HYBRID METHOD TO ASSIST BUSINESS PROCESS REENGINEERING IN DEVELOPING COUNTRIES

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To my late beloved mother (Inna), May her gentle soul rest in Jannatul-Firdaus.

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ABSTRACT

Public institution spending in developing countries is constantly increasing in the last decades, and the available data shows that there is a lack of efficiency in resource consumption not reflected in efficiency improvement. This necessitates the need to reengineer business process that will increase efficiency at a lower cost. To address this, the researcher employed interview and observation data collection strategy where 50 employees from the central registration team of Yobe State University and 22 Health practitioners including doctors, nurses and radiologists from Sani Abatcha Specialist Hospital, Damaturu-Nigeria were interviewed and observed respectively. In this research, the approach based on design science that integrates Knowledge Map, Enterprise Ontology and lean using approach to find unnecessary transactions that must be reengineered to improve the organizational efficiency was adopted. This approach was chosen as a basis for finding a solution because it provides a better understanding of the dynamics of an organization, and allows a good alignment between the enterprise design and operation. Demonstrations of the processes collected from Yobe State University and Radiology Department of Sani Abatcha Specialist Hospital, Damaturu-Nigeria, making it possible to find transactions that can be refined or improved. Evaluation was carried out by means of descriptions and the Four Principles from Österle. Findings indicated that the number of transactions were reduced by 25% in the case of Yobe State University registration process and also reduced by 41.7% in the case of Radiology Department of Sani Abatcha Specialist Hospital. In conclusion, the results proved that the approach yields an adequate and clear process view and is reliable when it comes to reengineering organizational operational processes.

ABSTRAK

Perbelanjaan institusi awam bagi negara membangun mencatatkan peningkatan pada dekad terakhir ini dan data menunjukkan ketidakcekapan dalam penggunaan sumber yang tidak menunjukkan peningkatan kecekapan. Hal ini menandakan bahawa perlunya kejuruteraan semula proses perniagaan yang dapat meningkatkan kecekapan dengan kos yang lebih rendah. Oleh itu, penyelidik menjalankan kaedah temu bual dan strategi pengumpulan data melalui pemerhatian ke atas 50 orang pekerja dari pusat pendaftaran (*Yobe State University*) dan 22 orang pengamal kesihatan termasuk doktor, jururawat dan pakar radiologi dari Hospital Pakar Sani Abatcha, Damaturu-Nigeria yang telah ditemu bual dan diamati. Pendekatan kajian ini adalah berdasarkan reka bentuk sains yang mengintegrasikan Peta Pengetahuan, bersandarkan Ontologi Perusahaan dan menggunakan pendekatan bagi mengenal pasti urus niaga yang tidak diperlukan yakni memerlukan kejuruteraan semula bagi meningkatkan kecekapan organisasi. Pendekatan ini dipilih sebagai asas kepada penyelesaian kerana dapat memberikan pemahaman yang lebih baik bagi organisasi dan membolehkan pelarasan yang baik antara reka bentuk perusahaan dengan operasi. Kajian kes telah dijalankan di (*Yobe State University*) dan Jabatan Radiologi di Hospital Pakar Sani Abatcha, Damaturu, Nigeria untuk mencari transaksi yang boleh diperkemaskan atau diperbaiki. Penilaian telah dijalankan melalui kaedah penerangan dan Empat Prinsip daripada Österle. Keputusan menunjukkan bahawa bilangan transaksi telah berkurang sebanyak 25% bagi proses pendaftaran di (*Yobe State University*) dan 41.7% bagi kes di Jabatan Radiologi Hospital Pakar Sani Abatcha. Kesimpulannya, keputusan yang dihasilkan dapat membuktikan bahawa kaedah ini menghasilkan pandangan dan proses yang jelas serta boleh dipercayai dalam proses operasi bagi kejuruteraan semula organisasi.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AALAD	-	Group/Actor/Role based modelling language
ABD	-	Actor Bank Diagram
AGR	-	Agent/Group/Role
AIMIL	-	Agile Integration Modeling Language
AM	-	Action Model
ATD	-	Actor Transaction Diagram
BPD	-	Business Process Diagrams
BPEL	-	Business Process
BPI	-	Business Process Improvement
BPML	-	Business Process Modeling Language
BPR	-	Business Process Reengineering
CIO	-	Communication Intensive Organization
CM	-	Construction Model
C-World	-	Coordination World
DEA	-	Data Envelopment Analysis
DEMO	-	Design Engineering Methodology for Organization
DS	-	Design Science
DSRM	-	Design Science Research Methodology
ED	-	Emergency Department
EDO	-	Expert Dependent Organization
EO	-	Enterprise Ontology
GDP	-	Gross Domestic Product
IAM	-	Interaction Model
IDEF0	-	Icam DEFinition for Function Modeling
IS	-	Information Systems
ISM	-	Intersticion Model
IT	-	Information Technology
IUT	-	Information Use Table

JPDL	-	Process Definition Language
KM	-	Knowledge map
KRO	-	Expert Dependent Organization
MOISE+	-	Model of Organisation for multiagent Systems
OECD	-	Organization for Economic Corporation and Development
OFD	-	Object Fact Diagram
OPL	-	Object Property List
PDQ	-	Provided Direct Queuing
PSI	-	Personality Systems Interaction
PSD	-	Process Structure Diagram
PM	-	Process Model
RAD	-	Rapid Application Development
RD	-	Radiology Department
RFID	-	Radio Frequency Identification
SADA	-	Symbolic Analyst Dependent Organization
SADT	-	Structured Analysis and Design Technique
SECI	-	Socialization Externalization Combination Internalizat
SM	-	State Model
TMQ	-	Total Quality Management
UML	-	Unified Modeling Language

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

As business is growing, there is tendency for human being to be fed up with the usual ways of doing same business and this lead to the desire for improving business process through new technology. There is no aspect of business that is not affected by this desire for change and this led to the idea of business process change.

In many developing countries, this idea of business process change led to sudden change in doing business. As technology become the bedrock on which almost all the businesses run so also the information technology became the enabler for global economy through business process change.

In developing countries, one typical paradigm of serious concern that got so much attraction is business process reengineering (BPR). The term BPR according to Hammer and Champy, 1993 is refer to "fundamental rethinking and radical re-design of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed"

Many organizations in developing countries either public or otherwise are into BPR project in one way or the other considering the kind of output their

counterpart are able to achieve through implementation of BPR (Alastair, et. al., 2015).

The whole idea behind BPR was because of series of events initiated by Japanese automobile company that gave rise to a paradigm in business like Total Quality Management (TQM) with the rapid improvement in IT and other techniques related to automobile over the years. There was a report on significant success for Japanese automobile, which led to other organization, and institutions venture into implementing the same concept of BPR (Ali, et. al., 2014).

However, despite the success report from many organization couple with high expectations for business process improvement, not in all cases these success are realized so much that a failure were frequently reported (Rio, et. al, 2012). Even though organization need to reengineer their business in order to improve on quality and eliminate non-value added transaction, some authors argue that there is no strong and reliable method to reengineer the business process (Dietz and Hoogervorst, 2008; Matthew, et. al., 2016).

The reasons for these high failure rates has been debated and a number of factors have been posited as to why these expected benefits has not been realized. One factor is focusing on steps in the business process at the exclusion of the environment and the second factor is the fact that previous BPR techniques and methods do not deal with enterprise dynamics at the operational level (Henriques, et. al., 2010; Rio, et. al., 2012; Ilia and Amin, 2014).

Following this, our research proposes an approach based on hybrid method that integrate knowledge management technique and Enterprise Ontology (EO). Lastly, the researcher adopts the concept of Lean approach for identifying possible improvements from models, and then prioritizes them in terms of impact and feasibility.

Therefore, our research main objective is to provide a hybrid method based on knowledge structure map, EO and Lean to find non value-added transactions, and reengineer them to improve efficiency in both higher education and healthcare systems.

The research was conducted using the Design Science (DS) approach that aims at creating and evaluating artifacts to solve relevant organizational problems (Henver et al., 2004). The obtained artifact is a method that provides guidance on how to find improvements through a set of steps divided in two phases. It starts with the Modeling Phase, which uses Knowledge structure map and EO for modeling and understanding the essence of the organization and its processes. Then, the Innovation Phase based on some Lean steps, identifies possible improvements from models, prioritizes them in terms of impact and feasibility, and finally the organization is reengineered to include the most relevant improvements.

The hybrid method was demonstrated in Yobe State University Students registration procedure and radiology department (RD) of Sani Abatcha Specialist Hospital-Nigeria (SASH) where the two departments were modeled using knowledge structure map and EO, then innovate using additional steps from Lean approach. The artifact was thereafter evaluated by using a framework proposed by Pries-Heje, et. al., (2008) and the four principle by Österle et al., (2011) with additional framework from Moody and Shank (2003). Finally, the artifact was communicated to scientific community through paper presentations and publications in peer review journals.

1.2 Problem Background

BPR by their nature are high success or high failure outcome due to the nature of the activities of destabilizing the organization. It is expected therefore for BPR to have high total impact on organizational performance (Rio, et. al., 2012).

In the literetures, there are reports on how BPR implementation help in improving business process that led to more efficient business environment. A good example of this is Motorola Company when faced with longer cycle's time and defect rate, decided to implement BPR in its tooling process. This action taken by Motorola was able to reduce down the cost of production to almost one billion USD per year. BPR was also implemented by Hallmark which led to acheaving 75% cut in production time (Ranganathan and Jasbir, 2001; Arwa and Rizwan, 2016)

Many organizations have been reengineering or are into reengineering their business process ranging from order fulfillment and customer relationship applications. A study suggests that many organization gain significant benefit from BPR programme (Ozcelik, 2010). Example is the CIGNA Corporation, which was successful in their BPR programme and realized a saving of 100 million US Dollars by reducing its cost through improving the customer relationship services expenses (Ozcelik, 2010). So also, for the case of FORD Motors the BPR programme, help the company to increase the speed of payment process and get better company relationship with its suppliers (Grant, 2016).

As a result of this much proven success story, the concept of BPR get widely accepted and subsequently several organizations decide to venture into it. A research conducted indicated that out of 224 firms it surveyed 70% has already venture into BPR programme (Martinez, 2009). Another study confirmed that 85% of the respondents to a survey conducted in 2012 regarding BPR have initiated the programme (Jung and Lee, 2016).

Meanwhile, there was a survey that was conducted by D. Little that shows 85% of the top management of organizations were not actually satisfied with implementation (Kleiner, 2000). This report goes hand in hand with a lot of findings reported in 90s that insist on 70% of the BPR has end up delivering below expectations (Shaio, et. al., 2015).

Although many organizations in developing countries welcome the idea of BPR, however not many of them are happy with the outcome. A lot studies indicates that the outcome are many times embarrassing (Rao, et. al., 2012). In the 90s the concept was yielding a good and large scale success, but as a result of difficult nature of the programme, the idea of the BPR become od serious concern to the practitioners (Rao, et. al., 2012; Khosravi, 2016).

This situation become more worrisome when a data is indicating huge investment in BPR whereas the outcome in many cases is disturbing, (Kaplan and Porter, 2011; Musa, et. al. 2014).

In a world of growing business dynamics, there is tendency that many organizations would want continuously take advantage of BPR to reengineer their business process in order to achieve efficiency and operational benefit. Lack of innovation that will assist in simplifying the BPR is one of the reason behind the reported failure (Shaio, et. al., 2015).

Higher education and Healthcare organizations as their counterpart in other industries has implemented BPR in order to improve their business process, this become necessary considering the strong competition existing in the sector. They were forced to implement BPR so that they can comfortably compete with their counterpart and survive the external forces like dynamic costumer needs and technological breakthrough (Kotter, 1996). Consequently, those organizations need to improve their business process to achieve the reported benefit of cost saving and efficiency improvement (Christensen, et. al., 2009; Rob, et. al., 2016).

Hampering these transformation challenges, developing countries suffers from a serious and growing problem of unsustainability, since its expenditure accounts for a large percentage of the GDP in developed countries, and there is an increasing trend (Christensen, et. al., 2009; Walshe and Smith, 2010). The cost exceeded almost 10% of the GDP in an average of forty countries, the expenditure in

function of the GDP doubled in fifty years, and there are no signs of a slowdown (Walshe and Smith, 2010; Jonathan, et. al., 2015).

The expenditure in Nigeria is also in line with global expenditure where (Omeruan, et. al., 2015) reported that the percentage of GDP from 2000 to 2015 was increasing at an alarming rate. It is clear that the highest spending was in 2013 where Developing countries spent almost USD25 billion in 2016 for the purpose of BPR implementation in various sectors of the economy including healthcare and education as illustrated in Figure 1.1.

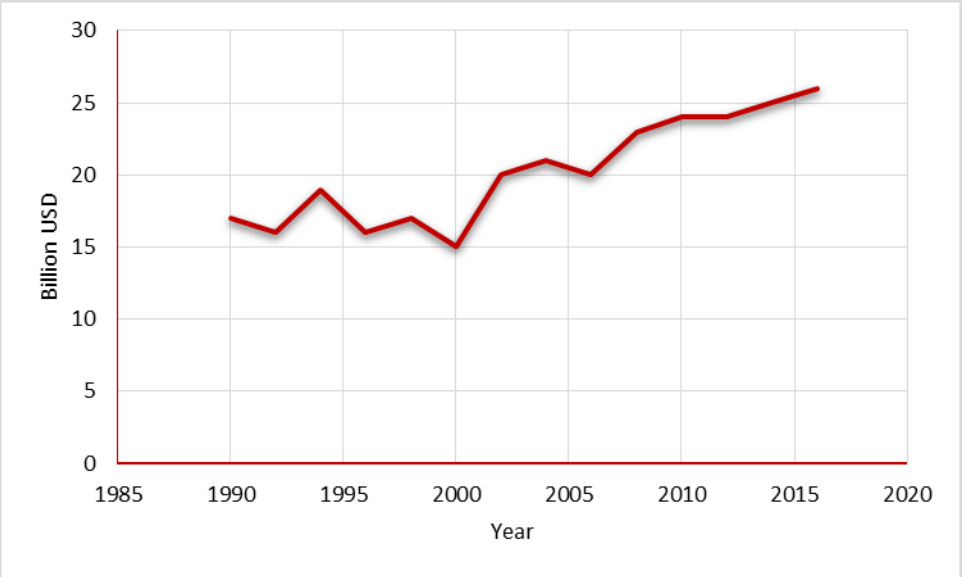

Figure 1.1: General spending in BPR in Developing countries (RDS/OECD., 2016)

This much spending indicates the level of commitment to reengineering in developing countries so much so that a whole sum of 25 billion USD was spents in developing countries in 2016 just to improve on business process through BPR. While various reforms have been put forward by the Nigerian government to address the wide ranging issues in the education system, they are yet to be implemented at the state and local government area levels. (Peter, et. al., 2014).

Education expenditure in developing countries like Nigeria is refers to the current operating expenditures in education, including wages and salaries and excluding capital investments in buildings and equipment. According to World Bank estimates using data from the United Nations Statistics Division's Statistical Yearbook, and the UNESCO Institute for Statistics online database, in 2014 Nigeria spend over USD5 billion on education compare to USD5 Million only in 1970. However, with all the increasing expenditure in education, which include higher education the output in terms of quality of education, remain alarming as indicated in figure 1.2.

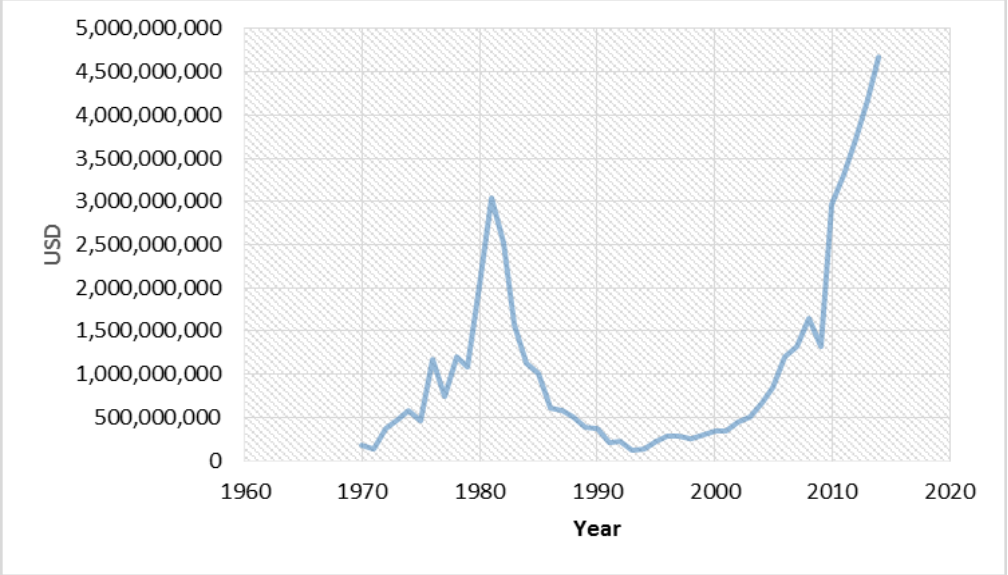

Figure 1.2: Spending in Education in Nigeia (MUNDI Index, Unesco Institute of Statistics, 2014)

In healthcare also the situation is the same in developing countries where there were higher expenditure and poor servises such as delays in admission process and medical errors, like misdiagnosis, incorrect procedures, and incorrect prescriptions (Jonathan, et. al., 2015). The extent and impact of these issues may vary from place to place, but they are present nonetheless and contribute to difficulties in many Hospitals in developing countries. (Vergidis and Tiwari, 2008).

The expenditure in healthcare in Nigeria is also in line with global expenditure where (Omeruan, et. al., 2015) reported that the percentage of GDP from

2000 to 2015 was increasing at an alarming rate. It is clear that the highest spending was in 2013 where Nigeria spent almost 7.1% of its GDP in healthcare as illustrated in Figure 1.1.

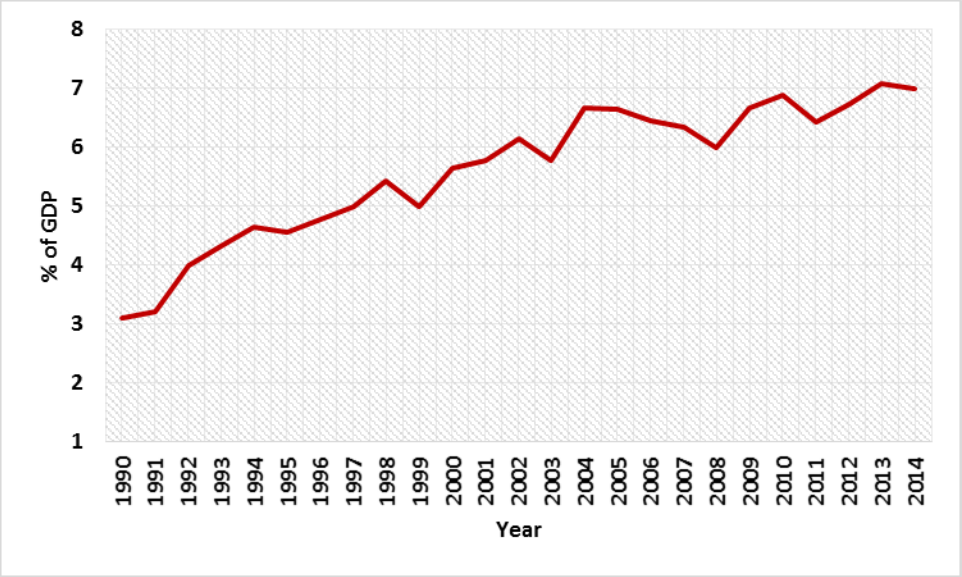

Figure 1.3: Healthcare spending with respect to GDP in Nigeria (Omeruan, et. al., 2015)

The Nigerian health care has suffered several down-falls (Asangansi and Shaguy, 2009). Despite Nigerian's strategic position in Africa; the country is greatly underserved in the health care sphere. Health facilities (health centers, process flow, personnel, and medical equipment) are inadequate in the country, both in rural and urban areas (Nigeria Health Care Policies, 2014).

While various reforms have been put forward by the Nigerian government to address the wide ranging issues in the health care system, they are yet to be implemented at the state and local government area levels. (Mlay, et. al., 2013; Peter, et. al., 2014).

Subsequently, a lot research is conducted aims at identifying the possible factors that lead to those poor services both in education and health sectors. Among the factors pointed out by previous researchers are focusing on the business process

diagrams alone without paying significant attention to the environment within which the BPR is carried out (Yu and Mylopoulus, 2012; Ilia and Amin, 2014).

A second factor identified is lack of integration among the various enterprise elements at the design level and lastly, the inability to deal with the enterprise dynamics at the operational level due to weak enterprise construction models. Previous BPR techniques and methods only support understanding of the business process but unfortunately, they do not take into cognizant the enterprise description that will identify the need for improvement in the process, and this is one of the most difficult part of the business process (Henriques, et. al., 2010; Ali, et. al., 2014; Bibi and Hassan, 2014).

Recently, a number of studies were conducted aims at addressing these problems of inefficiencies through BPR, using several techniques. Example, Arun and Shams, (2014), Dias, (2013), Syed, (2013), and Satyanarayana, (2012). However, all these studies could not address the issues identified above as they all focus more on the steps in business process (eg. business process diagrams) alone at the exclusion of the environment. Secondly they do not address the enterprise dynamics at the operational level as previously mention.

Following this, our research is aims at addressing these issues. The issue of lack of understanding the environment during business process reengineering programs can be addressed through hybrid method of integrating the existing knowledge management technique (Rao, et. al., 2012).

One of the knowledge management techniques that will be relevant in identifying knowledge within the environment is the knowledge structure map. Knowledge structure map can be used for identifying the source of knowledge in organization, and opportunities for knowledge creation within the same organization. Map will also help in increasing the opportunity for knowledge sharing and will help explore the competencies available within the organization the nature of their interactions (Eppler, 2008; Shaker, 2015; Ali, et. al., 2015).

Secondly, the problems of lack of integration among the various enterprise elements at the design level can be addressed by introducing EO. This will help in understanding the enterprise description of the entire organizations (Hinkelmann, et. al., 2015). EO will provide a better understanding of an organization's dynamics with its strong and well-formed theory, and allows a good alignment between the enterprise design and operation (Reijswoud, et. al., 1999; Dietz, 2006a). If these issues are resolved, they will go a long way in improving the BPR efforts and subsequently help organizations to realize the much-anticipated benefit of this BPR.

Although, enterprise ontological modeling techniques have been identified as essential to leverage and clearly define a set of enterprise concepts, but it is still lacking in literature an analysis on how these concepts retrieved from the ontological models can support and improve efficiency. The success of this research field may have a big impact in the improvement in efficiency, on the accessibility of its services, and the possibility of reallocating investment in other public services.

1.3 Problem statement

BPR has become much popular management tools for dealing with rapid technological and business changes in today's competitive environment. It has been a high-risk, high-reward proposition. BPR has the potential to significantly improve business performance. Studies indicated that many gain significant benefit from BPR programme and this led to wide acceptance of the concept, and as a result, several organizations decide to venture into it.

However, on the other hand, failure rate recorded by (Rao, Gunjan and Kweku-Muata 2012) is as high as 70%. Researcher has debated on the factors that bring about these failure rates, and identified 2 factors which has discussed in section 1.2. These factors are the main courses of the failures in BPR project and need to be addressed accordingly (Hinkelmann, et. al., 2015).

As a result, it is necessary to address these issues especially in higher education and healthcare domain. In other words, the main problem is how to develop hybrid method that will finds non-value added transactions and reengineer them in order to improve efficiency in the systems

1. What are the existing techniques currently used in business process reengineering
2. How to develop Hybrid method based on knowledge map, enterprise ontology and lean for enhancing BPR
3. How to demonstrate the method in a case study domain of higher education and health care systems.
4. How to evaluate the Artifact using appropriate methodologies and practitioners point of view

1.4 Research objectives

The main goal of this research is to develop a hybrid method based on knowledge structure map, enterprise ontology and Lean to find non value-added transaction, and reengineer them to enhance the efficiency. To achieve this, the following set of objectives are presented:

1. To examine the existing technique currently used in business process reengineering.
2. To develop a hybrid method based on knowledge, enterprise ontology and Lean approach for enhancing BPR
3. To demonstrate the method in a case study domain
4. To evaluate the artifact using appropriate methodologies and practitioners point of view

1.5 Research Scope

The scope of this research is developing a method base on knowledge structure map and enterprise ontology for enhancing BPR in higher education and healthcare management in Nigeria. This study cannot pretend to address every problem in Nigerian healthcare sector; therefore it is necessary to specify the boundary of knowledge behind the study. The Study is based on DS.

Therefore the research will focus on identified stages to develop the method. Other scopes of the study include the following:

1. The existing techniques consider for this research includes organizational knowledge, knowledge maps, enterprise ontology and Lean approach.
2. Interview, Observation are the two data collection techniques for this study
3. Descriptive. observational and analytical methods will be used as the tool for evaluation of the proposed method
4. The developed a hybrid method will be demonstrated only in Higher education and Healthcare organization domain as the case study.

1.6 Justification of the study

Despite the fact that many organizations had initiated the process of BPR, a study indicated that only few of them are successful. A lot of organization has attempted to reengineer their business process but end up in failure. The reengineering team normally focused more on technical issues and pay little or no attention to organizational issues. As a result, the team even though undertakes the reengineering process rigorously but eventually fails.

Although many organizations embraced the concept of this BPR programs, only a few of them immerge successful in their effort. Study indicates that many top management of organizations are seriously disappointed with the result of the programme, as the failure encountered is very devastating (Hlupic, et. al., 2000).

The reported inefficiency and disappointment have impact on the quality of life because it may create a knock-on effect on economy, leading to the potential misallocation of resources and a reduction in purchasing power. Unless funding for other public services is denied or taxes are raised to extreme levels, there will be serious difficulties in financing public services for retired or poorest people, affecting the productivity and the public health conditions (Christensen, et. al., 2009; Yu and Mylopoulus 2012).

This study is aims at addressing these gap by developing a hybrid method for BPR so that the issues of organizational knowledge and enterprise elements integrations will be considered during the reengineering program.

1.7 Research Contributions

Overall, this research developed a new artefact for enhancing business process reengineering in higher education and healthcare, and make the following specific contributions to the field:

- To provide a method based on enterprise ontology to find non value-added transaction, and reengineer them to improve efficiency
- With the developed method, management practices that advocates the development of self-awareness within higher education and healthcare organizations will be encourage, and the integration among the various enterprise elements at the design level

- To demonstrate the developed method in both higher education and healthcare departments as real case studies there by using naturalistic approach to show how the method works in many setup.
- To evaluate the method and its results using appropriate methodologies, in order to show its suitability and efficiency to solve the research problem, as well as to show that the design science research method extends the current state-of-the-art approaches.
- As part of design science principles, this research also communicates the research to relevant audiences including academics and practitioners through the publication of papers.

1.8 Organization of the Thesis

The study consists of six chapters organized in logical and systematic manner to achieve the aims of the research through addressing the objectives of the study.

The first chapter gives details background of the research and highlights previous studies conducted by researchers in the literatures in order to develop the research problems. This is then follows by research objectives, research questions, research focus and scope, research, justification and contributions for the study and finally organization of the thesis is presented.

The second chapter presents the review on the literature discussing business process and business process reengineering. The chapter continue to discuss implementations of BPR in some organization objectively criticizing the where there is need to improvement based on the suggestions by previous researchers.

The chapter went ahead to discuss the techniques in BPR organizational modeling that comprises of enterprise ontology and knowledge map. Finally, the

shortcoming and limitations of the previous techniques for BPR were critically analyze and presented.

The third chapter outline the research methodology used for this study, describing different research paradigms and research design and the reason for selecting this approach. The chapter will describes the stages involved in design science research methodology (DSRM) approach which is methodology adopted for this study. The chapter will also describe how the developed method was arrived at. The chapter will as well explain how the interview and observational data were collected and analysed to address the objectives of the research.

The fourth chapter present the demonstration of the developed method in both higher education and healthcare organization, more specifically in student's registration process and radiology department of Sani Abatcha Specialist Hospital (SASH). The new model for registration process and that of radiology departments before and after reengineering will also be presented in this chapter

The fifth chapter present the design science evaluation strategies. The chapter discussed evaluation strategy for DSRM artefact by Pries-Heje, follows by Moody and Shanks Quality Management Framework by Pries-Heje (2008).

Lastly, the chapter also discussed the four principles to evaluate a DSRM artefact by Österle et al., (2011) where both model and artefact were evaluated using the four principle framework. Lastly, the sixth chapter summarize all the findings and draw conclusion of the research. The chapter will then provide the practical and theoretical implications for the study and finally present the future direction of the research.

1.9 Summary

This chapter outlines the essential parts of the study for integrating knowledge map and enterprise ontology for enhancing business process reengineering. The background of the research problems, research goal as well as statement of problems along with the research questions and objectives are well described. Scope of the research, justification for the study and research contributions is also mentioned. This chapter therefore serve as the introductory for this research.

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