

The Effect of Big Data on Operational Performance A Study On Commercial Banks in Egypt

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Abstract

The objective of the research is to examine the impact of Big Data (BD) on Operational Performance (OP). The research population consists of all employees at Commercial banks in Egypt. The researcher adopted a sampling method to collect data for the study. The appropriate statistical methods such as Alpha Correlation Coefficient (ACC), Confirmatory Factor Analysis (CFA), Multiple Regression Analysis (MRA), were used to analyze the data and test the hypotheses.

The research has reached a number of results, the most important of which are (1) organizations do not rely on business intelligence applications and technologies as a repository of data and immediate analytical processing, (2) the organizations operate in a competitive framework, represented by other organizations operating in the Egyptian environment, which makes the organization's environment suitable for using business intelligence and competitive intelligence applications, (3) the low level of the organizations 'infrastructure to deal with the field of software that supports business intelligence. Perhaps this is due to the organizations' tendency to deal with technologies that work to accomplish the traditional activities of the organization, (4) the interest in business intelligence was limited to certain aspects, the most important of which is the use of business intelligence in reviewing and completing operations within the organization, while the lesser concerns were related to various aspects, the most important of which is cooperation with individuals inside and outside the organization, and the search for new knowledge, and allowing individuals to learn in multiple locations, (5) attention has been focused on the practice of business intelligence in specific aspects, the most important of which is the focus on ensuring that workers in the organization understand the importance of business intelligence for the success of the organization and considering this concept as part of the organization's culture.

The study referred to a number of recommendations, the most important of which are (1) the necessity of attracting workers with experience and skill in dealing with business intelligence techniques, as well as the possibility of developing workers in the technical field by directing them to participate in training courses in this field, (2) the use of the data warehouse as the most prominent techniques that provide analytical information through which administrative decisions are made, in addition to the analytical and immediate processing of the data and presenting it in an appropriate manner, (3) the necessity of integrating business intelligence techniques in a manner that achieves the highest level of efficiency in exploiting and analyzing data, in order to achieve the highest level of decisions in light of the use of cost-benefit analysis, (4) identify the applications of business intelligence in organizations operating in the same field in order to benefit from them and achieve the highest levels of benefit in this field, (5) the need to pay attention to amending the services provided by banks to their customers, with the aim of making use of business intelligence systems in developing the performance of employees, which leads to the survival, growth, and distinction of the banking sector while it is in the process of providing services to its customers, (6) the necessity to invest in all available resources in a manner that meets the needs and desires of customers on a daily basis, and to work on increasing and diversifying the services provided.

Keywords: Big Data, Operational Performance, Commercial Banks

1. Introduction

Organizations follow different strategies in order to be competitive, and the competitive advantage of the organization can be achieved through interest in BD analysis and business intelligence (Marin-Ortega, et al, 2014).

BD is not new, and the main reason for creating a data warehouse in the 1990s was to store a large amount of data (Watson, 2014).

Data volumes began to rise during the first years of the year 2000, and BD has become a technical problem for organizations, as well as those working in the field of information systems, in terms of storage.

Therefore, companies have shifted from being unable to manage BD to collecting and analyzing that data (Russom, 2011).

BD has become a topic of interest in multiple fields such as information systems, management, and the social sciences in general (Constantin & Kallinikos, 2015).

The phenomenon of interest in BD is due to the widespread spread of social media, mobile devices, wireless investment networks, information systems integration, and the Internet of things. BD is one of the technologies that make up the concept of digital transformation (Schwertner, 2017).

BD is also considered one of the technologies that underpin the concept of the Fourth Industrial Revolution (Tortorella et al, 2018). It is also considered one of the basic components of Big Science (Delic & Riley, 2015).

Operations is a set of activities associated with the production process through the transformation of inputs and passing them through a processing process to convert them into outputs in the form of products or services useful to the consumer (Matthias et al, 2017, Slack et al, 2013).

Operational management is an administrative function that involves managing people, equipment, technology, information, and all other resources needed to produce goods and services. Operational management is the primary function of every organization (Stevenson, 2014).

Operational management is also a source of competitive advantage and profit generation (Abker et al, 2018).

The importance of operational management is to familiarize customers with the organization's products, to draw the characteristics of the products, to achieve high quality of goods and services in light of the customer's requirements, and to achieve the goals of the organization efficiently and effectively (Kobbacy et al, 2007).

2. Literature Review

2.1. Big Data

2.1.1. Big Data Concept

BD is a technology direction based on the massive analysis of data that cannot be processed or analyzed using traditional tools (Parra & Halgamuge, 2018).

BD plays an important role in the sustainable development program in order to achieve the goal of sustainable consumption and production. BD also positively affect the achievement of regulatory compatibility (Dubey et al., 2018).

BD is the collection, storage and analysis of a large amount of data in order to benefit from it in providing the organization with information resulting from it that helps in building wise decisions of real benefit. Investing in BD through proper organization and analysis contributes greatly to making appropriate decisions for the organization (Janssen et al., 2017).

BD is high-speed, variable, and complex data that requires advanced techniques to collect, store and distribute data for later use (Matthias et al, 2017).

BD concept came out in 2001 by Laney. He described BD as data that cannot be processed with traditional data management tools. In order for this BD to exist, it must have three characteristics which are volume, velocity, and variety. Three other characteristics have been added to BD which are validity i.e. data integrity veracity, value i.e. value data. Complexity is the degree of environmental linkage between the data structure and complexity. However, the first three are still the most important characteristics of BD (Wang et al., 2016).

BD is a recent terminology that has emerged as a recent trend in describing the massive flow of data. It is noted that we all produce a very large amount of digital data daily. This data that is produced through the internet, and all the devices and tools that we deal with are recorded and stored in the various applications and programs available (Power, 2016).

BD is one that is characterized by speed, diversity, size, honesty, and value within a production or service organization (Akter, et al, 2016).

BD refers to the large and varied data that can be collected, managed and utilized in an efficient and effective manner (George et al, 2016).

BD are different sets of data that are heterogeneous, independent, and varied in dimensions, relationships, and volumes in a manner that makes it difficult for traditional tools to store, manage, analyze and exploit them effectively (Sun et al, 2015).

BD is a problem for many organizations in many fields and disciplines, and given that processing current data does not help in making use of BD. The main reason for organizations to process and analyze BD is to reduce organizational and technological risks and generate profits, in the light of the fact that organizing and analyzing data will help in reaching useful parameters that help in making the right decisions and ensuring a strong future for the organization (Bohdan, 2015).

BD refers to three types. They are traditional data, data produced by devices, and social media data (Opresnik & Taisch, 2015).

BD are information assets that are characterized by size, speed, and diversity that require the use of advanced technology to convert it into a value that can be used in decision-making (De-Mauro et al, 2015).

BD has become an issue of concern to many researchers and decision makers in government sectors and companies. There is a very large acceleration in the growth of information. Also, BD has caused great troubles for humans, and it includes many untapped treasures. In addition to that BD stores many potential, useful and valuable benefits (Chen & Zhang, 2014).

BD is large-scale data with diverse sources that cannot be addressed by traditional methods and that aims to solve organizational or societal problems (Kamioka & Tapanainen, 2014).

BD is that data that is referred to as huge because of its size, the speed at which it arrives, and the various forms in which it is (Watson, 2014).

BD is made up of a large body of data, updated quickly and frequently, and takes a wide range of different forms (Davis, 2014).

BD are data sets of sizes that exceed the ability of regular software tools to capture, organize, manage and process them within a limited period of time (Bharadwaj et al, 2013).

BD is a combination of size, diversity, speed and accuracy capable of creating opportunities for the organization by imposing a competitive advantage in the digital world (Schroeck et al, 2012).

BD is the high-volume and high-speed data that requires new forms of processing to improve decision-making (Beyer & Laney, 2012).

BD is one that focuses on data itself, data analytics, and presentation of analysis results that allow creating commercial value (Gantz & Reinsel, 2012).

2.1.2. Big Data Importance

Due to the complexity and breadth of BD scenarios, organizations need a lot of data and information to record and process in order to help make immediate and informed decisions based on the data analysis approach to business intelligence (Jayakrishnan et al., 2018).

BD analytics is the tool that will change business intelligence that relies on data analysis for objective decision-making (Fan et al., 2015).

BD analysis is about BD, and how to analyze it, with the goal of creating one of the most important trends in business intelligence (Russom, 2011).

Organizations that rely on various and sophisticated methods of extracting information from BD for business intelligence, with the aim of making better decisions (Jin & Kim, 2018). BD analysis is a form of sophisticated business intelligence (Panian, 2012).

2.1.3. Big Data Dimensions

The dimensions of BD are variety, velocity, volume, and BD analysis (Aydiner, et al., 2019; Shafique, et al., 2019; Matthias, et al., 2017; Johnson, et al., 2017; Balachandran & Prasad, 2017; Lee, 2017; Gunasekaran, et al., 2016; Jony, 2015).

2.1.3.1. Variety

Variety is one of the important dimensions of BD and this is due to the need to treat each data source in a different way, which leads to storing data for a long time, and variety refers to the diversity of analyzes that are performed on BD.

The variety of BD means that the data comes from different sources and therefore has different types such as data. The data consists of files such as audio, video, etc. This data is analyzed with various tools and methods.

2.1.3.2. Velocity

Velocity refers to the rate of growth and production of data, and velocity is a critical factor in making decisions based on this data. And because there is a variety of data sources, this leads to a speedy reception, which requires a system characterized by high velocity in analyzing BD.

Velocity refers to the high rate at which data is generated and received, and it also indicates the velocity of data analysis and examination.

2.1.3.3. Volume

Volume refers to the increasing amounts of data being collected due to the speed and variety in its internal and external sources.

Volume is the most important characteristic in analyzing BD, as there are no global standards for determining the size, speed and diversity of data, but size is usually measured at home.

2.1.3.4. Big Data Analysis

BD is one of the types of information systems resource in an organization. In general, data needs to implement an analytical process to gain value from BD in order to create new opportunities and solve real business problems.

Analyzing and interpreting BD by providing actionable descriptive, predictive, indicative and directive results that lead to creating value from data that can be used in making decisions in a more efficient and effective manner.

2.2. Operational Performance

2.2.1. Operational Performance Concept

OP is the outcome or result achieved due to operational capabilities (Tan et al, 2007).

OP is the work to improve the organization's response to a changing competitive environment (Flynn et al, 2010).

OP can be considered as either internal performance or process performance within the organization (Manikas & Terry, 2010)

OP plays a mediating role in developing financial performance and market performance (Garmaki et al, 2016)

OP drives and directs the performance of various financial operations in the organization (Kablan & Norton, 1992).

2.2.2. Operational Performance Dimensions

The dimensions of OP are flexibility, innovation, delivery, cost and quality (Charles & Omwenga, 2017; Al-Sa'di, et al., 2017; Collier & Evans, 2017; Abdallah, et al., 2016; Sangari & Razmi, 2015; Chae et al., 2014).

2.2.2.1. Flexibility

Flexibility is the ability of the operational management to adapt and respond quickly to the diversity or changes that occur in the characteristics of services design, or changes related to the volume of customer requests and the multiplicity of their desires. This requires a variety of operating features such as reduced costs, reduced service delivery time, improved quality, increased profits, and increased productivity (Chavez et al, 2015; Slack et al, 2013).

Flexibility refers to the ability to make rapid changes in service design or speed in introducing new services, or rapid changes in the size of service penetration (Hammer, 2018).

2.2.2.2. Innovation

Innovation is the development of new solutions in the form of a product, service, process or system in order to meet and provide the needs and desires of customers (Collier & Evans, 2017).

Innovation is a new way, a new idea, and a new product, that is, a change that creates a new dimension of performance (Slack et al, 2013).

Innovation is related to the design function in operations functions because innovation creates a new idea, and design makes it foolproof (Slack et al, 2013).

Innovation in the field of information such as BD because it has internal and external benefits that include lower production costs, increased profits, and faster delivery (Gunday et al., 2011; Boer & Durim, 2001; Damanpour, 2010).

2.2.2.3.Delivery

Express delivery, meaning delivery in a timely manner, according to agreed specifications, and given that distribution decisions are affected by transportation costs and delivery times. The popular method has become to outsource the delivery of services. Operational management focuses on delivery, which implies that the organization transforms inputs into outputs in an efficient manner (Stevenson, 2014).

The rapid delivery of services in a timely manner and with appropriate and agreed upon specifications contributes significantly to maintaining clients and thus increasing profits (Bento & Tontini, 2018).

2.2.2.4. Cost

Cost is doing things at a low cost, and producing goods at a cost that enables the organization to price them appropriately to the market, and achieve profits at the same time (Chavez et al, 2015).

Cost is a measure of performance, so organizations seek to reduce procurement costs, which affects cost reduction while preparing their services (Beamon, 1999).

Cost is the main goal of organizations that directly compete on price, and the lower the production cost, the lower the price for customers (Slack et al, 2013).

Cost is doing things at a low cost and producing services at a price that is appropriate to the market, which leads to increased production (Chavez et al., 2015).

2.2.2.5. Quality

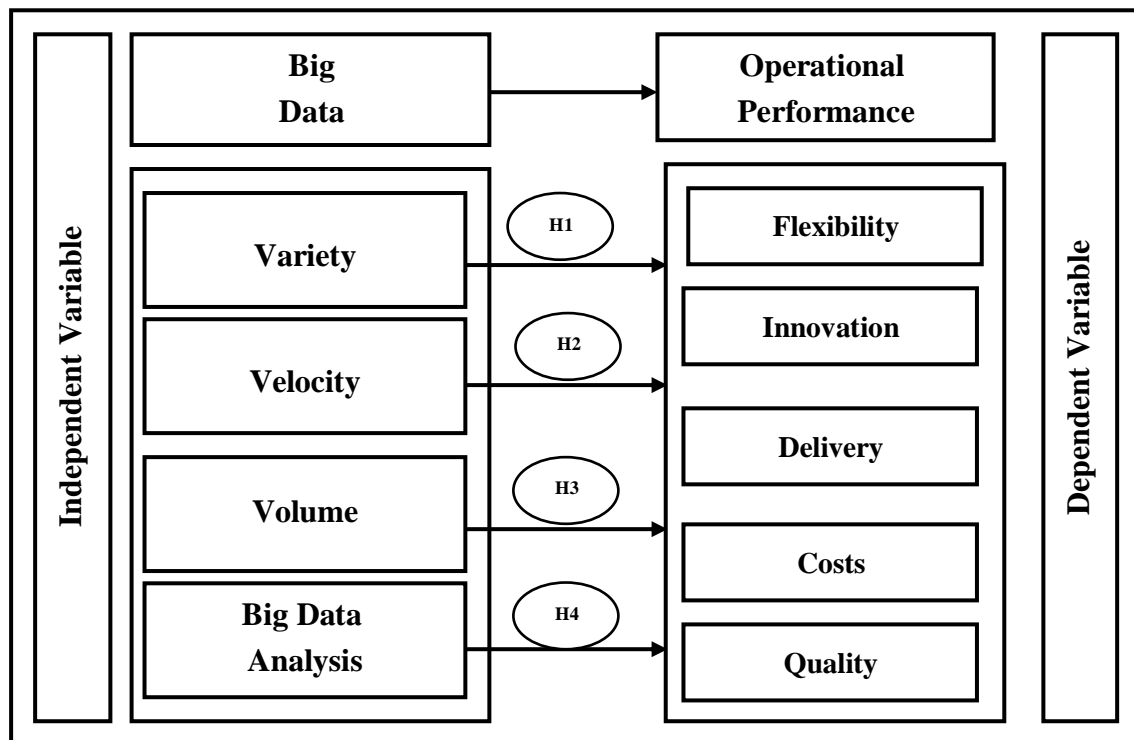
Quality is one of the modern management concepts that aim to continuously improve and develop performance by responding to customer desires (El-Tohamy & Al Raoush, 2015).

Quality means obtaining general acceptance of the service as perceived by the consumer or the end user. The general acceptance is influenced by the expectations of the consumer and therefore the organizations must exert their utmost energies in order to reduce the difference between the expectations of the customers and what is already there (Gentile et al, 2007).

Quality is the general acceptance of services as seen by the end user from his own point of view (Subramanian & Balaniabban, 2005).

3. Research Model

Figure (1) Proposed Comprehensive Conceptual Model



The diagram shows that there is one independent variable of BD. There is one dependent variable of OP. It shows the rational link among the two types of observed variables. The research framework suggests that BD have an impact on OP.

BD is measured in terms of variety, velocity, volume, and BD analysis (Aydiner, et al., 2019; Shafique, et al., 2019; Matthias, et al., 2017; Johnson, et al., 2017; Balachandran & Prasad, 2017; Lee, 2017; Gunasekaran, et al., 2016; Jony, 2015).

OP is measured in terms of flexibility, innovation, delivery, cost and quality (Charles & Omwenga, 2017; Al-Sa'di, et al., 2017; Collier & Evans, 2017; Abdallah, et al., 2016; Sangari & Razmi, 2015; Chae et al., 2014).

4. Research Questions

The research problem has two sources. The first source is to be found in previous studies. There is a lack in the number of literature review that dealt with the analysis of the relationship between BD and OP. This called for the researcher to test this relationship in the Egyptian environment.

According to the previous studies, there is a study aimed at identifying the direct impact of BD on decision-making. The study found that there is a positive effect of data quality on the quality of decisions. The study also indicated that data diagnosis positively affects the quality of decisions (Ghasemaghahi & Calic, 2019).

There is a study aimed at identifying the direct impact of BD analysis on supply chain performance. The study found that BD analysis positively affects supply chain performance. The study also indicated that an organization that relies on BD analysis leads to improved supply chain performance (Shafique et al, 2019).

There is a study aimed at identifying the effect of BD on organizational performance. The study found that the exploitation of BD positively affects the organizational performance. The study also indicated that the organization that analyzes BD needs sophisticated tools that can be used for the purpose of improving its organizational performance (Ghasemaghsei, 2018).

There is also another study aimed at identifying the impact of BD on the sustainability of the supply chain. The study found a significant relationship between BD and supply chain sustainability. The study also indicated that the organization that wants to achieve sustainability for the supply chain, it must focus on

analyzing BD through the availability of human capabilities and advanced tools in analyzing BD (Jeble, et al, 2018).

The second source is the pilot study, which was conducted an interview with (30) employees at commercial banks in Egypt to identify the dimensions of BD and OP. The researcher found through the pilot study several indicators notably the important role that could be played by BD in affecting OP at commercial banks in Egypt. The research questions of this study are as follows:

Q1: What is the relationship between BD (Variety) and BI at commercial banks in Egypt?

Q2: What is the nature of the relationship between BD (Velocity) and BI at commercial banks in Egypt?

Q3: What is the extent of the relationship between BD (Volume) and BI at commercial banks in Egypt?

Q4: What is the nature and extent of the relationship between BD (Big Data Analysis) and BI at commercial banks in Egypt?

5. Research Hypotheses

In the light of a review of previous studies, There is a study aimed at exploring the impact of BD analysis on supply chain flexibility. The study found that analyzing BD plays an important role in increasing supply chain flexibility. The study also indicated that BD analysis includes analysis of past performance data of suppliers, which leads to appropriate decision-making (Mandal, 2019).

There is also another study aimed at identifying the performance of decision-making in the era of BD. The study found that there is a significant relationship between individuals' decision-making performance and the ability to analyze BD. The study also indicated the mediating role of the business intelligence system between BD and decision-making within the organization (Trieu et al, 2018).

There is a study aimed at identifying the impact of BD analysis on areas of operational management. The study concluded that BD contribute to enhancing operational performance. The study also indicated that there are opportunities to achieve the competitive advantage of the organization through the application of smart systems (Mathhias et al, 2017).

There is also another study aimed at evaluating the impact of BD on the performance of business organizations. The study found that BD provides great potential for organizations in terms of developing their products and improving their operations, and analyzing BD leads to saving operational costs and taking appropriate decisions, which leads to the quality of products and services (Lee, 2017).

The following hypotheses were developed to decide if there is a significant correlation between BD and OP.

H1: There is no statistically significant relationship between BD (Variety) and OP at commercial banks in Egypt.

H2: BD (Velocity) has no statistically significant effect on OP at commercial banks in Egypt.

H3: There is no relationship between BD (Volume) and OP at commercial banks in Egypt.

H4: BD (Big Data Analysis) has no significant impact on OP at commercial banks in Egypt.

6. Research Population and Sample

The population of the study included all employees at commercial banks in Egypt. The total population is 66536 employees. Determination of respondent sample size was calculated using the formula (Daniel, 1999) as follows:

$$n = \frac{N \times (Z)^2 \times P(1-P)}{d^2(N-1) + (Z)^2 \times P(1-P)}$$

A number of samples, obtained by 382 employees at commercial banks in Egypt, are shown in Table (1).

Table (1) Distribution of the Sample Size

Bank Type	Number of Population	Percentage	Sample Size
1. General Commercial Banks	52564	79%	382X 79% = 302
2. Joint Commercial Banks	11977	18%	382 X 18% = 69
3. Foreign Branches of Banks	1995	3%	382 X 3% = 11
Total	66536	100%	382 X 100% = 382

Table (2) Frequency Distribution Table of Demographics

Demographic Variables		Number	Percentage
1- Job Title	General Manager	18	% 6
	Deputy General Manager	24	% 8
	Agent General Manager	15	% 5
	Deputy Manager	30	%10
	Controller	30	%10
	Excellent Banker	45	%15
	Banker A	57	%19
	Banker B	81	%27
Total		300	100%
2- Marital Status	Married	195	% 65
	Single	105	% 35
	Total	300	100%
3- Age	Less than 30 years	105	% 35
	From 30 to 45	135	% 45
	More than 45	60	% 20
	Total	300	100%
4- Educational Level	University Education	135	%45
	Post Graduate Studies	165	%55
	Total	300	100%
5- Period of Experience	Less than 5 years	65	%20
	From 5 to 10	210	%70
	More than 10	50	%10
	Total	300	100%

7. Procedure

The goal of this study was to identify the significant role of BD in affecting OP. A survey research method was used to collect data. The questionnaire included three questions, relating to BD, OP, and biographical information of employees at commercial banks in Egypt. About 382 survey questionnaires were distributed. Multiple follow-ups yielded 300 statistically usable questionnaires. Survey responses were 78%.

8. Research Variables and Methods of Measuring

The 20-item scale BD section is based on Aydiner, et al., 2019; Shafique, et al., 2019; Matthias, et al., 2017; Johnson, et al., 2017; Balachandran & Prasad, 2017; Lee, 2017; Gunasekaran, et al., 2016; Jony, 2015. There were five items measuring variety, five items measuring velocity, five items measuring volume, and five items measuring big data analysis.

The 25-item scale OP section is based on Charles & Omwenga, 2017; Al-Sa'di, et al., 2017; Collier & Evans, 2017; Abdallah, et al., 2016; Sangari & Razmi, 2015; Chae et al., 2014. There were five items measuring flexibility, five items measuring innovation, five items measuring delivery, five items measuring cost and five items measuring quality.

Responses to all items scales were anchored on a five (5) point Likert scale for each statement which ranges from (5) “full agreement,” to (1) for “full disagreement”.

9. Data Analysis and Hypotheses Testing

9.1. Coding of Variables

The research consists of two main variables. The first is BD (independent variable). The second is OP (dependent variable). Description and measuring of the research variables is presented in Table (3) as follows:

Table (3) Description and Measuring of the Research Variables

Main Variables		Sub-Variables	Number of Statement	Methods of Measuring Variables
Indep endent Variab	Big Data	Variety	5	Aydiner, et al., 2019; Shafique, et al., 2019; Matthias, et al., 2017; Johnson, et al., 2017; Balachandran & Prasad, 2017;
		Velocity	5	
		Volume	5	

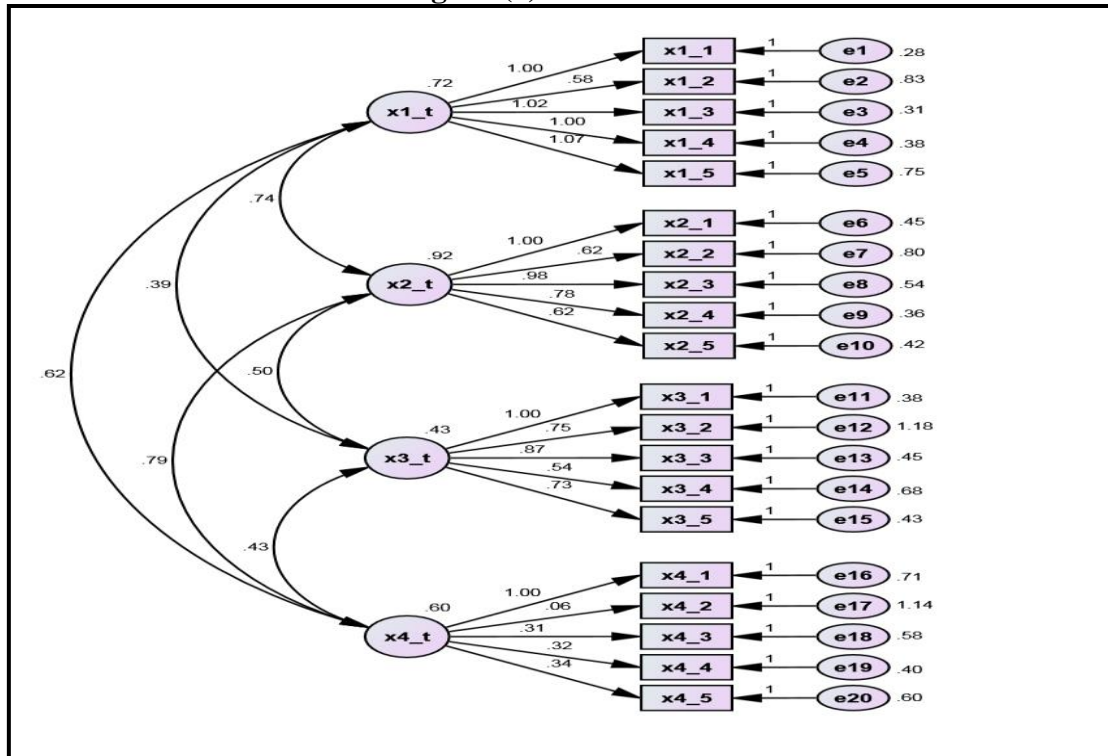
		BD Analysis	5	Lee, 2017; Gunasekaran, et al., 2016; Jony, 2015
Total BD			20	
Dependent Variable	Operational Performance	Flexibility	5	Charles & Omwenga, 2017; Al-Sa'di, et al., 2017; Collier & Evans, 2017; Abdallah, et al., 2016; Sangari & Razmi, 2015; Chae et al., 2014
		Innovation	5	
		Delivery	5	
		Cost	5	
		Quality	5	
Total OP			25	

9.2. Construct Validity

9.2.1. Big Data

The researcher used Confirmatory Factor Analysis (CFA) for BD. The total number of BD is 20 statement. This can be illustrated by the following figure:

Figure (2) CFA For BD



From the previous figure, it is clear that all the statement of BD are greater than 0.50, which corresponds to GFI. This is a good indicator of all other statistical analysis. The quality indicators for BD can be illustrated in the following table:

Table (4) Quality Indicators for BD Using AMOS Analysis

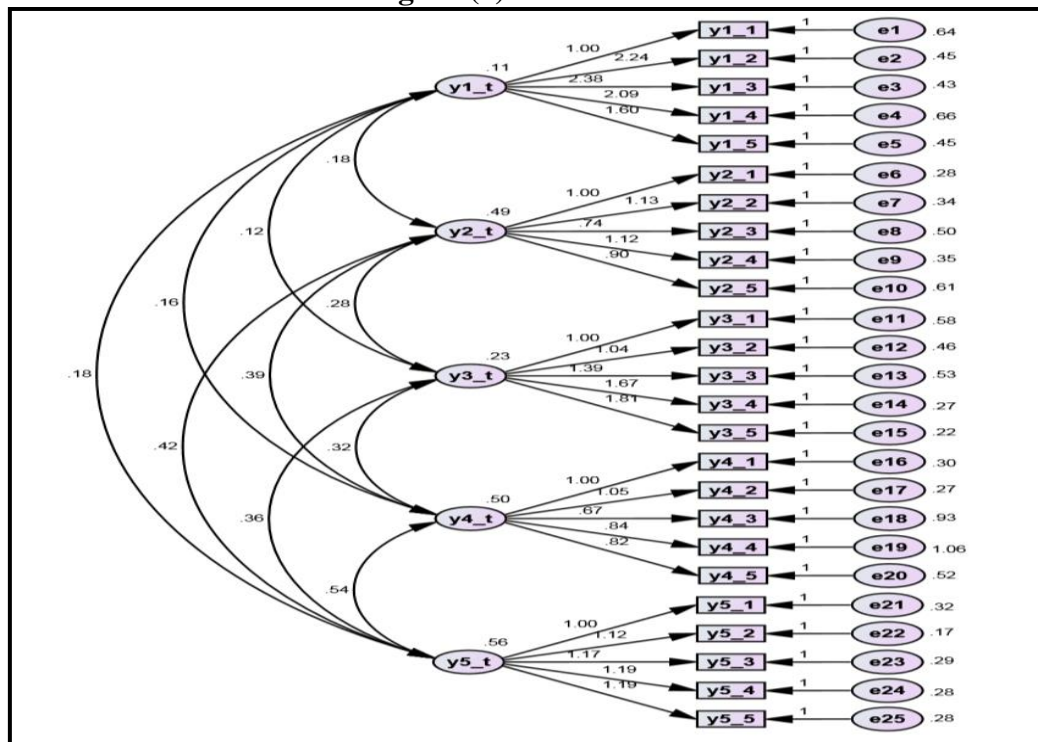
Test the Quality of the Model Acceptance Condition (Daire et al., 2008)	Test Value
X ² / Degree of freedom >5	1536.579
P. value > 0.5	0.000
Goodness of fit Index (GFI) > 0.90	0.614
Tuker-Lewis Index (TLI) > 0.95	0.519
Comparative Fit Index (CFI) > 0.90	0.638
Normed Fit Index (NFI) > 0.90	0.624
Incremental Fit Index (IFI) > 0.95	0.680
Relative Fit Index (RFI) > 0.90	0.621
Root Mean Square Residual (RMR) < 0.5	0.104
Root Mean Square Error of Approximation (RMSEA) < 0.5	0.142

In light of the above-mentioned indicators, it is clear that the previous indicators are good for making all other statistical analysis.

9.2.2. Operational Performance

The researcher used CFA for OP which consists of three dimensions. This can be illustrated by the following figure:

Figure (3) CFA For OP



According to Figure (2), it is clear that all the statement of OP are greater than 0.50. This is a good indicator of all other statistical analysis. The quality indicators for OP can be illustrated in the following table:

Table (5) Quality Indicators for OP Using AMOS Analysis

Test the Quality of the Model Acceptance Condition (Daire et al., 2008)	Test Value
X ² / Degree of freedom < 5	2247.8
P. value > 0.5	0.000
Goodness of fit Index (GFI) > 0.90	0.665
Tuker-Lewis Index (TLI) > 0.95	0.655
Comparative Fit Index (CFI) > 0.95	0.696
Normed Fit Index (NFI) > 0.90	0.670
Incremental Fit Index (IFI) > 0.95	0.697
Relative Fit Index (RFI) > 0.90	0.627
Root Mean Square Residual (RMR) < 0.5	0.074
Root Mean Square Error of Approximation (RMSEA) < 0.5	0.158

In light of the above-mentioned indicators, it is clear that the previous indicators are good for making all other statistical analysis.

9.3. Descriptive Analysis

Table (6) shows the mean and standard deviations of BD and OP

Variables	The Dimension	Mean	Standard Deviation
Big Data	Variety	3.12	0.850
	Velocity	3.02	0.834
	Volume	3.08	0.620
	Big Data Analysis	4.16	0.539
	Total Measurement	3.34	0.601
Operational Performance	Flexibility	3.30	0.700
	Innovation	3.26	0.743
	Delivery	3.32	0.732
	Cost	3.10	0.733

	Quality	3.31	0.884
	Total Measurement	3.26	0.664

According to Table (6), most of the respondents identified the presence of variety (M=3.12, SD=0.850), velocity (M=3.02, SD=0.834), volume (M=3.08, SD=0.620), big data analysis (M=4.16, SD=0.539), and total BD (M=3.34, SD=0.601).

Regarding to OP, most of the respondents identified the flexibility (M=3.30, SD=0.700), innovation (M=3.26, SD=0.743), delivery (M=3.32, SD=0.732), cost (M=3.10, SD=0.733), quality (M=3.31, SD=0.884), and total OP (M=3.26, SD=0.664).

9.4. Evaluating Reliability

Table (7) presents the reliability of BD. The 20 items of BD are reliable because the ACC is 0.906. Variety, which consists of 5 items, is reliable because the ACC is 0.847. The 5 items related to velocity, are reliable because the ACC is 0.843 while the 5 items of volume are reliable because the ACC is 0.667. The 5 items related to BD analysis, are reliable because the ACC is 0.523. Thus, the internal consistency of BD can be acceptable.

Table (7) Reliability of BD and OP

Variables	Dimension	Number of Statement	ACC
Big Data	Variety	5	0.847
	Velocity	5	0.843
	Volume	5	0.667
	Big Data Analysis	5	0.523
	Total Measurement	20	0.906
Operational Performance	Flexibility	5	0.772
	Innovation	5	0.844
	Delivery	5	0.844
	Cost	5	0.782
	Quality	5	0.930
	Total Measurement	25	0.953

The 15 items of OP are reliable because the ACC is 0.953. Flexibility, which consists of 5 items, is reliable because the ACC is 0.772. The 5 items related to innovation are reliable because the ACC is 0.844. The 5 items related to delivery are reliable because the ACC is 0.844. Cost, which consists of 5 items, is reliable because the ACC is 0.782 whereas the 5 items related to quality are reliable because the ACC is 0.930. Thus, the internal consistency of OP can be acceptable.

9.5. The Means, St. Deviations and Correlation among Variables

Table (8) Means, Standard Deviations and Intercorrelations among Variables

Variables	Mean	Std. Deviation	BD	OP
Big Data	3.34	0.601	1	
Operational Performance	3.26	0.664	0.804**	1

Table (8) shows correlation coefficients between BD and OP. BD is (Mean=3.34; SD=0.601), while OP is (Mean=3.26; SD= 0.664). Also, the correlation between BD and BI is (R=0.804; P <0.01).

9.6. The Correlation between BD and OP

Table (9) Correlation Matrix between BD and OP

Research Variables	1	2	3	4	5
1. Variety	1				
2. Velocity	0.787**	1			
3. Volume	0.583**	0.615**	1		
4. Big Data Analysis	0.547**	0.593**	0.432**	1	
5. Operational Performance	0.733**	0.775**	0.632**	0.506**	1

Based on Table (9), correlation between BD (variety) and OP is 0.733 whereas BD (velocity) and OP shows correlation value of 0.775. Also, BD (volume) and OP is 0.632 whereas BD (BD analysis) shows correlation value of 0.506. The overall correlation between BD and OP is 0.804.

9.6.1. Big Data (Variety) and OP

Table (10) MRA Results for BD (Variety) and OP

Big Data (Variety)	Beta	R	R ²
1. Information systems in the organization have the ability to collect data from its various sources.	0.160*	0.648	0.419
2. Information systems in the organization have the ability to collect data in various forms.	0.068	0.281	0.078
3. The organization needs a variety of data sources to suit the nature of the tasks required of it.	0.262**	0.671	0.450
4. The organization seeks to obtain various data to be used in the analysis process.	0.280**	0.673	0.452
5. The organization resorts to the use of various tools in the process of analyzing various data.	0.226**	0.618	0.381
<ul style="list-style-type: none"> ▪ MCC ▪ DC ▪ Calculated F ▪ Degree of Freedom ▪ Indexed F ▪ Level of Significance 		0.767 0.589 84.160 5, 294 3.01 0.000	

As Table (10) proves, the MRA resulted in the R of 0.767 demonstrating that the 5 independent variables of BD (variety) construe OP significantly. Furthermore, the value of R², 5 independent variables of BD (variety) can explain 0.58% of the total factors in OP level. Hence, 42% are explained by the other factors. Therefore, there is enough empirical evidence to reject the null hypothesis that it said there is no relationship between BD (variety) and OP.

9.6.2. Big Data (Velocity) and OP

Table (11) MRA Results for BD (Velocity) and OP

Big Data (Velocity)	Beta	R	R ²
1. The organization creates its data quickly to suit the nature of its work.	0.369**	0.719	0.516
2. The information systems in the organization absorb the data that is generated at high speeds.	0.100*	0.453	0.205
3. The organization needs to sort the data quickly after obtaining it from its sources.	0.182**	0.659	0.434
4. The organization works to analyze the data available to it immediately and without delay.	0.253**	0.677	0.458
5. The time period that the organization needs to examine the data after its analysis is very short.	0.057	0.524	0.274
<ul style="list-style-type: none"> ▪ MCC ▪ DC ▪ Calculated F ▪ Degree of Freedom ▪ Indexed F ▪ Level of Significance 		0.795 0.631 100.665 5, 294 3.01 0.000	

As Table (11) proves, the MRA resulted in the R of 0.795. This means that BD has been significantly explained by the 5 independent variables of BD (velocity). As a result of the value of R², the five independent variables of BD justified 63% of the total factors in OP. So, there is enough empirical evidence to reject the null hypothesis that it said there is no relationship between BD (velocity) and OP.

9.6.3. Big Data (Volume) and OP

Table (12) MRA Results for BD (Volume) and OP

Big Data (Volume)	Beta	R	R ²
1. The organization needs to generate a large amount of data as a result of its daily operations.	0.269**	0.535	0.286
2. Information systems in the organization have the ability to deal with	0.161**	0.379	0.143

a large amount of data daily.			
3. The organization has the ability to discover data regardless of its size.	0.282**	0.543	0.294
4. The organization has the ability to analyze a large amount of data once it is obtained.	0.011	0.208	0.043
5. The organization has the ability to examine a large amount of data after its analysis.	0.199**	0.443	0.196
<ul style="list-style-type: none"> ▪ MCC ▪ DC ▪ Calculated F ▪ Degree of Freedom ▪ Indexed F ▪ Level of Significance 		0.666 0.444 46.952 5, 294 3.01 0.000	

As Table (12) proves, the MRA resulted in the R of 0.666 demonstrating that the 5 independent variables of BD (volume) construe OP significantly. Furthermore, the value of R², 5 independent variables of BD (volume) can explain 0.44% of the total factors in OP level. Hence, 56% are explained by the other factors. Therefore, there is enough empirical evidence to reject the null hypothesis that it said there is no relationship between BD (volume) and OP.

9.6.4. Big Data (BD Analysis) and OP

Table (13) MRA Results for Big Data (BD Analysis) and OP

Big Data (Big Data Analysis)	Beta	R	R²
1. After analyzing the data, the organization can identify work-related events.	0.680**	0.681	0.463
2. After analyzing the data, the organization can know the period of work-related events.	0.197**	0.061	0.003
3. After analyzing the data, the organization can know the details of work-related events.	0.002	0.252	0.063
4. After analyzing the data, the organization can predict future events or problems.	0.283**	0.320	0.102
5. After analyzing the data, the organization can identify what is the best solution for each problem.	0.075**	0.281	0.078
<ul style="list-style-type: none"> ▪ MCC ▪ DC ▪ Calculated F ▪ Degree of Freedom ▪ Indexed F ▪ Level of Significance 		0.766 0.587 83.711 5, 294 3.01 0.000	

As Table (13) proves, the MRA resulted in the R of 0. 766. This means that BD has been significantly explained by the 5 independent variables of BD (BD analysis). As a result of the value of R², the five independent variables of BD justified 58% of the total factors in OP. So, there is enough empirical evidence to reject the null hypothesis that it said there is no relationship between BD (BD analysis) and OP.

10. Research Results

By reviewing the results of testing the research hypothesis, the study reached a set of results which will be reviewed and discussed as follows:

1. Commercial banks in Egypt do not rely on business intelligence applications and technologies as a repository of data and immediate analytical processing. Perhaps this is due to the low knowledge of workers about these applications as one of the directions that beneficiaries must deal with.
2. Commercial banks in Egypt operate in a competitive framework, represented by other organizations operating in the Egyptian environment, which makes the organization's environment suitable for using business intelligence and competitive intelligence applications.
3. The low level of the Commercial banks in Egypt infrastructure to deal with the field of software that supports business intelligence. Perhaps this is due to the organizations' tendency to deal with technologies that work to accomplish the traditional activities of the organization.
4. The interest in business intelligence was limited to certain aspects, the most important of which is the use of business intelligence in reviewing and completing operations within the organization, while the

lesser concerns were related to various aspects, the most important of which is cooperation with individuals inside and outside the organization, and the search for new knowledge, and allowing individuals to learn in multiple locations. Perhaps this is due to the leaders' lack of interest in adopting business intelligence in the completion of activities and processes within the organization, in addition to the lack of technical personnel necessary to manage and operate business intelligence systems in the organization.

5. Attention has been focused on the practice of business intelligence in specific aspects, the most important of which is the focus on ensuring that workers in the organization understand the importance of business intelligence for the success of the organization and considering this concept as part of the organization's culture. Therefore, the organization focused on the need to support the top management in achieving the role of business intelligence in the success of the organization. As for the aspects that received a lesser level of attention, they were represented in the organization's management expecting a high level of participation in the development and exchange of experiences in the field of business intelligence.
6. The interest of Commercial banks in Egypt in the vital role played by BD technology and business intelligence in transforming data into information, which is the first step in knowledge management, as well as the extent of organizations' interest in all methods and procedures related to improving performance in the organization.
7. Commercial banks in Egypt use data from a variety of sources, and that is why organizations are keen to use BD technology to link their various data sources, store them, and facilitate the speed of their analysis, with the aim of studying them and making use of them in all the different work in the organization.
8. Commercial banks in Egypt adopt many data analyzes that help them in analyzing what happened in the past regarding customers in terms of their desires and needs, and predicting what will happen in the future.
9. The operational management in Commercial banks in Egypt seeks to improve the quality of the services they provide as a major factor in achieving customer satisfaction, as well as the desire to increase the size of their customers, which leads to a reduction in the cost of producing their services on the one hand, and the speed in delivering the service with the required specifications on the other hand.
10. There is a conviction from the operational management that business intelligence plays an important role in improving and developing the operational performance in the organization, in addition to the interest of the operational management in the necessity and importance of effective use of business intelligence in order to make the appropriate decision at the appropriate time.

11. Recommendations

In the light of the previous results, the researcher concluded with a set of recommendations summarized as follows:

1. The necessity of attracting workers with experience and skill in dealing with business intelligence techniques, as well as the possibility of developing workers in the technical field by directing them to participate in training courses in this field.
2. The use of the data warehouse as the most prominent techniques that provide analytical information through which administrative decisions are made, in addition to the analytical and immediate processing of the data and presenting it in an appropriate manner.
3. The necessity of integrating business intelligence techniques in a manner that achieves the highest level of efficiency in exploiting and analyzing data, in order to achieve the highest level of decisions in light of the use of cost-benefit analysis.
4. Identify the applications of business intelligence in Commercial banks in Egypt operating in the same field in order to benefit from them and achieve the highest levels of benefit in this field.
5. The need to pay attention to amending the services provided by banks to their customers, with the aim of making use of business intelligence systems in developing the performance of employees, which leads to the survival, growth, and distinction of the banking sector while it is in the process of providing services to its customers.

6. The necessity to invest in all available resources in a manner that meets the needs and desires of customers on a daily basis, and to work on increasing and diversifying the services provided.
7. Interest in designing flexible organizational structures with which the organization's management can respond to the increasing changes in the market on the one hand, and strengthening its position in the application of business intelligence systems on the other hand.
8. Work to form communication networks with academic institutions, whether universities, research centers or others, with the aim of getting acquainted with what is new in the field of business intelligence systems and benefiting from them.
9. Conducting more studies and research in the field of business intelligence and making use of it in developing, improving and diversifying the services provided by the organization.
10. The need for Commercial banks in Egypt to pay attention to employing business intelligence tools in building strategic information systems and activating their role in all different areas in the organization.
11. Benefiting from the experiences of developed Commercial banks in Egypt and countries in building and employing business intelligence tools and making use of available technologies, developing them and supporting them in a manner that leads to efficient and effective use of them.
12. The need for higher management in the Commercial banks in Egypt to pay attention to the mechanism of obtaining information from the various parties, so that this information is stored in the organization's storage warehouses after verification, collection and transfer so that the organization can use it well in all its decisions.
13. Increasing the interest of senior management in generating knowledge from employees and converting it into tacit knowledge, through which it is possible to achieve competitive excellence and excellence for the organization.
14. The need to pay attention to the causes of the decline in interest in the business intelligence system by strengthening the relationships between all existing information systems in the organization, and choosing modern technology in collecting information, in addition to working to exploit the implicit knowledge possessed by workers in the organization, which leads to building learning organization.
15. The necessity of investing the progress made between the business intelligence system in enhancing knowledge transfer processes on the basis that it is the main gateway to achieving the learning organization, by identifying the necessary resources for the development of the organization, and the optimal investment for the business intelligence system in knowledge acquisition and sharing among users in a manner that allows the organization to diversify Its informational resources.
16. Increasing attention to the need to build the technical capabilities of individuals working in the field of information technology, through specialized training courses that increase their capabilities and skills in the field of business intelligence technology.
17. The necessity and importance of spreading a culture of reliance on data among the organization's personnel in a manner that leads to the exploitation of the capabilities provided by both BD and business intelligence in improving the performance of all different operations of the organization.
18. The necessity of holding training courses and workshops at the level of the operational departments in the organization in order to identify the importance of data and business intelligence and their role in improving the operational performance of the organization.

12. Future Studies

The present study attempts to reveal the dimensions of BD and its impact on the dimensions of the OP, but the scope of this study, the methods used and its findings indicate that there are areas for other future studies.

Among these research areas are (1) the impact of BD on business intelligence in different sectors, (2) the effect of business intelligence on strategic intelligence, (3) the impact of business intelligence on organizational excellence, (4) the impact of business intelligence on strategic success, (5) the impact of business intelligence on organizational prowess, (6) the role of BD and business intelligence in improving operational performance.

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