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Critical Success Factor in Business Process Reengineering In Healthcare: An Exploratory Investigations

Mahdi Alhaji Musa
Department of Computer Science
Yobe State University
Damaturu Nigeria
mahdiamusa@gmail.com

***Abstract*—Healthcare organizations face several challenges such as providing services efficiently, achieving strategic and operational success, and improving their business processes. They are forced to make these re-engineering not only to compete and prosper, but also to merely survive strong external forces, such as technological breakthroughs. In last few years, one of the recent trend in business paradigm which has gained a lot of concern is business process re-engineering. Consequently, the healthcare institutions have to take advantage of using business process reengineering to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed. A lot of factors must be put into consideration for any Healthcare institutions that need to venture into BPR. This paper uses factor analysis to examine the BPR critical success factors (CSFs) as perceived by employee. In this study, three main factors categories related to the BPR CSFs within a Healthcare environment including use of IT, Methods selections and Strategic alignment were identified and measured. The factors were tested by surveying employees of the Sani Abatcha Specialist Hospital, Nigeria. The results revealed that measurement of effectiveness of IT on BPR (UIT4) having highest validity coefficient of 0.89 is the most critical indicator for BPR implementation.**

Keywords—BPR, Healthcare, CSFs, Factor analysis

1 Introduction

Business process reengineering (BPR) was given so many definition by so many authors, one of the definition that is more relevant to this study was posed by M. Hammer, (1993) who defined it as basic rethinking and radical redesign of all business process that need to be reengineers in order to achieve a breakthrough in performances indicators such as saving cost, quality and services. Even though organization have very high expectations from BPR process, but it is not the case for many organization, as the failure rate was reported to be 70% according to research conducted by Yasin Ozcelik, (2009).

BPR by their nature are high success or high failure outcome due to the nature of the activities of instabising the organization. It is expected therefore for BPR to high total impact on organizational performance. (Ali, R. J., Zahra, S. and Ali, V., 2014).

Literatures have shown how implementation of BPR help many organizations achieved dramatic breakthrough performance in terms of saving cost, quality and services. Popular example is Motorola, when faced with the challenge of high rate of defect percentage and longer cycles times, decide to totally redesign its parts and tooling process, and at the same time upgrading manufacturing facilities. This BPR process was also able to cut the production cost by one billion US Dollars per year (US$1) and cut cycle time by half. Hallmark also achieved 75% decrease in introduction time on cards. (Ranganathan, et. al., 2011)

Meanwhile, a survey conducted by a D. Little consulting firm indicated that 85% of the top management of an organization were not happy or satisfied with the outcome of the reengineering project (Kleiner A., 2000). This is in line with the series of research conducted in the early 90s which indicated that 70% of the reengineering programmes had only delivered less than what they are expected to do otherwise had fails (Grover Kettinger W., 2000).

Therefore, even though a lot of organizations embraced the concept of this BPR programs, only few of them immerge successful in their effort. Study indicates that many top management of organizations are disappointed with the result of the programme. (J.

Moad, 1993). And that the failure rates are as high as 70% (Lila Rao, 2012). The initiation and diffusion of the BPR like most of the management concept follows a S-shaped curve. When this concept was first introduce in early 90s there was an overwhelming success and large scale acceptance. After spate of failures and difficult nature in implementation, the initiatives become serious challenges to both the researchers and practitioners (Rao, et. al., 2012).

This high rates of failures prompted researchers in that field to view the concept of BPR as a passing management short-lived fashion. Some of the earlier approach of the programme is changing and the researchers are now looking PBR as not only process change but overall organizational change (Rao, et al., 2009).

Despite many uncertainties which occurred throughout the process, many Healthcare institutions still venture into BPR not minding the critical area that need attention. These ambiguities make it so difficult for BPR team and Healthcare administrators to focus only on the effective factors, therefore complete understanding of those effective factors of BPR is needed. Mahdi, A. M., and Mohd, S. O., (2016).

A good way of overcoming these uncertainties in BPR program is to recognize those effective and critical factors in BPR which are referred to as Critical Success Factors. Critical Success Factors (CSF) entitles something which must be implemented if organization wants to be success. These factors should be controllable and measurable and also few in number (Musa and Othman, 2012).

The main idea behind this study therefore is to examine the CSF of BPR in healthcare institutions as perceived by the employee of that institutions. The study considers grouping each category of CSF using confirmatory factor analysis. The rest of the article is organized as follows: section 2 discuss the definitions of relevant terms which is presented as review of related literature. Section 3 discuss research design and methodology employed for this study. Section 4 summarizes the study finding by way of presenting the result and discussion. Finally, section 5 concludes the article with conclusion and future direction.

BPR is considered by so many researchers to have had its days and therefore researchers like Foster, (1994) stated that BPR is a misnomer, that's mean reengineering does not exist which mean business systems were never reengineered in the first place but only developed. While others like Savoie, (1994) and Irani, (1997) argue that BPR is fascinating concept which has a lot of potential for saving a failing company and consequently lead to its survival. Farmer, (1993) and DeBuyn (1997) reported empirical evidences with BPR having positive impact after reengineering program. (Ali, B. et. al., 2015)

Over the last decade, the reengineering concepts has change from radical change to a more contextual realism (Caron et al. 1994, Earl, 1995). Davenport and Short (1990) proposed five steps approach to BPR. They are of the view that process reengineering requires considering broader view of both Information Technology and business activity and of cause the relationship between them. The concept of BPR is continuously as a form of organizational change having characteristic of strategic transformation of subsystems within the organizations producing different level of impact. This change within the organization understand that PBR is not a monolithic concept rather it is continuum approaches to process change. Grant, D., 2016; Kettinger et. al. 1997)

some of the steps associated with BPR are; defining a vision and mission to prepare for the program, mapping and critically analyzing the current process, identifying the opportunity for improvement and reengineer the new systems and finally implementing the the reengineering process (R.J. Mayer, 1995 and S. Muthu, L. Whitman, S.H. Cheraghi, 1999). The process

The steps that have been associated with BPR include, defining a vision and mission to prepare for BPR, mapping and analyzing the current processes (i.e. the AS-IS process), identifying improvement opportunity and designing new processes (i.e. the TO-BE processes) and implementing reengineering processes (R.J. Mayer, 1995 and S. Muthu, L. Whitman, S.H. Cheraghi, 1999). Mapping and analyzing AS-IS processes and designing TO-BE processes requires a careful analysis of the process under consideration. Several techniques have been used for modelling these business processes to improve their understanding [S.A. White, 2004 and P. Wohed, 2006)

The supreme idea behind BPR is to redesign the organizations in such a way to achieve improvement in areas like cost, quality, and services. The attainment technique can be change management, use of Information Technology (IT) or Strategic alignment. With regard to BPR there are critical factors which can include issues like technological, example of which is aligning IT infrastructure with organizational strategy (Al-Mashari and Zairi 1999). A second factor of BPR is the methods and tools selection which may involve ability for the

organization to identify and select best method that can serve the objective of the BPR. And the third factor is strategic alignment which involve alignment of BPR strategy with cooperate strategy (Lockamy and Smith 1997)

1.1 Critical Success factors of BPR

Literature in the field of BPR has classified Critical Success Factors (CSFs) into several dimension and are varies from one another. Herzog Herzog, Polajnar, and Tonchia (2007) has classified them as change in management systems, use of IT, Top management commitment, Employee Cooperation, Collaborative working environment and Egalitarian leadership. These factors play vital role in achieving organizational goals and fulfillment of BPR expectations as BPR itself does not guarantee achieving goals unless CSFs are properly examine and employed. McAdam and O'Hare (1998) conducted a survey in Public sector to understand BPR related to the public sector and at the same time to find out whether BPR in public sector are also applicable to private sectors. Finally the analysis shows that Top management commitment, Effective communication and Team work are the critical factors for BPR in public sectors.

By considering a few definitions given by previous authors (for example, Pearce and Robinson, 1997; in this research context CSFs defined as the few things which must go right for the BPR to happen successfully). This paper discusses the CSFs of BPR in Healthcare in order to ensure the successful model implementation of BPR. The determination of the CSFs of BPR could aid healthcare institutions to plan their approach and to make their action plan.

Abdolvand, Albadvi, and Ferdowsi (2008) conducted a survey in two companies in order to access the readiness of the companies toward BPR implementations and the degree of success and failures factors that affect their readiness toward the implementation. The author classified CSFs into four main categories as change in management systems, use of IT, Top management commitment, Employee Cooperation, Collaborative working environment and Egalitarian leadership and 17 sub-categories with only one failure factors which is resistance to change considered in the study.

A survey was also conducted by Ahmad, Francis, and Zairi (2007) with aims at identifying CSFs in Education sectors and found out that team work, change management, project management, financial resources and use of IT are the major CSFs for BPR in education. Just like in the case of Abdolvand, Albadvi, and Ferdowsi (2008) use of IT and change management are very important and critical success factors for BPR as well. Terziovski et al. (2003) also suggested that CSFs can be classified as management commitment, continues improvement, performance outcome, customer focus strategy and use of IT. The author also found out that use of IT and strategic alignment are very important CSFs in BPR which is in line with the finding from Ahmad, Francis, and Zairi (2007)

Maull et al. (1995) classified CSFs as; Involving Human and organizational factors, business process architecture, integrating performance measurement, role of IT and strategic approach. These classification also mention IT and strategic approach. A lot of studies done in the area of CSFs have produced different sets of factors. Hence, there is no general agreement on which set of factors is the key to success in BPR implementation this might be due to differences in sampling technique and sometime selecting appropriate respondent.

All the researchers above consider all the critical factors and examine their level of criticality. It is therefore difficult to refine the result since the scope is too wide considering change in management systems, use of IT, Top management commitment, Employee Cooperation, Collaborative working environment and Egalitarian leadership. The data they have collected could not be ascertained sine the nature of instrument requires for use of IT perception is different than that of management commitment.

However, previous researchers has identified some critical factors that are more related to healthcare. (Soudabeh Khodambashi; 2013 J., et. al., 2002; Alastair, K. A., et. al., 2015) also classified CSFs in healthcare into four mentioning repositioning IS/IT function and selecting appropriate vendor amongst the four CSFs in healthcare. These two categories are similar to use of IT and method and tools selection in our category.

With this, this research therefore concentrates only on use of IT, Methods and tools selection, and Strategic alignment as they are the CSFs related to healthcare as identified in the above paragraph. As these factors are directly connected to healthcare institutions, the researcher as such narrows the scope to perception of these factors by the employees in healthcare since the case study hospital undergone a successful BPR in 2014. Therefore, the objective of this study is to examine the critical success factors in BPR acceptance by from Healthcare employees' perspective. The study aims at determining the BPR

critical success factors using the exploratory factory analysis approach.

2 Methodology

This section is aim at giving details on method employed for this research. Under this section there are 2 items: data collection procedures which entails the process of selecting with their statistical descriptions. Secondly, the instrument use for the data collection which entails questionnaire development and categorizing the CSFs in accordance with their applications.

2.1 Data Collection

The data for this research were gathered by means of survey questionnaire administered employees of Sani Abatcha Specialist Hospital, Damaturu with a total of 1200 employees. According to Krejcie and Morgan (1970) sampling size table in having 520 respondents which is more than estimated of 290 according to the table. The survey instructed the employees to provide their experience about successful BPR recently undergone in the hospital. The survey targeted top management, middle management and operational staff of the hospital. The respondents were majority male (67%) compare to female (33%). By age respondent were grouped into 18-25(27%), 26-35(39%), 36 and above (34%). In terms of staff level, top management constitutes 4%, middle management have 15% while operational staff having 81% as depicted in table 1.

Details on the employees descriptive statistics is provided in table 1 below:

Table1. Demographic profile of the surveyed employees

Items	Value	Frequency (n)	Percentage (%)
Gender	Male	348	(67%)
	Female	172	(33%).
Level	Top management	21	4%,
	Middle management	78	15%
	Operational staff	421	81%
Age	18-25	140	(27%)
	26-35	203	(39%)
	36 and above	167	(34%).

3.2 Instruments

The literature review suggested that BPR CSFs categories are use of IT, methods and tools and strategic alignment. Each CSFs categories was represented by latent constructs that was observed via group of indicators. Questionnaire was constructed using 5 points Likert`s scale and then administered to employees in order to get data for this study: 1-Strongly Agree, 2- Agree, 3-Neutral, 4-Disagree, and 5-Strongly Disagree. This survey instrument comprises of three parts, one for each BPR CSFs category (use of IT, Change Management and Strategic alignment)

This study proposed three BPR CSFs in healthcare, which are: use of IT, Methods and Tools and Strategic alignment. There are so many instrument developed by previous researchers regarding measurement of CSFs and are proved to be effective, as a result there are a lot indicators to measures CSFs in BPR based on employee`s perspective. (See appendix A)

Seven indicators (UIT1-UIT7) were adopted from Al-Mashari and Zairi (1999) to measure the richness and reliability of using IT in BPR. These indicators are concern with Alignment of IT infrastructure and BPR strategy, Building of effective IT infrastructure Adequate IT investment and sourcing decisions, Adequate measurement of IT infrastructure, and effectiveness on BPR. (See appendix A for details of constructs)

Seven indicators (MT1-MT9) which are instrument to measure methods and tools was adopted from (Moad, 1993). These indicators are concern with usage of process mapping to distinguish productive activities from non-value-added activities, Revise procedures that focus on satisfying internal demands rather than the marketplace, and concept design phase to develop a rough-cut design and to identify major issues

Lastly, five indicators (SA1-SA5) were also adopted from Lockamy and Smith (1997) to measure the strategic alignment. The indicators are focusing on alignment of BPR strategy with corporate strategy and building of BPR vision by forming a clear and compelling vision for future processes. Table 2 below shows the details values for means and standard deviations of all the three constructs. (For items descriptions see also appendix A for details)

Table 2. Descriptive statistics of BPR CSFs

Constructs	Items	Means	Standard deviation (SD)
Use of IT (UIT)	UIT1	3.44	0.98
	UIT2	3.67	1.01
	UIT3	3.89	1.02
	UIT4	4.00	0.97
	UIT5	3.74	0.97
	UIT6	3.88	1.07
	UIT7	4.01	1.04
Methods and Tools (MT)	MT1	3.77	0.96
	MT2	3.76	0.98
	MT3	4.02	1.04
	MT4	3.89	1.10
	MT5	3.79	1.02
	MT6	3.78	0.94
	MT7	3.65	1.06
Strategic Alignment (SA)	SA1	3.72	1.03
	SA2	3.83	0.99
	SA3	3.91	1.07
	SA4	3.95	0.96
	SA5	3.79	1.00

3 Examination of Confirmatory Factor Analysis

Exploratory factor analysis was conducted in order to understand and identify and validate the underlying the critical indicators in each BPR CSFs categories (use of IT, Methods and Tools and Strategic alignment). The factor analysis specifies the relations of the observed indicators to the BPR CSFs category. The idea of the model is to describes how well the observed indicator serve as critical measurement of BPR CSFs category. The same factor analysis was employed to validate the BPR CSF categories. LISREL version 9.1 was used for developing the polychoric correlation and asymptotic covariance matrices used in generating the loading of each factor since all items were represented by ordinal variables. Table 3 below shows the result for Promax-rotated factor loading. Items intended to measure the same BPR CSF must shows a factor loading of >0.50. Any construct with the highest value of factor loading is representing the most valid indicator for measurering that that category and subsequently is the most critical factor for measurement of that category as well according to Selim, (2007).

Table 3. Factor loading

	UIT	MT	SA
UIT1	**O.76**	0.06	-0.05
UIT2	**0.85**	0.07	0.06
UIT3	**0.77**	0.03	0.11
UIT4	**0.89**	-0.01	-0.08
UIT5	**0.78**	0.05	0.04
UIT6	**0.84**	-0.04	0.00
UIT7	**0.79**	0.08	0.02
MT1	-0.03	**0.77**	0.00
MT2	0.01	**0.79**	-0.05
MT3	0.14	**0.76**	-0.01
MT4	0.04	**0.75**	0.03
MT5	0.02	**0.78**	0.02
MT6	-0.06	**0.66**	0.04
MT7	0.00	**0.80**	-0.01
SA1	0.03	0.03	**0.73**
SA2	-0.01	-0.01	**0.71**
SA3	-0.04	0.00	**0.70**
SA4	0.07	-0.07	**0.65**
SA5	0.01	0.12	**0.63**

All the 7 items (UIT1-UIT7) proposed to measure the use of information technology as critical success factor for successful BPR were highly correlated with the constructs as indicated by the factor loading values of >0.70 in the above table 3. This indicate and testify the validity of the indicators used for capturing the use of IT factors. All the items related to this factor use of IT as enabler during BPR program. With this therefore the following recommendations can be deducted from the factor loading:

- There is need to strongly aligns IT infrastructures with BPR strategy. This means that all the infrastructures related to IT has to be tilted and tailored toward achieving successful implementation of the BPR program.
- There is need to adequately measure IT infrastructure effectiveness on BPR. In this case all the IT infrastructures must be measured to know their effectiveness on the BPR program.
- Information systems has to be integrated during BPR program so that duplication of activities will be avoided.

The result of factor analysis indicates that use of IT is the most critical success factor for BPR in healthcare sector since almost all the factor loading are>0.70. This is emphasizing on the need to appropriately deployed information technology and at the same time align the IT with corporate strategy.

Methods and tools construct (MT1-MT7) is comprised of 7 indicators and all the 7 items were related to appropriately selecting best methods and tools for BPR program. (See table 3). These factors includes ability to utilized hand-on experience in

reengineering diverse process and using concept design phase to develop rough-cut designing and to identify major issues and also focusing on outcome rather that the task. All the 7 factors were having loading of >0.70 except MT6 which is having 0.66 loading. This indicator stands for revise procedures that focus on satisfying internal demands rather than the marketplace. Consequently, the construct is having a good factor loading which placed it second most critical success factor for BPR after use of IT construct.

The last construct (SA1-SA5) represent Strategic Alignment is having 5 indicators. The indicators were related to aligning BPR strategy with that of cooperate and also building BPR version by forming clear and compelling version for future process and so on. Some indicators like SA1, SA2 and SA3 which stands for aligning BPR strategy with of corporate, trying BPR project goals to major business objectives, and building BPR version by forming a clear vision for future process respectively were having factor loading of ≥0.70 which indicates their significant and critical level for BPR in healthcare sector. Other indicators SA4 and SA5 are having low factor loading of 0.65, and 0.63 respectively which shows that they are less significant compare to the rest of the indicators within the same construct. Those indicators are concern with stands for BPR selections process with regard to customers and BPR selections with regards to impact on financial performance. This category is the third most critical success factors for BPR in healthcare after use of IT and methods and tools selection constructs. It is therefore clear that use of IT and selections of methods and tools are the 2 most critical success factor for BPR in healthcare while strategic alignment follows.

Table 4. BPR CSFs instrument reliability

CSF	Cronbach Alpha	Variance Extracted
UIT	0.96	0.81
MT	0.95	0.79
SA	0.92	0.69

The instrument`s reliability for BPR CSF assessment was measured using the concept of Cronbach alpha. Table 4 above shows the values for Cronbach alpha for the 3 BPR CSFs that emerged from previous factor analysis shown in table 3. According to Hair, Anderson and Black, (1998) the4 suggested value that is acceptable is ≥0.70. We can see that all the factors already exhibited a very high degree of internal consistency since the value for alpha were ≥0.70. Therefore, it is concluded that the indicators can be used for measuring the factors with acceptable reliability.

The average of the variance extracted reflect the overall amount of variance in the items accounted for by the corresponding factor. This average variance is more conventional than Cronbach alpha since the composite reliability measure is 0.5 or above that is acceptable (Fornell and Larcker, 1981). From table 4 it is shown that all the average extracted variance values were ≥0.69. This value can be used for evaluating discriminant validity. The squire root of this average extracted variance should be under normal situation greater that the correlations between the factor and all other factors (Fornell and Larcker, 1981). Table 5 below shows the correlations matrices of BPR critical success factors and their corresponding Square root of average extracted variance. From the table all the square root of the average extracted variances were≥0.80 which indicate that there are no problem with discriminant validity.

Table 5. Correlation matrices of BPR CSFs

Factor	UIT	MT	SA
UIT	0.90*		
MT	0.37	0.89*	
SA	0.29	0.39	0.83*

* Square root of average extracted variance

The average variance extracted, which reflects the overall amount of variance in the items accounted for by the factor. The average variance extracted is more conservative than Cronbach alpha as a composite reliability measure and its accepted value is 0.5 or above (Fornell & Larcker, 1981). As shown in Table 5, all the average extracted variance values are ≥0.69. Average extracted variance can be used to evaluate the discriminant validity. The square root of the average extracted variance for each factor should be greater than the correlations between that factor and all the other factors (Fornell & Larcker,1981). Table 6 shows the correlation matrix of the e-learning CSFs and the square root of the average extracted variance, which is in line with study by Musa, M.A. & Othman, M. S. (2012) on e-learning critical success factors. The discriminant validity does not reveal any problems.

Conclusion and Future Direction

A sample of 520 employees of Sani Abatcha Specialist Hospital was used in identifying and measurement of the proposed BPR CSFs. The employees perceived the three factors as critical in

lunching BPR project. The employees indicated that use of IT in BPR project is the most critical success factor follows by methods and tools selections and then strategic alignment. Therefore, according to employees whenever healthcare institutions want to venture in to BPR project, the following factors must be considered based on their criticality level which is the objective of this study:

- The organizational IT infrastructures must be fully align with the BPR strategy. This means all the resources related to IT must be tailored toward achieving the strategies enshrined for BPR
- The effectiveness of IT infrastructures on the BPR must be adequately measured. In this case all the IT related resources invest on BPR project must be properly utilized and their contributions towards the successful implementation of the project must be quantitatively measured.
- All the information systems within the organization must be effectively integrated, so that duplication of responsibilities will be avoided and no-value added transactions can be easily eliminated from the systems.
- In selecting best BPR tools, hand-on experience professional with diverse process must be considered so that the issues of train-on the job will be minimized.
- The use process mapping to distinguish productive activities from non-value-added activities must be adhered to
- Most of the procedures that focus on satisfying internal demand must be revise in order to focus on market demand.

All the indicator from the use of IT construct were very important and significant measures. Employees perceived use of IT enthusiasm as critical to any BPR implementation. Alignment of IT with the corporate strategies therefore very important factor. The indicators from second construct which is methods and tools selection came second in criticality ranking which mean is also very important to best select methods and tools that can distinguished productive activities from non-value added task. And finally, the strategic alignment construct came last with least criticality level compare to other constructs.

However, the most critical indicator came from use IT construct is UT4 which represent measurement of effectiveness of IT on the BPR. The indicator has a factor loading of 0.89 which is the highest among all the construct for IT usage and this indicate the level of criticality in successful BPR implementation in healthcare. The indicator with the least factor loading came from strategic alignment construct (SA5) with factor loading of 0.65 and is representing impact of selecting BPR on financial performance of the organization.

In conclusion, this study investigated the critical success factors affecting the implementation of BPR project in healthcare institutions as perceived by the employees. These factors that were identified and measured can significantly assist healthcare institutions when intend to venture into BPR project in the future.

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Appendix A: BPR CSFs Instruments

Use of IT (UIT)	
UIT1	Alignment of IT infrastructure and BPR strategy
UIT2	Building of effective IT infrastructure
UIT3	Adequate IT investment and sourcing decisions
UIT4	Adequate measurement of IT infrastructure effectiveness on BPR
UIT5	Increasing IT function competency
UIT6	Proper information system integration
UIT7	Effective use of software tools
Methods and Tools Selection (MT)	
MT1	Utilize hands-on experience in reengineering diverse processes
MT2	Use concept design phase to develop a rough-cut design and to identify major issues
MT3	Determine all setup details, tooling, scheduling, maintenance, storage, replenishment, quality, etc. before implementation
MT4	Simplify material flow, logistics, planning, and other distinct operations by using group technology
MT5	Use process mapping to distinguish productive activities from non-value-added activities
MT6	Revise procedures that focus on satisfying internal demands rather than the marketplace
MT7	Focus on the outcome rather than task
Strategic Alignment (SA)	
SA1	Alignment of BPR strategy with corporate strategy
SA2	Tying of BPR project goal to key business objectives
SA3	Building of BPR vision by forming a clear and compelling vision for future processes
SA4	Process selection for BPR have a significant impact on customer satisfaction and delight
SA5	Process selection for BPR have a significant impact on financial performance