The Impact of Business Process Reengineering on Enhancing the Agility of Management Information Systems: A Survey Study

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Abstract:

This research addressed two prominent concepts. The first is an important approach to change that aims at achieving radical and fundamental transformation, known as Business Process Reengineering (BPR). The second concept strongly advocates reliance on computers, software, and communication networks, referred to as Management Information Systems (MIS). Accordingly, this study examined and analyzed the use of business process reengineering as an approach for change and transformation toward agile management information systems, which require considerable efforts for development and improvement.

The study included two dimensions: a theoretical dimension concerned with presenting a conceptual framework for the topic, and a field dimension aimed at identifying the nature of the relationship and impact between the variables of business process reengineering and the agility of management information systems. A questionnaire was adopted as the main instrument for data collection, consisting of (58) items covering the study variables. The questionnaire was administered to a sample of (137) beneficiaries at the University of Mosul.

To achieve the required results, the study employed several statistical methods. The findings revealed that business process reengineering of management information systems contributes significantly to enhancing the agility of management information systems. The study recommended reengineering management information systems and making the necessary decisions consistent with the requirements of implementing this modern developmental approach.

Keywords: Business Process Reengineering, Agility, MIS, BPR, Modern Developmental Approach.

1. Introduction

In light of the revolution in information and communication technology and the rapid developments associated with it, as well as the necessity of achieving a qualitative leap in management information systems, business process reengineering emerged as a managerial approach capable of achieving radical changes in management information systems based on the vision of the final beneficiary. This is accomplished by redesigning systems from scratch through radical redesign supported by technological innovations and solutions in a manner that can improve their structure and methods of operation, thereby achieving their objectives and increasing their agility.

Possessing an information system alone is no longer sufficient; rather, it has become the decisive factor in achieving competitive advantage and organizational success. In today's

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dynamic era, merely having information is meaningless unless it can be obtained efficiently and effectively. From this standpoint, the idea of this study emerged, based on the belief that the importance and quality of management information systems can only become effective when accompanied by reengineering as an appropriate approach for transformation toward agile management information systems.

The study consisted of five sections. The first section presented the research methodology, the second discussed business process reengineering, the third addressed the agility of management information systems, the fourth examined the testing of hypotheses, while the final section included the conclusions and recommendations reached by the study.

2. Research Methodology

2.1 Research Problem

Contemporary challenges impose on organizations the necessity of adopting new approaches to increase the agility of their information systems. Benefiting from modern managerial thought requires adopting an approach that provides radical solutions rather than relying on incremental solutions that are no longer effective in addressing chronic problems. Instead, such an approach ignores the existing reality and attempts to start anew, which is considered an effective way to avoid accumulated problems.

Comprehensive and radical change extends beyond form to substance, achieving compatibility with the requirements of the modern era through business process reengineering, which represents one of the essential pillars for enabling management information systems to survive, grow, and expand. The concept of reengineering has increasingly attracted attention due to its ability to achieve substantial improvements in quality, cost, speed, flexibility, creativity, and fulfillment of the final beneficiary's requirements by redesigning and reinventing effective information systems through changing their structures, operational methods, and resolving obstacles hindering workflow, ultimately achieving system agility.

Based on the above, the research questions can be formulated as follows:

1) Does the investigated organization adopt business process reengineering for its management information systems?
2) Is there a significant correlation between business process reengineering and the agility of management information systems in the investigated organization?
3) Does business process reengineering affect the achievement of agility in management information systems within the investigated organization?

2.2 Importance of the Research

1) The importance of the investigated organization (University of Mosul) stems from the fact that the final beneficiaries require information, in addition to the university's distinguished scientific position and its interaction with society, as well as its continuous efforts to keep pace with developments in information and communication technology.
2) Motivating the investigated organization to pay greater attention to reengineering its information systems due to its importance in leading organizations toward success.
3) The significance of the study is also reflected in providing a scientific framework for an integrated model whose variables were examined comprehensively and holistically, relying on internationally recognized and tested measurement tools within Iraqi organizations.
4) Keeping pace with the enormous and rapid developments in information technology across all fields, especially management information systems, and enhancing their agility to satisfy beneficiaries' needs through reengineering.
5) Identifying weaknesses in management information systems and proposing alternatives through reengineering.

2.3 Research Objectives

The research objectives are as follows:

1) Exploring the features of the organizational environment that support the reengineering of management information systems in the investigated

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organization.

2) Conducting a theoretical review of available sources to prepare a theoretical framework and provide an academic contribution regarding the research variables, which are considered contemporary topics.
3) Presenting a practical vision for utilizing business process reengineering in enhancing the agility of management information systems and transforming them from traditional designs and administrative methods into innovative systems capable of accommodating the changing needs of final beneficiaries.
4) Identifying the relationship and effect between business process reengineering and the agility of management information systems in the investigated organization.
5) Reaching conclusions and recommendations that contribute to enhancing Iraqi organizations' awareness of the importance of adopting business process reengineering and its impact on system agility.

2.4 Hypothetical Research Model

The methodological treatment of the research problem requires the design of a hypothetical model that illustrates the logical relationships between the two dimensions of the study, representing the temporary solutions proposed by the researchers to answer the research questions raised in the problem statement. This model was based on the possibility of measuring each dimension of the study and its comprehensiveness. Business Process Reengineering of Management Information Systems represented the independent (explanatory) variable, whereas the dependent (responsive) variable was represented by the Agility of Management Information Systems, as illustrated in Figure (1).

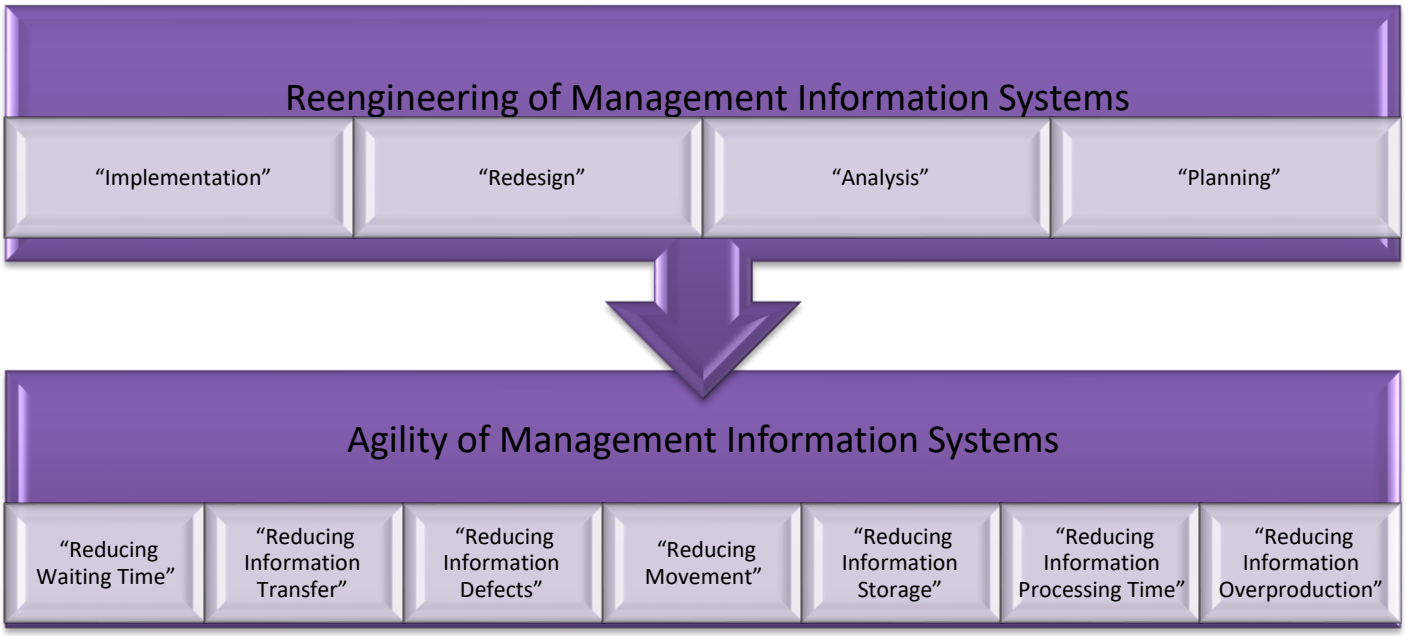


Figure 1. Hypothetical Research Model

Source: Prepared by the researchers

2.5 Research Hypotheses

In line with the objectives of the research and for testing its hypothetical model, the study adopted the following main hypotheses:

- **The First Main Hypothesis:**
  The investigated organization adopts business process reengineering for its management information systems

- **The Second Main Hypothesis:**
  There is a significant correlation between business process reengineering and the agility of management information systems.
- **The Third Main Hypothesis:**
  Business process reengineering significantly affects the achievement of agility in management information systems.

2.6 Methods of Data and Information Collection

To cover the theoretical aspect of the research, the study relied on the contributions of researchers collected from scientific references, including books, journals, theses, dissertations, and scientific studies, in addition to sources obtained through the Internet.

Regarding the field aspect, the researchers relied on several essential methods for collecting data, including:

a) **Personal Interviews**
   Interviews were conducted with the respondents to obtain a general understanding of the concepts related to the research dimensions, as well as to clarify ambiguous items in the questionnaire whenever necessary, ensuring accurate responses that support the objectives of the study.

b) **Questionnaire Form**
   The questionnaire represented the primary source for data collection. Care was taken in its formulation to ensure clarity in identifying and measuring the study dimensions. Since no ready-made scale was available to measure the study variables, the researchers relied on previous studies and literature addressing the dimensions of the research in order to benefit from them in constructing the measurement scale for this study as well as a five-point Likert scale was used.

The questionnaire consisted of two sections (Al-Sultan,2001, p.538; Malhotra ,1998, p.5-6; Abdous & He,2008, p.2; Liker, 2021, p.386; slack, et.al.,2022, p.523; Martin,2010, p.92-95; Larman& Vodde, 2009, p.21-22):

- **The First Section:**
  measured the dimension of Business Process Reengineering of Management Information Systems, which included four variables (Planning, Analysis, Redesign, Implementation).
- **The Second Section:**
  measured the dimension of Agility of Management Information Systems, which included seven variables (Reducing overproduction of information, reducing information processing time and operations, reducing information storage, reducing movement, reducing defective information, reducing information transfer, Reducing waiting time).

Additionally, to verify the validity and reliability of the measurement scale, the researchers used the Reliability Alpha coefficient. The overall Alpha value reached (95.8%), which indicates a very high level of reliability compared with the standard Alpha value of (60%) commonly accepted in humanities research.

2.7 Statistical Analysis Methods

Several statistical tools were employed to test the validity of the research hypotheses using the statistical software package SPSS Version 27. These statistical methods included:

I. Spearman Rank Correlation Coefficient to measure the strength of the relationship between two variables.
II. Chi-Square Test to identify the degree of association between variables.
III. Simple Linear Regression Analysis to measure the effect of the independent variable on the dependent variable.

2.8 Methods

The study adopted the descriptive analytical approach, which describes the phenomenon quantitatively and qualitatively through collecting, classifying, and analyzing information, then

identifying relationships among its dimensions in order to interpret them adequately and reach general conclusions that contribute to understanding the present situation and diagnosing its causes.

2.9 Description of the Research Population and Sample

To implement the current research, it was necessary to identify organizations characterized by intellectual knowledge and practical expertise. Accordingly, the University of Mosul was selected as the field for conducting the study.

The respondents consisted of beneficiaries of management information systems at the university. The reason for selecting this category is that the university possesses computerized information systems.

A total of (146) questionnaires were distributed to beneficiaries of management information systems at the university, of which (137) questionnaires were retrieved, yielding a response rate of (93.8%)

2.10 Personal Characteristics of the Research Sample

Table 1. Personal Characteristics of the Research Sample.

Variable	Frequency	Percentage
Gender		
Male	86	62.8%
Female	51	37.2%
Total	137	100%
Marital Status		
Married	92	67%
Single	45	33%
Total	137	100%
Age Groups		
26–30 years	23	16.9%
31–35 years	35	25.5%
36–40 years	40	29.2%
41–45 years	28	20.4%
46 years and above	11	8%
Total	137	100%
Educational Qualification		
Bachelor's Degree	61	44.6%
Higher Diploma	15	10.9%
Master's Degree	30	21.9%
Ph.D.	31	22.6%
Total	137	100%

Source: Prepared by the researchers.

3. Business Process Reengineering / Conceptual Framework

3.1 The Concept of Business Process Reengineering

Business Process Reengineering (BPR) is considered one of the

modern concepts of development and change in management. Organizations that adopt reengineering seek to introduce radical and fundamental changes in all aspects and areas of organizational work, particularly management information systems, in order to achieve progress and adaptation within rapidly changing environmental conditions.

(Reid & Sanders, 2002, p.13) defined reengineering as a radical measure focusing on fundamental rather than incremental changes. It implies transformations in work duties and the adoption of different methods for performing tasks by employees.

(Turban et al., 2003, p.302) viewed reengineering as part of process innovation that requires revisiting the overall objectives of processes and introducing innovative and effective changes to achieve major improvements. This includes examining new business strategies and actual activities for process design while investing in their technical, human, and organizational dimensions.

Similarly, (Krajewski & Ritzman, 2007, p.141) defined it as the fundamental rethinking and radical redesign of processes to improve performance in terms of cost, quality, service, and speed. It is a process of reinvention rather than incremental improvement, accompanied by substantial changes in information technology.

(Mohammed, 2008, pp.71–72) described it as a modern systematic managerial concept based on restructuring processes, structures, functions, and systems, then starting anew through a set of innovative methods and procedures relying on existing entities to face environmental changes and achieve improvements in system performance.

Finally, (Malhotra, 1998, p.1) considered it the critical analysis and radical redesign of current processes to achieve substantial improvements in performance measures.

Based on the above definitions, the researchers believe that business process reengineering is a process of analysis and redesign that relies on utilizing tools, techniques, and methods compatible with modern technology in order to create change that starts from scratch rather than merely reforming the existing situation.

3.2 Objectives and Advantages of Business Process Reengineering

Business process reengineering is considered one of the important tools that organizations can rely on to improve systems. Its outcomes contribute to improving processes, enhancing workflow, and eliminating activities that do not add value.

To meet the growing demand for high-quality information, processes must be simplified. Reengineering radically changes the work environment by integrating separate processes to achieve efficiency and productivity. It provides a framework for improving and redesigning work processes, achieving optimal performance, reducing errors, and eliminating unnecessary or random activities (Daft, 2001, p.373).

This enables users to make immediate decisions that eliminate obstacles and increase operational speed (Adeyemi & Aremu, 2008, pp.1–2). Reengineering also reduces waste and losses while ensuring the effective use of information technology at the right time and place through keeping pace with continuous technological changes.

Moreover, it contributes to achieving compatibility between human resources, processes, and technology, as well as increasing the organization's ability to adapt rapidly to environmental changes. It also enhances flexibility in meeting the changing requirements of beneficiaries and providing better services to final users (Al-Hanawi & Al-Sayed, 1999, p.233).

This is not only beneficial for overall organizational performance, but also increases beneficiary satisfaction, improves efficiency, and enhances the quality of information.

3.3 Stages of Business Process Reengineering

Most researchers agree that the reengineering process should be implemented according to a preplanned framework consisting of interconnected and integrated stages that are far from randomness. These stages include (Al-Sultan,2001,p.538;

Malhotra ,1998 ,p. 5-6; Abdous & He , 2008 ,p.2):

1) **Planning**

Planning refers to establishing a work plan for implementing and initiating the information system by identifying the objectives to be achieved and preparing specialized staff to perform this task.

Planning activities analyze the baseline of the current information system in relation to the external environment, infrastructure, and technological capabilities in order to develop a vision of what the information system should become and the methods required to achieve this vision.

This can be expressed through a series of models and architectures that define the system, processes, information resources, and supporting technologies in a manner consistent with the information system model.

2) **Analysis**

This stage involves a set of procedures related to describing the current information system, identifying its drivers, and utilizing modern technologies and methods to conduct reengineering operations according to established objectives and standards.

This includes:

- Identifying strengths and weaknesses in the system.
- Recognizing internal problems.
- Enhancing positive aspects.
- Properly utilizing resources.
- Identifying modern technological methods and successful reengineering models.
- Determining the requirements necessary for implementing reengineering according to performance objectives and standard criteria.

3) **Redesign**

This stage is considered one of the most important and difficult stages of reengineering because it relies on the outcomes of the analysis phase to generate new ideas and methods for developing and improving the information system.

At this stage:

- A new information system is designed and documented to replace the current system.
- A new design is established based on the defects observed in the current system's performance.
- The best design alternative is selected among various design options.
- Information technology is employed to support the new information system.
- System architecture is determined according to current and future information requirements without being restricted by existing limitations.

This stage may also require restructuring the information system, especially in cases involving comprehensive changes. Additionally, detailed procedures, systems, policies, skills, and expertise required for implementation are determined during this phase.

4) **Implementation**

This stage determines the success of all previous efforts and the benefits achieved throughout earlier stages. Without actual implementation, previous efforts remain ineffective.

Implementation involves:

- Employing technical tools and skills compatible with modern methods and developments.
- Ensuring the transition toward a complete reformulation of all functions within the information system.

From the above discussion, the researchers conclude that the various stages of reengineering are fundamentally based on adopting innovative ideas and methods that contribute to creativity in formulating a new management information system capable of achieving effectiveness and efficiency.

4. Agility of Management Information Systems / Conceptual Framework

4.1 The Concept of Lean/Agility

The concept of agility or lean systems was initially associated mainly with manufacturing operations; however, it can also be applied to service and administrative operations. It is not a new phenomenon, as Japanese organizations have been developing it for more than fifty years.

The concept was notably implemented by the Toyota Motor Corporation, which enabled it to outperform other automobile companies in terms of quality, profitability, and competitiveness.

Lean philosophy is based on several interconnected principles and programs aimed at reducing waste in operations. Some losses, such as waiting times and maintenance downtime, are considered inevitable in traditional systems; however, lean philosophy seeks to minimize or eliminate them and improve operational efficiency (Badran, 2010, p.9).

Accordingly, lean is defined as a set of actions performed correctly, in the correct sequence, at the right time, in order to create value for a specific beneficiary (Womack & Daniel, 2004, p.15).

Similarly, (Slack et al., 2022, p.523) described lean as doing things properly or performing tasks better while continuously reducing waste at every stage and maintaining the required quality level.

(Krajewski & Ritzman, 2005, p.483) viewed lean as focusing on reducing inefficiency and unproductive time within operations through continuous improvement, product and service quality enhancement, employee participation, and eliminating activities that do not add value.

(Heizer & Render, 2008, p.642) emphasized that lean systems focus on understanding the final beneficiary by delivering exactly what the beneficiary wants, precisely when needed, without waste, through continuous improvement.

Meanwhile, Larman and Vodde (2009, pp. 9, 20) considered lean as providing increased value to beneficiaries while reducing waste and meeting customer requirements efficiently. Waste is regarded as anything that does not add value from the customer's perspective.

According to (Tortorella et al., 2021, p.841), every moment that does not directly add value to the customer is considered waste, especially unnecessary waiting time.

Therefore, lean systems focus on reducing or eliminating waste while maximizing activities that add value from the perspective of the final beneficiary. This is achieved by ensuring the right product or service is delivered with the right quality, at the right place, while improving productivity.

The researchers believe that focusing on the final beneficiary represents the starting point for agility because correctly understanding beneficiary needs ensures that all processes concentrate on satisfying those needs, thereby eliminating waste. This is precisely what modern methodologies for developing management information systems seek to achieve.

4.2 Types of Waste

Reducing waste is the core concept of lean philosophy. Lean systems operate actively and efficiently to identify and eliminate various types of waste. Waste refers to any process or cost that does not add value to information. The final beneficiary perceives value through the final output (information) and is unconcerned with the costs resulting from processing operations, maintenance, storage, transportation, and similar activities that do not add value to information.

(Sianturi & Singgih, 2024, p.2) defined waste as any activity that consumes space, resources, and time without adding value at any stage of production. Likewise, (Begum et al., 2024, p.18) described waste as any activity that consumes resources without creating value for the final customer, including overproduction, waiting time, unnecessary transportation, excess inventory, unnecessary movement, defects, and underutilization of employee skills.

Sources of waste are often interconnected; therefore, eliminating one type of waste may contribute to reducing or eliminating other types as well. Researchers have identified the following major forms of waste (Naraghi&Ravipati,2009, p.13; James,2012, p.4; Abdullah,2003, p.8-9; slack, et.al.,2022, p.523; Martin,2010, p.92-95; Larman & Vodde, 2009, p.21-22; Liker, 2021, p.386):

1) **Improper Information Storage**

   It is necessary to determine whether data items actually need to be stored and identify the appropriate storage medium. Information storage has a

comprehensive philosophy targeting all organizational units and seeks to identify problems before they occur in order to reduce losses and ensure the provision of accurate information in the correct quantity, condition, time, place, and cost to the appropriate beneficiary.

Waste occurs when excessive amounts of information, data, or in-process data inventories are stored, occupying unnecessary storage space.

2) **Overproduction of Information**

This refers to producing more information than required by processing operations. Poor planning, inaccurate forecasting of beneficiaries' information needs, lack of quality control, and producing excessive quantities in one stage while neglecting the speed of other processing stages create imbalance and lead to waste.

3) **Defects and Errors in Information**

These are outputs (information) that do not correspond to the needs of the final beneficiary. Such defects are among the most dangerous forms of waste because inaccurate or incorrect information may lead beneficiaries to make incorrect decisions.

This results in wasted resources and effort. Furthermore, poor information quality significantly increases waste, especially when quality measurement standards are limited, thereby increasing quality costs beyond normal levels. Therefore, it is essential to identify the causes of such costs.

4) **Waste Resulting from Excessive or Incorrect Processing**

This type of waste involves unnecessary processing steps that do not add value from the perspective of the final beneficiary. Examples include ineffective processing caused by poor output design in terms of content or format, leading to unnecessary procedures and defective outputs.

Unproductive activities, inefficient work tools, and failure to maintain devices and software properly also contribute to unnecessary movement and defects in outputs. In addition, producing outputs with unnecessarily excessive quality levels is considered waste.

5) **Waste Resulting from Transportation**

This includes unnecessary movement of employees and information between processes without adding value. Poor internal planning, weak workplace organization, inefficient transportation methods, and inadequate network infrastructure may cause information to be transferred multiple times.

Similarly, insufficient maintenance of networks and software causes delays in delivering information to final beneficiaries with the required characteristics.

6) **Waiting Time**

Waiting refers to idle time between operations or delays between workflow stages, from system design to information production.

Waiting includes:

- Employee idle time
- Equipment and software downtime
- Delays caused by system failures
- Bottlenecks in processing operations
- Delays resulting from equipment preparation and software installation

This type of waste may constitute more than 90% of the total time required to produce information. Since its causes can usually be identified, it can often be reduced or eliminated.

7) **Movement**

This type of waste results from unnecessary movements that increase fatigue and waste time without adding value to outputs. It includes unnecessary movement by employees within the organization or unnecessary physical actions during work performance.

Poor internal arrangement of devices and facilities, ineffective work movements, repeated searching, inspection, handling, and unnecessary motion increase employee fatigue, reduce productivity and quality, and increase operational costs.

Such issues can be addressed through the application of ergonomic principles and effective workplace design.

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4.3 Principles of Lean/Agility

The basic idea behind lean systems is simple yet highly beneficial: management information systems should focus intensively on the most efficient and effective methods for producing valuable information for final beneficiaries.

Lean systems address this challenge through the application of core lean principles, which serve as guidelines for performing the right tasks, in the right place, at the right time, and in the correct quantity. These principles include (McGrath, 2007, p.12; Al-Naama ,2006, p.10; Kollberg et al., 2007, p.8):

1) **Flexibility**

Standardizing work contributes to achieving high productivity. Flexibility refers to the capability of management information systems to produce diverse information rapidly without sacrificing quality or efficiency, thereby reducing waste in time.

2) **Pull System**

Information should be produced according to the requests of the final beneficiary rather than through excessive information production. This principle is fundamental because all operations should originate from the actual needs of the beneficiary.

3) **Preventive Maintenance**

Preventive maintenance reduces repeated failures of devices, software, printers, scanners, and other equipment. Scheduled maintenance also facilitates replacing defective components and reduces operational and maintenance costs.

Preventive maintenance contributes to:

- Reducing failure points
- Achieving optimal use of equipment
- Improving output quality
- Ensuring better information reliability

4) **Minimizing Waste to the Greatest Extent Possible**

This principle focuses on eliminating all processes that do not add value to information by distinguishing between value-adding and non-value-adding activities from the beneficiary's perspective.

Any process, feature, or activity that is unnecessary for creating value is considered waste and should be removed. Waste elimination is a continuous cycle consisting of:

- Identifying waste
- Analyzing waste causes
- Designing solutions
- Testing solutions
- Implementing solutions

while maximizing the use of financial and human resources.



Source: Prepared by the researchers.

5) **Continuous Improvement**

Continuous improvement involves striving for gradual and ongoing enhancement by performing small tasks better and consistently achieving higher performance levels.

Continuous improvement applies to (Worley & Doolen, 2006, p.229; Profiroiu et.al, 2020, p.464):

- Employees
- Hardware
- Software
- Networks
- Work procedures and regulations

Its fundamental idea is improving processes

through the participation of employees and final beneficiaries in proposing new ideas and suggestions. This aligns with modern methodologies for developing management information systems.

6) **Achieving Excellent Quality from the First Time**

This principle emphasizes striving toward zero defects and identifying problems and challenges at their source immediately upon occurrence.

4.4 Culture of Lean Application

The implementation of lean systems does not depend solely on tools, techniques, and procedures, but also requires building an organizational culture compatible with lean philosophy through the following principles:

- Viewing mistakes as opportunities for improvement.
- Accepting the occurrence of limited mistakes when necessary.
- Establishing mutual trust between management and employees to encourage the identification of errors.
- Considering employees as problem solvers rather than sources of problems.
- Focusing on solving problems instead of blaming individuals responsible for them.

5. Testing the Research Hypotheses

5.1 Testing the First Main Hypothesis

"The investigated organization adopts business process reengineering for its management information systems."

1) The calculated value of the Chi-Square test for the dimension of Business Process Reengineering of Management Information Systems (collectively) reached (54.562), which is greater than the tabulated value of (49.766) at a significance level of (0.05). This indicates the existence of a high degree of agreement regarding the dimension of business process reengineering.
2) The calculated Chi-Square value for the Planning variable reached (61.226), which exceeds the tabulated value of (21.026) at the significance level of (0.05). This demonstrates that the planning variable possesses a strong degree of agreement.
3) The calculated Chi-Square value for the Analysis variable was (54.175), which is greater than the tabulated value of (18.307) at the significance level of (0.05), indicating that the analysis variable has a good level of agreement.
4) The calculated Chi-Square value for the Redesign variable was (78.723), exceeding the tabulated value of (22.362) at the significance level of (0.05).
5) The calculated Chi-Square value for the Implementation variable reached (72.431), which is greater than the tabulated value of (19.675) at the significance level of (0.05), indicating that the implementation variable also demonstrates a high level of agreement.

These findings indicate the existence of significant agreement concerning the dimension and variables of business process reengineering of management information systems. Therefore, the first hypothesis is accepted, meaning that the investigated organization adopts business process reengineering for its management information systems.

Table 2. Chi-Square Test Results for BPR of MIS and Its Variables.

Variables	Calculated Chi-Square	Tabulated Chi-Square
Planning	61.226	21.026
Analysis	54.175	18.307
Redesign	78.723	22.362
Implementation	72.431	19.675
BPR of MIS	54.562	49.766

Sig = 0.001 N = 137At significance level (0.05)

Source: Prepared by the researchers based on SPSS statistical outputs.

5.2 Testing the Second Main Hypothesis

"There is a significant correlation between business process reengineering and the agility of management information systems in the investigated organization."

The data presented in Table (3) reveal the existence of a significant correlation between business process reengineering and the agility of management information systems.

Regarding the strength of this relationship, the findings indicate that the relationship is strong, as demonstrated by the correlation coefficient value of (0.667) at the significance level of (0.01).

Based on these findings, the second hypothesis is accepted.

Table 3. Correlation Relationship between Business Process Reengineering and the Agility of Management Information Systems.

Variable	Correlation Coefficient
Agility of MIS	0.667

N = 137 At significance level (0.01)

Source: Prepared by the researchers based on SPSS statistical outputs.

5.3 Testing the Third Main Hypothesis

"Business process reengineering significantly affects the agility of management information systems in the investigated organization."

To identify the nature of the effect proposed in the third hypothesis, the results presented in Table (4) indicate a significant effect of business process reengineering on the agility of management information systems.

The calculated F-value reached (104.872), which is higher than the tabulated value of (3.96) at a significance level of (0.05) and degrees of freedom (1,135).

The coefficient of determination (R^2) reached (0.437), indicating that approximately 43.7% of the variation in the investigated organization's orientation toward the agility of management information systems is explained by the effect of business process reengineering, while the remaining 56.3% is attributed to other variables not included in the research model.

Furthermore, the value of the regression coefficient (β) and the corresponding T-test indicate that the effect of business process reengineering on the agility of management information systems amounted to (0.747), with a calculated T-value of (10.241), which is greater than the tabulated value of (1.652).

This reflects the respondents' perceptions regarding the ability of business process reengineering to explain improvements in the agility of management information systems.

Accordingly, the third hypothesis is accepted.

Table 4. the Effect of Business Process Reengineering on the Management Information Systems Agility.

DV	R^2	D.F	Calculated F	Tabulated F	β	Calculated T
Agility of MIS	0.437	1,135	104.872	3.96	0.747	10.241

N = 137 At significance level (0.05)

Source: Prepared by the researchers based on SPSS statistical outputs.

6. Conclusions and Recommendations

This section presents the most important conclusions reached by the research and attempts to provide recommendations that may benefit future researchers and scholars, in addition to assisting the investigated organization in strengthening its progress and achieving its objectives.

6.1 Conclusions

Business process reengineering of management information systems represents a modern and effective approach for achieving agility, as it enables organizations to rethink their processes and create innovative methods that lead to substantial improvements in system development and design to meet beneficiaries' needs and expectations.

Information technology constitutes the initial foundation for reengineering management information systems, as most reengineering operations revolve around the flow of information and the increasing demand for it by final beneficiaries within dynamic organizational environments seeking competitiveness and strength.

It is essential to accurately identify the needs of final beneficiaries when implementing reengineering operations because the primary objective of reengineering projects is to develop management information systems capable of producing outputs (information) that satisfy beneficiaries' needs and desires.

The analysis results concerning the reengineering dimension revealed that the investigated organization adopts reengineering of management information systems through highly effective designs. This was demonstrated through the Chi-Square test values, which indicated agreement among respondents regarding the dimension of reengineering and its sub variables (planning, analysis, redesign, and implementation).

Finally, Business process reengineering contributes significantly to enhancing the agility of management information systems within the investigated organization. The analysis results showed a clear effect of reengineering on system agility, as adopting reengineering strategies provides organizations with opportunities to continue technological and developmental advancements in management information systems.

Additionally, the analysis results also demonstrated a significant correlation between business process reengineering and system agility. Reengineering is considered one of the important approaches that improve management information system processes and all related technical, organizational, and human aspects, ultimately achieving continuous agility.

6.2 Recommendations

Based on the findings the authors recommend the following:

1) Reengineering management information systems and making the necessary decisions consistent with the requirements of implementing this modern developmental approach, while introducing the required changes to information systems in accordance with the circumstances of each college.
2) Supporting investment in modern information technology to achieve radical transformation in the operation of management information systems and adopting technologies that enhance their agility.
3) Continuously providing devices, equipment, and technologies related to management information systems while expanding and updating software applications to ensure effective utilization.
4) Increasing attention toward adopting strategies and policies aimed at developing infrastructure in management information systems and keeping pace with developments in reengineering to maximize the utilization of available resources and contribute to building agile management information systems.
5) Organizing training and developmental courses related to reengineering and the philosophy of change for university staff in order to increase awareness regarding the importance of implementing changes that positively influence the agility of management information systems.
6) Creating a suitable environment for implementing reengineering by preparing beneficiaries of management information systems to accept change and adapt to evolving information needs, incorporating these changes into the redesign process of management information systems.
7) Enhancing the satisfaction of final beneficiaries at administrative levels regarding the outputs of management information systems by ensuring that information outputs correspond appropriately with their managerial levels, thereby enabling creativity, innovation, and sound decision-making that contribute to organizational growth and effectiveness.

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