impacts on organizational learning and growth.	0.000	0.404	Confirmed
H3c	ICT adoption has significant positive impacts on customer satisfaction.	0.000	0.371	Confirmed

5. Analysis of original model course and general fitness of research model

In present model, we are going to study relationship among independent variable of ICT adoption and dependent variables of business process reengineering, internal business performance, organizational learning and growth, customer satisfaction and financial performance. To this end, we use multiple regression model, therefore, our targeted model is as follows (figure 2):

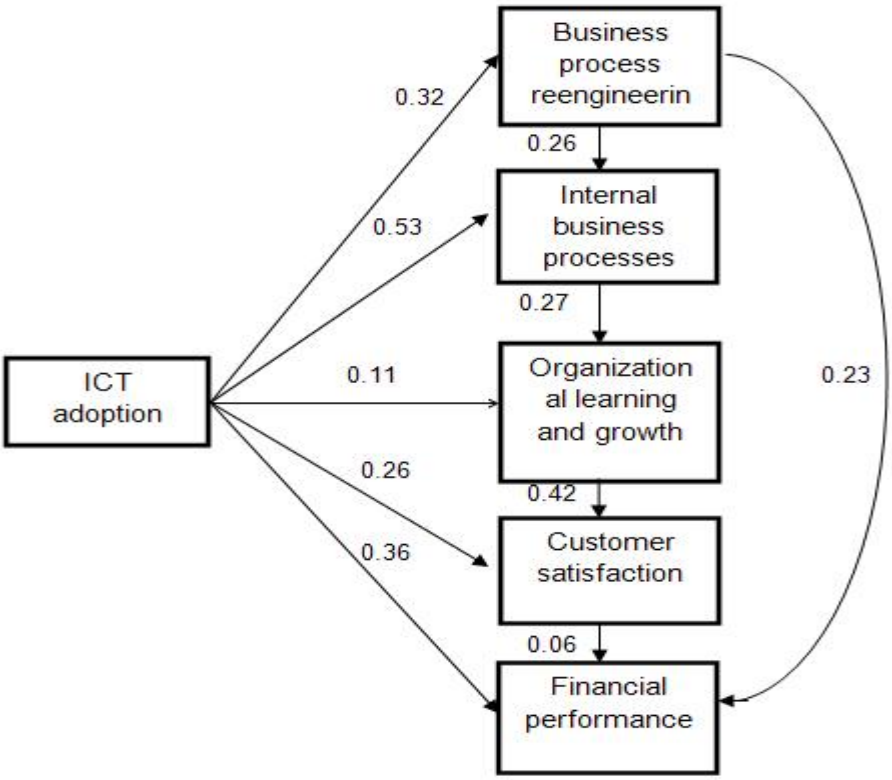

Figure2. Final model of research

With respect to general model obtained, it can be concluded that ICT adoption influence business process reengineering, internal business performance, organizational learning and growth, customer satisfaction and financial performance with regression coefficients of 0.32, 0.53, 0.11, 0.26 and 0.36, respectively. Business process reengineering with regression coefficient of 0.26 affects internal business process performance. Internal business performance with regression coefficient of 0.27 affects organizational learning and growth, customer satisfaction with regression coefficient of 0.06 affects financial performance. For this model, statistic x^2 equals 88.86 freedom degree is 56 and significance level is 0.000. Since significance level is less than 0.05, it is concluded that regression model fitted among independent and dependent variables is significant and appropriate. Following criteria are used to examine appropriateness of the model:

NFI: this index compares independent model (one in which there is no relationship among variables, also known as basic model) with the model we provided; RFI: it is relative fitness index examining appropriateness of model provided; IFI: this is the measure of increasing fitness index; CFI: this is the measure of comparative fitness index. The closer the values are to 1, the more appropriate the model the model is. As observed in table 2, the model fitted to data is highly appropriate.

Table2. Measure of final model fitness

Model	NFI	RFI	IFI	CFI
general model	0.968	0/993	0/994	0.985
independent model	0.000	0.000	0.000	0.000

6. Conclusion

Many enterprises report that ICT-enabled BPR improves performance in terms of costs savings, quality breakthrough, better customer services, time reduction, and revenue increases (Morris and Brandon, 1993).However, empirical data for the linkage between ICT impact and BPR is rare, and how these technologies affect business reform remains unclear. The literature lacks a full and complete picture of the inter-relations among ICT adoption, ICT-enabled BPR, and related performance.

The results confirm that enterprises can improve the performance of internal, learning, customer satisfaction, and finance only when they re-engineer their business to strategically align with ICT (Buckby et al., 2008; Henderson and Venkatraman, 1991, 1993).

Given the significantly positive correlation between ICT adoption and business process reengineering, and given indirect effect ICT adoption has on internal business performance, organizational learning and growth, customer satisfaction and financial performance and significant positive correlation among them, it is concluded that ICT shapes BPR and business performance. These findings will be valuable in understanding various motivations for ICT adoption, and predicting outcome of ICT enabled BPR and business performance.

In order to increase ICT adoption, managers of small and medium sized enterprises must apply policies which will increase business process reengineering. As mentioned in questionnaire, these policies include (granting rewards based on performance measurement, allocating rewards to the best services provided to customers; job improvement through data gathered; Employee's basic salary to rival's ratio; incentive policies; belief in view; easy perception of transfer; manner of looking at knowledge and competence; development of knowledge and competence as a continuous process; education of group work and that beyond personal education; education for providing better performance).Given the results from present research, researcher provides suggestions as follows:

1- Many firms assume that they can take full advantage of ICT adoption (Al-Qirim, 2007; Kang et al., 2008; Pan and Jang, **2008).** This paper suggests that firms can achieve that by aligning their dynamic capabilities with the environment and optimizing business processes.

2- Our sample mostly covered machinery, contacts, chemical, packaging, food, wood, manufacturing, production of raw materials and other industries. Further studies in more diversified enterprises with the same issues will be valuable to assess the generalizability of our research findings.

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