

The Role of Big Data and Business Intelligence in Enhancing Operational Performance: A Study on Telecommunication Sector in Egypt

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Abstract

The objective of the research is to examine the role of Big Data (BD) and Business Intelligence (BI) in enhancing Operational Performance (OP). The research population consists of all employees at Telecommunication sector 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 BI 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 BI and competitive intelligence applications, (3) the low level of the organizations' infrastructure to deal with the field of software that supports BI. 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 BI was limited to certain aspects, the most important of which is the use of BI 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 BI in specific aspects, the most important of which is the focus on ensuring that workers in the organization understand the importance of BI 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 BI 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 BI 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 BI 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 BI 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: Role of Big Data, Business Intelligence, Operational Performance, Telecommunication Sector in Egypt

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 BI (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 allocating crisis budgets 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 (Constantion & 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).

The term BI appeared in 1958 when Hans Peter adopted the idea of building an automated system for disseminating information at the level of the organization (Luhn, 1958). However, the real interest in BI began in the late 1980s, as it was the beginning of the shift from focusing on reporting and information to managers to focusing more on situational analysis about how the organization has performed in the past, current performance, and future performance (Ionescu & Podaru, 2014).

Howard Dresner, Chief Executive Officer at Hyperion, is considered the father of the term BI in 1989, which he described as the concepts and methods that are used in the process of improving decision-making at work through the use of supportive systems based on facts (Evans, 2010).

The term BI has been used instead of decision support systems, executive information systems, and management information systems, and in some literature the term BI and analytics (Abai et al., 2016).

Reports indicate that investments in BI tools are expected to double at the service level (Tabbitt, 2013).

In the context of the decision support environment, BI systems have improved the effectiveness of decision-making at different levels in various areas, including the industrial sector in airlines, banking, insurance, finance, securities, manufacturing, and communications (Propovic et al., 2012, Ramakrishnan et al., 2012).

Although many organizations have successfully implemented BI systems in organizational decision-making, decision-making and performance, some organizations have not achieved this (Henshen, 2008).

Researchers have viewed BI from different perspectives, with some researchers studying BI as a tool from a technical perspective (Elbashir, et al., 2008), while others have viewed BI as an approach or a means to support decision-making (Moss & Atre, 2007).

The effectiveness of BI lies in its ability to support the decision-making process within the organization and to provide decision-makers with appropriate and timely information (Massa & Testa, 2005).

Most organizations are striving to understand the increasing diversity, speed, and volume of data that is being produced from internal and external sources. The importance and role of BI in understanding the huge volume of data and helping organizations improve their performance appears (Isik et al., 2013).

A critical component of an organization's success is its ability to make use of all available information (Cody et al., 2002). The ability to collect and analyze data and turn it into information that can be used in a timely manner is not only a necessity for success, but also a necessity for survival (Pirttimaki et al., 2006).

Investing in BI has a high priority in all organizations worldwide (Gartner, 2016), and its global market is expected to reach 22.8 billion dollars in 2020 (Ghosh, 2018).

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 dimensions and characteristics of the products, to achieve high quality of goods and services in light of the customer's requirements, and finally 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 high-speed, variable, and complex data that requires advanced techniques to collect, store and distribute data for later use (Matthias et al, 2017).

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 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 concept came out in 2001 by Laney. He described BD as data that cannot be processed with traditional data management tools. For BD, it must have three characteristics which are volume, velocity, and variety. Three other characteristics have been added to BD which are validity and 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 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 (Schroech 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 BI (Jayakrishnan et al., 2018).

BD analytics is the tool that will change BI 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 BI (Russom, 2011).

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

2.2.1. Business Intelligence Concept

The concepts presented by researchers regarding the term BI have varied and varied, depending on the scientific background or the viewpoint through which this concept is viewed.

Intelligence is the mental energy that we apply to our prior knowledge in order to generate ideas, discover relationships between things, draw conclusions, and solve problems. Intelligence has transferred to organizations and their actions, and organizations have turned to BI or the use of information systems to collect and analyze information from internal and external sources in order to make efficient and effective decisions (Chen, 2016).

BI is the leveraging of software and services to transform data into actionable vision and support strategic and tactical business decisions of the organization (Pratt & Fruhlinger, 2019).

BI is a term that encompasses analytical applications and infrastructure, as well as best practices in creating benefit (Gartner, 2019).

BI is the technologies, applications, and practices for collecting, integrating, analyzing and presenting business information to support better and faster decision-making (Balachandran & Prasad, 2017)

BI is an umbrella term that includes a variety of information technology applications that are used in analyzing the organization's data and communicating it to users (Maheshwari, 2015).

BI is the use of analytical methods with the purpose of using them both now and in the past to predict the future (Alawin & Mayteh, 2014).

BI is a set of technological tools and processes that help convert data into information, information into knowledge, and knowledge transfer to help the organization's strategy for planning and facing competitors (Loshin, 2013).

BI is a set of technologies that help to discover the best data from the huge amount of data to improve the production process (Naraina, 2013).

BI is the process of transforming raw data into useful information in order to create strategic and operational vision on the one hand, and decision-making on the other hand, with the aim of achieving real business benefits (Duan & Xu, 2012).

BI is a set of tools and techniques that help convert a large amount of data from different sources into meaningful information to support decision-making and improve organizational performance (Ramakrishnan et al., 2012).

BI is the computer-based technologies used in identifying, extracting and analyzing business data and using it in making various decisions in an organization with the aim of improving its performance (Kumar, 2012).

BI is the use of technology in the process of retrieving, extracting and analyzing the organization's data in order to produce concise and meaningful information to support decision-making, and this type of intelligence is usually presented in the form of a written report, summary or presentation with diagrams (Barbieri, 2012).

BI is the core of the organization's system, which is based on a series of strategic and tactical steps implemented by technology in terms of providing data and producing analytical results to generate an efficient and effective decision-making process in the business sector, at a time when many organizations seek to explore the vast amount of data. (Karim, 2011).

BI is a term that includes tools, databases, data warehouses, and performance management, all of which are combined into a unified software package (Turban & Volonino, 2011).

BI is a set of processes, tools, and technologies that deal with data and turn it into information, and information into knowledge, and this accumulated experience, as well as the accumulated knowledge, are transformed into sections that are managed intelligently and used in decision-making, building appropriate strategies and tactics (Turban et al., 2011).

BI is a process that focuses on supporting a variety of business functions, and using advanced analytics to create real benefit (Glancy & Yadav, 2011).

BI is a group of programs that collect and analyze data in order to assist workers in the field of making decisions efficiently and effectively (Chaudhuri et al., 2011).

BI is the approach followed by the management of an organization that allows identifying useful information relevant to its decisions (Lloyd, 2011).

BI is a set of tools and practices that help managers and users control business activities, improve organization performance and maintain competitiveness (Matei, 2010).

BI is the use of technologies, applications, and processes to collect, store and analyze data with the purpose of helping its users reach appropriate decisions (Wixom & Watson, 2010)

The steps in analyzing BI systems are to process data with the aim of producing the necessary information for its users. These steps are data collection, data storage, information dissemination and use of information (Kaplan & Norton, 2010).

BI is a set of perceptions, methods, and processes to improve managerial decisions, use information from multiple sources, and apply experiences to develop a correct understanding of business dynamics (Tabatabaei, 2010).

BI is an integrated set of tools, technologies and software used to discover, simplify and analyze information from various sources (Yeoh & Koronios, 2009).

BI is a large group of application programs that are used in data collection, analysis, and storage with the purpose of assisting business practitioners in making better decisions (Watson, 2009).

BI is a set of data repositories related to customers, competitors, the competitive environment and internal processes of the organization, which gives the organization the ability to make decisions efficiently and effectively (Dayal et al., 2009).

BI is a technological method that is used in business management to manage data in order to make better decisions (Rubio et al., 2008).

BI is a description of the applications that are used to collect, analyze and provide data and information in the organization for the purpose of making business decisions in the best possible way (Wu et al., 2007).

BI is the process of properly collecting the right information in the right way and at the right time and delivering the right results to the right people for the purpose of making appropriate decisions (Xu & Kaycl, 2007).

BI is a package of new technologies such as data warehouse, real-time analytical processor, and data search that are used in structured data processing and analysis (Haag et al., 2007).

BI is the umbrella that brings together the architecture, tools, database, analytical tools, applications, and methodologies (Turban et al., 2007).

BI is a set of tools and methods that improve executive decision-making, business activities, and increase value in an organization (Zeng et al., 2006).

BI is all that is related to obtaining, accessing, understanding, analyzing and converting one of the basic and valuable assets of the organization, which is raw data into effective information for the improvement of business and decision-making process in the organization (Azvine et al., 2006).

BI is a management philosophy and an essential tool that helps organizations manage and improve information in order to make more effective decisions (Lonnqvist & Pirttimaki, 2006).

BI is a set of approaches and processes by which raw information is converted into final information that is used in support of strategic, tactical and operational plans in a manner that leads to improved decision-making (Kimball et al., 2005).

BI is a set of software used to rationalize decisions within an organization and increase its effectiveness. This is in addition to providing the latest information on the various commercial actors (Pirttimaki, 2004).

BI is a set of analytical tools used to understand the capabilities available to the organization, trends in the market, technology used in the environment and the work of competitors, with the aim of providing the necessary information to planners and decision-makers within the organization, with the aim of converting information into a competitive advantage for the organization (Negash, 2004).

BI is a group of processes that convert data into information, as well as convert information into knowledge (Golfarelli et al., 2004).

BI is an information system that allows users to look at data in databases easily and quickly (Turban, 2002).

BI is a purposeful analytical process to collect and accurately analyze information about competitors, markets, and customers to support business decisions or convert data, information and knowledge into actionable value (Kalakota & Robinson, 2000).

2.2.2. Business Intelligence Importance

BI analyzes help to discover important trends, identify the opportunities that can be exploited, as well as the threats that must be faced, and BI helps shape strategic intelligence analyzes (Fleisher & Bensoussan, 2007).

The benefits of BI are tangible and intangible, and that is why companies invest in it in the hope of a quantum leap in the future (Negash, 2004).

The tangible benefits of BI are to reduce the overall infrastructure costs in the organization by eliminating the data extraction processes that are widespread in the organization that may contain duplicate data. Accessing data from multiple sources in a centralized, single format (Watson & Wixom, 2007).

BI plays an important role in improving organizational performance (Trieu, 2018). It also contributes to improving the operational efficiency of operations, raising the dynamic capabilities necessary to innovate new products or services, enhancing organizational intelligence, and the dynamic organizational structure (Moreno et al., 2018).

BI also helps in making appropriate strategic and operational decisions since it eliminates the method of guessing, in addition to that BI provides more accurate data on various business aspects such as financial data, production, and customers, which helps management in making decisions that are based on reality. It is not just a guess (Moreno et al., 2018).

2.2.3. Business Intelligence Dimensions

There are three dimensions of BI. They are technology, people, and strategic alignment (Torres et al., 2018; Knabke & Olbrich, 2017; Yeoh & Popovič, 2015; Sangari & Razmi 2015; Cosic et al., 2012).

2.2.3.1. Technology

Technology refers to the technological components of a BI system, and includes extracting accurate data from various process systems to be integrated into the data ware house, and using interactive reporting technology to address structural problems.

In addition to that, the use of data mining technology to deal with non-structural problems, and display information according to the user's request for the system, in addition to the necessity of integrating the BI system with other information systems.

BI technology includes data quality from its sources, information query, report generation, data visualization functions, and knowledge discovery by extracting variable information from data in databases (Yeoh & Koronios, 2010). A set of basic elements of technology must be taken into account in the sense that it is one of the basic dimensions of BI and these elements are data quality, reporting and visualization technology, discovery baseness analytic technology, user access, integration with other systems, Systems Integration (Torres et al., 2018).

2.2.3.2. People

The management role is concerned with the necessary support, the skills of the BI team, and the skills of the system user. Individuals include everything related to those related to BI systems, such as senior management, its team, and its users in terms of their predominant technical, managerial and cultural capacity that governs their actions and decisions (Mungree et al., 2013).

There is a set of basic elements for individuals in the sense that it is one of the basic dimensions of BI. These elements are to support the upper management, the team and its skills, the system user and the skills of (Yeoh, & Koronios, 2010).

2.2.3.3. Strategic Alignment

Strategic alignment means undertaking the necessary restructuring to align applications and uses of BI with the objectives of strategic operations in order to support and enhance the operational processes (Watson & Wixom, 2007).

Strategic alignment is the foundation in the governance of information systems, which requires alignment of BI, and business strategy must be aligned with strategies and plans of information technology with strategic business objectives so that information technology provides the ability to provide business value and create a clear vision of BI (Wilkin & Chenhall, 2010).

Strategic alignment means that BI strategies and plans are aligned with the objectives of operations management (Luftman, 2000).

2.3. Operational Performance

2.3.1. 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).

2.3.2. Operational Performance Dimensions

There are five dimensions of OP. They 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).

2.3.2.1. Flexibility

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).

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).

2.3.2.2. 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. 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 & DURING, 2001; Damanpour, 2010).

2.3.2.3. 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).

2.3.2.4. 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).

2.3.2.5. Quality

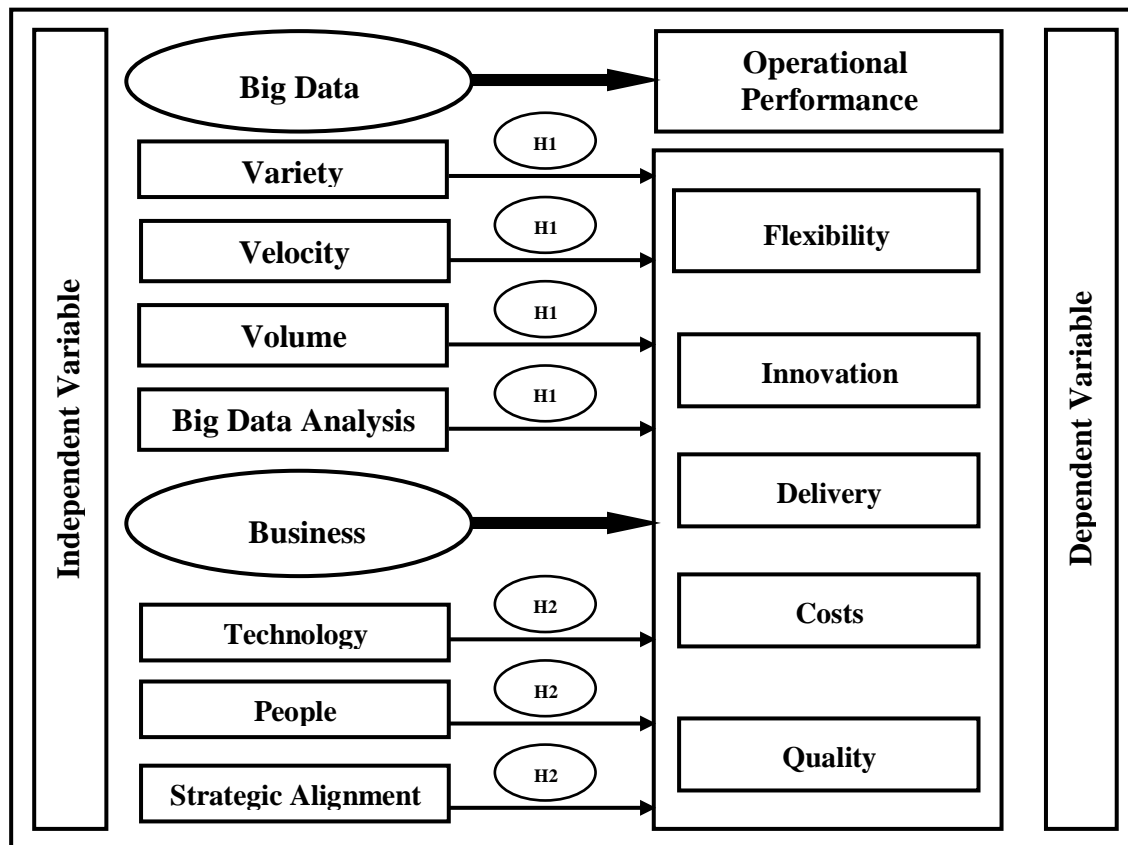
Quality is one of the modern management concepts that aim to continuously improve and develop performance by responding to customer desires (El-Tohamy & Al Raoush, 2015).

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 are two independent variable of BD and BI. There is one dependent variable of OP. The research framework suggests that BD and BI has 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).

BI is measured in terms of technology, people, and strategic alignment (Torres et al., 2018; Knabke & Olbrich, 2017; Yeoh & Popovič, 2015; Sangari & Razmi 2015; Cosic et al., 2012).

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 BI. This called for the researcher to test this relationship in the Egyptian environment.

In light of the review of previous studies towards BD, there is another 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 (Ghasemaghaei & 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).

As for the BI, there is a study aimed at identifying the effect of BI on BI capabilities. The study found that there is a significant relationship between the experience of BI employees and the capabilities of BI. The study also indicated that BI can be considered a strategic investment in improving the performance of the organization (Torres et al, 2018).

There is a study that aimed to implement the service oriented BI (SOBI) to integrate academic and financial data in the data warehouse, and to develop the data warehouse using the Galaxy system and implement it using the structural query language server. The study found that when implementing the BI-oriented service (SOBI), therefore, Dashboard applications that work to manage the data integration process must be performed, and data integration is usually done on the BI-oriented service with the help of the Web Service by building a provider. The service at the data source site and the service applicant on the Dashboard applications so that the service provider can be called by the dashboard application to perform the data retrieval process and transfer it to the data warehouse (Somya, 2018).

There is also another study aimed at identifying the effect of BI on artistic creativity. The study found a relationship between the BI dimensions represented in data storage, data mining, and immediate analytical processing on technical creativity in the organization (Irtaimeh et al, 2016).

There is a study aimed at identifying the impact of BI on managing organizational performance. The study concluded that BI is considered a basic necessity to assist decision makers in a way that leads to improving organizational performance.

The study also indicated that designing a good BI system is useful to ensure that the organization's performance management is done effectively and more dynamically (Yahaya et al, 2016).

There is a study aimed at identifying the way in which BI can help in knowledge management for employees. The study indicated that BI systems play an important role in achieving a competitive advantage for employees if they are able to employ and exploit BI tools such as data warehouse, data search, data analytical processing, and the process of reading, converting and writing data (Muhammad et al., 2014).

There is another study aimed at developing a framework of critical success factors in BI. The study found all the factors that are strongly and successfully linked to the application of BI, with the exception of the technological framework, and they classified these factors from most to least important which are senior management support, the executive sponsor, the clear vision, Managing change, user engagement, aligning

BI strategy with business goals, team skills, adequate resources, all of these factors lead to BI success (Mungree et al., 2013).

There is a study aimed at identifying the processes and methodologies that underlie business administration and the relationship between it and BI. The study found that managing and improving work performance is a prerequisite not only for increasing commercial profitability but also for staying in a competitive and fast-moving business environment (Yan & Xiangjun, 2010).

There is a study that aimed to know the BD analysis and BI. The study finds that the process of collecting, analyzing and applying BD through BI are inseparable and are not separated individually nor gradually. The study also indicated that the application of BI based on analysis of BD leads to appropriate decision-making (Jin & Kim, 2018).

There is a study aimed at identifying the performance of decision-making in the era of BD, in addition to the mediating role of BI systems. The study found that there is a significant relationship between the process of analyzing BD and taking appropriate decisions in productive and service organizations through the use of BI, which leads to improved organizational performance (Trieu et al, 2018).

Another study aims to identify a comprehensive view of BI and BD analysis in improving strategic performance. The study found that the use of BD analysis and BI is a characteristic - reaction framework in building a diagnostic mechanism for organizational strategic performance (Jayakrishhan et al, 2018).

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

Q1: What is the relationship between BD (Variety) and OP at Telecommunications sector in Egypt?

Q2: What is the nature of the relationship between BD (Velocity) and OP at Telecommunications sector in Egypt?

Q3: What is the extent of the relationship between BD (Volume) and OP at Telecommunications sector in Egypt?

Q4: What is the nature and extent of the relationship between BD (Big Data Analysis) and OP at Telecommunications sector in Egypt?

Q5: What is the relationship between BI (Technology) and OP at Telecommunications sector in Egypt?

Q6: What is the nature of the relationship between BI (People) and OP at Telecommunications sector in Egypt?

Q7: What is the extent of the relationship between BI (Strategic Alignment) and OP at Telecommunications sector in Egypt?

5. Research Hypotheses

In the light of a review of previous studies towards BD, 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 BI 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).

As for BI, there is a study aimed at identifying the effect of BI on the quality of decision-making. The study found that the existence of BI management has direct and indirect positive effects on data quality and information quality, and that all these factors affect the quality of managerial decision-making (Wieder & Ossimitz, 2015).

There is also another study aimed at identifying the effect of BI on the agile performance of the supply chain. The study concluded that there is a significant relationship between the different dimensions of BI in administrative efficiency, technical competence, cultural competence and the lean performance of the supply chain which is represented in customer satisfaction, productivity, Sales, delivery, cost, quality, and product development capability (Sangari & Razmi, 2015).

There is a study aimed at identifying the nature of the relationship between BI and knowledge management. The study concluded that BI systems play an important role as a tool for knowledge management for workers in the financial sector, and this is in addition to providing benefit to this sector, which is always characterized by the speed of change, as well as the huge size of Data used (Muhammed & et al., 2014).

There is also a study concerned with identifying the potential for BI to reduce the time allocated to decision-making in the organization. The study has found that the decision-making process necessarily leads to changes in the organizational behavior of all individuals working in the organization in a manner that leads to enhancing the quality of business decisions and their approach (Bara & Knezevic, 2013).

There is a study interested in learning about the role of BI in knowledge exchange. The study found that there is a significant impact of real-time analytical processing, data mining, and data warehouse on knowledge sharing. The results also indicated that BI tools had the greatest impact on sharing knowledge, and these tools are represented in the analytical processing of data, searching for it, and extracting it from all sources available to it (Barakat et al., 2013).

There is a study concerned with choosing the relationship between BI and information quality. The study found that the implementation of BI systems positively affects the quality of information, and the maturity of the BI system also affects the quality of the information content and the quality of the methods used (Popovic et al., 2009).

There is also a study aimed at identifying the challenges and benefits of using BD analytics for BI. The study found that the world of business is rapidly changing and faces many increasing pressures, which requires the necessity and importance of using BI in a way that leads to reducing costs and speeding up business performance, and achieving competitive advantage and quality of products and services (Balachandran & Prasad, 2017).

There is another study aimed at identifying BI and BD analytics on organizational performance management. The study found that there is an impact of BI and BD analysis on organizational performance management.

The study also indicated the necessity and importance of integrating BI and BD analysis in reaching appropriate decisions that seek to achieve an increase in the production and service aspects. The study also indicated that the integration of BI and BD analysis contributes to achieving the competitive advantage of the organization (Yahaya et al, 2016).

Another study aimed to identify the effects of BD analytics on BI. The study found that BD analytics offers many opportunities to enhance business value and productivity, and that the most important major applications of BD analytics in BI is to improve appropriate decision-making capabilities that meet customer desires and needs, and to develop strategies that lead to the launch of new products and services, new markets, reduce customer complaints, and enhance productivity for both workers and the organization (Ram et al, 2016).

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

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

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

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

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

H5: There is no statistically significant relationship between BI (Technology) and OP at Telecommunications sector in Egypt.

H6: BI (People) has no statistically significant effect on OP at Telecommunications sector in Egypt.

H7: There is no relationship between BI (Strategic Alignment) and OP at Telecommunications sector in Egypt.

6. Research Population and Sample

The population of the study included all employees at Telecommunications sector in Egypt. The total population is 56800 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 381 employees at Telecommunications sector in Egypt, are shown in Table (1).

Table (1) Distribution of the Sample Size

Telecommunication Sector In Egypt	Numbers	Percentage	Sample Size
1. Telecom Egypt	33000	58%	381X 58% = 221
2. Vodafone	7800	14%	381X 14% = 54
3. Orange	8000	14%	381X 14% = 53
4. Télécommunications	8000	14%	381X 14% = 53
Total	56800	100%	381X 100% = 381

Source: Personnel Department at Telecommunication Sector in Egypt, 2020

Table (2) Characteristics of Items of the Sample

Demographic Variables		Frequency	Percentage
1. Gender	Male	230	77%
	Female	70	23%
	Total	300	100%
2. Marital Status	Single	100	33%
	Married	200	67%
	Total	300	100%
3. Age	From 30 to 45	170	57%
	Above 45	130	43%
	Total	300	100%
4. Educational Level	University	220	73%
	Post Graduate	80	27%
	Total	300	100%
4. Period of Experience	From 5 to 10	190	63%
	More than 10	110	37%
	Total	300	100%

7. Procedure

The goal of this study was to identify the role of BD and BI in enhancing OP. A survey research method was used to collect data. The questionnaire included four questions, relating to BD, BI, OP, and biographical information of employees at Telecommunications sector in Egypt. About 381 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 data analysis.

The 15-item scale BI section is based on Torres et al., 2018; Knabke & Olbrich, 2017; Yeoh & Popovič, 2015; Sangari & Razmi 2015; Cosic et al., 2012. There were five items measuring technology, five items measuring people, and five items measuring strategic alignment.

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,” (4) for “agree,” (3) for “neutral,” (2) for “disagree,” and (1) for “full disagreement”.

9. Data Analysis and Hypotheses Testing

9.1. Coding of Variables

Table (3) Description and Measuring of the Research Variables

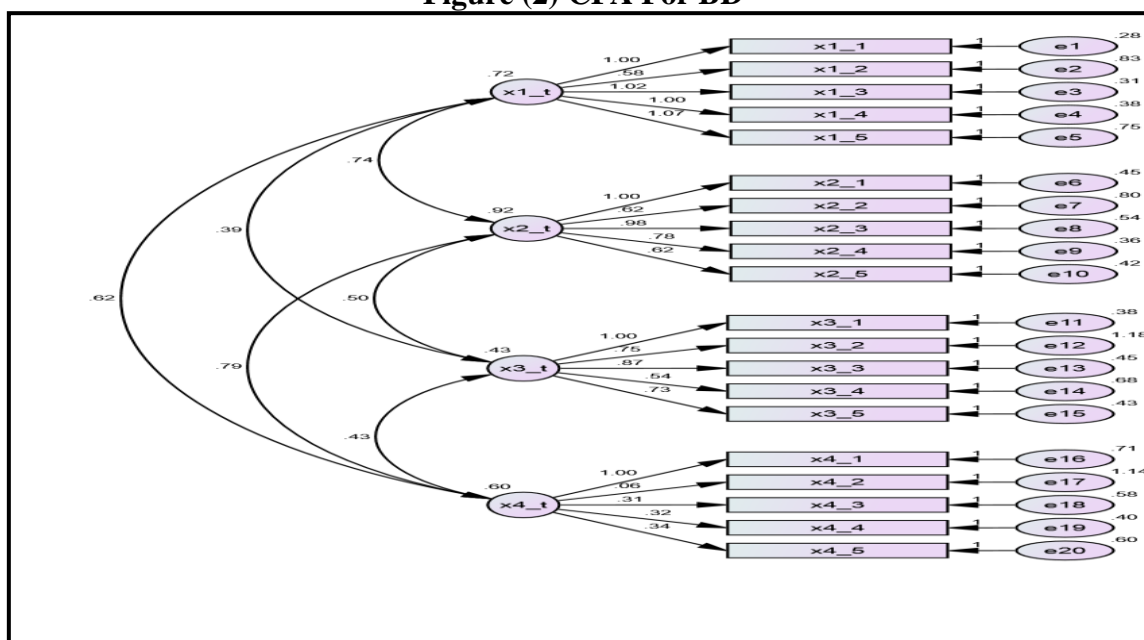
Main Variables		Sub-Variables	Number of Statement	Methods of Measuring Variables
Independent Variable	Big Data	Variety	5	Aydiner, et al., 2019; Shafique, et al., 2019; Matthias, et al., 2017; Johnson, et al., 2017; Balachandran & Prasad, 2017; Lee, 2017;
		Velocity	5	
		Volume	5	
		BD Analysis	5	
Total BD			20	
Independent Variable	Business Intelligence	Technology	5	Torres et al., 2018; Knabke & Olbrich, 2017; Yeoh & Popovič, 2015; Sangari & Razmi 2015; Cosic et al., 2012
		People	5	
		Strategic Alignment	5	
Total BI			15	
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. 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

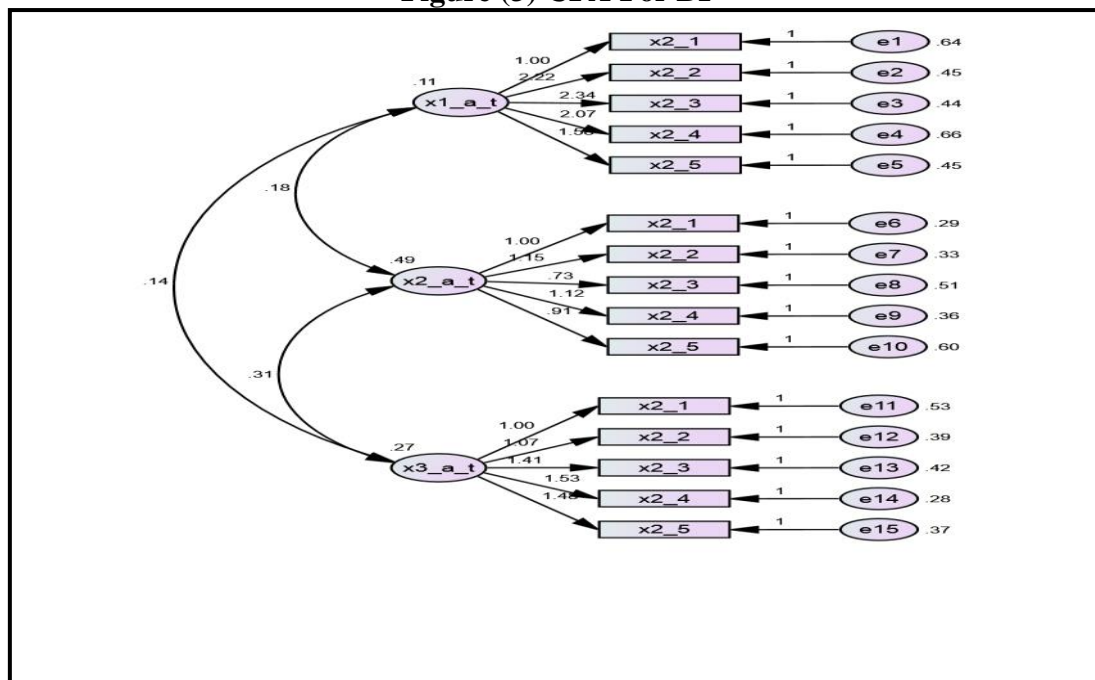
Test the Quality of the Model Acceptance Condition (Daire et al., 2008)	Test Value
X ² / Degree of freedom >5	1536.579
P. value > 0.5	0.000
Goodness of fit Index (GFI) > 0.90	0.593
Tuker-Lewis Index (TLI) > 0.95	0.561
Comparative Fit Index (CFI) > 0.90	0.621
Normed Fit Index (NFI) > 0.90	0.597
Incremental Fit Index (IFI) > 0.95	0.624
Relative Fit Index (RFI) > 0.90	0.533
Root Mean Square Residual (RMR) < 0.5	0.098
Root Mean Square Error of Approximation (RMSEA) < 0.5	0.167

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. Business Intelligence

The researcher used CFA for BI. This can be illustrated by the following figure:

Figure (3) CFA For BI



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

Table (5) Quality Indicators for BI Using AMOS Analysis

Test the Quality of the Model Acceptance Condition (Daire et al., 2008)	Test Value
X ² / Degree of freedom < 5	305.974
P. value > 0.5	0.000
Goodness of fit Index (GFI) > 0.90	0.875
Tuker-Lewis Index (TLI) > 0.95	0.879
Comparative Fit Index (CFI) > 0.95	0.900
Normed Fit Index (NFI) > 0.90	0.867
Incremental Fit Index (IFI) > 0.95	0.901

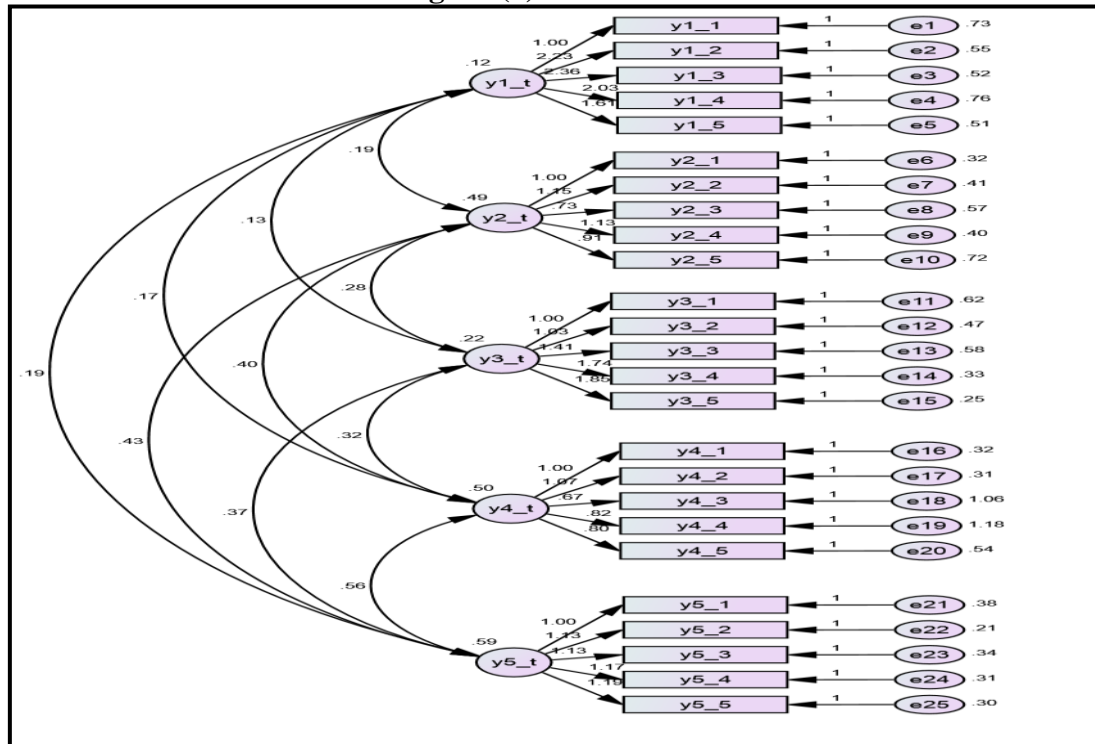
Relative Fit Index (RFI) > 0.90	0.839
Root Mean Square Residual (RMR) < 0.5	0.054
Root Mean Square Error of Approximation (RMSEA) < 0.5	0.092

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

9.2.3. Operational Performance

The researcher used CFA for OP. 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 (6) Quality Indicators for OP Using AMOS Analysis

Test the Quality of the Model Acceptance Condition (Daire et al., 2008)	Test Value
$X^2 / \text{Degree of freedom} < 5$	2270.997
P. value > 0.5	0.000
Goodness of fit Index (GFI) > 0.90	0.659
Tuker-Lewis Index (TLI) > 0.95	0.636
Comparative Fit Index (CFI) > 0.95	0.678
Normed Fit Index (NFI) > 0.90	0.653
Incremental Fit Index (IFI) > 0.95	0.680
Relative Fit Index (RFI) > 0.90	0.607
Root Mean Square Residual (RMR) < 0.5	0.084
Root Mean Square Error of Approximation (RMSEA) < 0.5	0.159

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 (7) shows the mean and standard deviations of BD, BI and OP

Variables	The Dimension	Mean	Standard Deviation
Big	Variety	3.08	0.846
	Velocity	3.00	0.831

Data	Volume	3.05	0.616
	BD Analysis	4.12	0.535
	Total Measurement	3.30	0.597
Business Intelligence	Technology	3.30	0.700
	People	3.26	0.743
	Strategic Alignment	3.32	0.732
	Total Measurement	3.29	0.643
Operational Performance	Flexibility	3.22	0.726
	Innovation	3.22	0.755
	Delivery	3.28	0.741
	Cost	3.06	0.743
	Quality	3.27	0.897
	Total Measurement	3.22	0.673

According to Table (6), most of the respondents identified the presence of variety (M=3.08, SD=0.846), velocity (M=3.00, SD=0.831), volume (M=3.05, SD=0.616), big data analysis (M=4.12, SD=0.535), and total BD (M=3.30, SD=0.597).

Regarding to BI, most of the respondents identified technology (M=3.30, SD=0.700), people (M=3.26, SD=0.743), strategic alignment (M=3.32, SD=0.732), and total BI (M=3.29, SD=0.643).

Regarding to OP, most of the respondents identified the flexibility (M=3.22, SD=0.726), innovation (M=3.22, SD=0.755), delivery (M=3.28, SD=0.741), cost (M=3.06, SD=0.743), quality (M=3.27, SD=0.897), and total OP (M=3.22, SD=0.673).

9.4. Evaluating Reliability

Table (8) Reliability of BD, BI and OP

Variables	Dimension	Number of Statement	ACC
Big Data	Variety	5	0.85
	Velocity	5	0.85
	Volume	5	0.67
	BD Analysis	5	0.53
	Total Measurement	20	0.91
Business Intelligence	Technology	5	0.77
	People	5	0.85
	Strategic Alignment	5	0.85
	Total Measurement	15	0.92
Operational Performance	Flexibility	5	0.76
	Innovation	5	0.83
	Delivery	5	0.84
	Cost	5	0.77
	Quality	5	0.93
	Total Measurement	25	0.95

Table (7) presents the reliability of BD. The 20 items of BD are reliable because the ACC is 0.91. Variety, which consists of 5 items, is reliable because the ACC is 0.85. The 5 items related to velocity, are reliable because the ACC is 0.85 while the 5 items of volume are reliable because the ACC is 0.67. The 5 items related to BD analysis, are reliable because the ACC is 0.53. Thus, the internal consistency of BD can be acceptable.

The 15 items of BI are reliable because the ACC is 0.92. Technology, which consists of 5 items, is reliable because the ACC is 0.78. The 5 items related to people are reliable because the ACC is 0.85. The 5 items related to strategic alignment are reliable because the ACC is 0.85. Thus, the internal consistency of BI can be acceptable.

The 15 items of OP are reliable because the ACC is 0.95. Flexibility, which consists of 5 items, is reliable because the ACC is 0.76. The 5 items related to innovation are reliable because the ACC is 0.83. The 5 items related to delivery are reliable because the ACC is 0.84. Cost, which consists of 5 items, is reliable because the ACC is 0.77 whereas the 5 items related to quality are reliable because the ACC is 0.93. Thus, the internal consistency of OP can be acceptable.

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

Table (9) Means, Standard Deviations and Intercorrelations among Variables

Variables	Mean	Std. Deviation	BD	BI	OP
Big Data	3.34	0.601	1		
Business Intelligence	3.29	0.643	0.834**	1	
Operational Performance	3.24	0.675	0.804**	0.962**	1

Table (8) shows correlation coefficients between BD, BI and OP. BD is (Mean=3.34; SD=0.601), while BI is (Mean=3.29; SD= 0.643). and OP is (Mean=3.24; SD= 0.675). Also, the correlation between BD and OP is (R=0.804; P <0.01) and the correlation between BI and OP is (R=0.962; 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
Variety	1				
Velocity	0.787**	1			
Volume	0.583**	0.615**	1		
Big Data Analysis	0.547**	0.593**	0.432**	1	
Operational Performance	0.731**	0.773**	0.634**	0.507**	1

Based on Table (9), correlation between BD (variety) and OP is 0.731 whereas BD (velocity) and OP shows correlation value of 0.773. Also, BD (volume) and OP is 0.634 whereas BD (BD analysis) shows correlation value of 0.507. The overall correlation between BD and OP is 0.804.

9.6.1. Big Data (Variety) and OP

Table (11) MRA Results for Big Data (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.	0.159*	0.648	0.419
2. Information systems in the organization have the ability to collect data in various forms.	0.072	0.277	0.076
3. The organization needs a variety of data sources to suit the nature of the tasks required of it.	0.279**	0.674	0.454
4. The organization seeks to obtain various data to be used in the analysis process.	0.263**	0.667	0.444
5. The organization resorts to the use of various tools in the process of analyzing various data.	0.229**	0.618	0.381
<ul style="list-style-type: none"> ▪ MCC ▪ DC ▪ Calculated F ▪ Degree of Freedom ▪ Indexed F ▪ Level of Significance 		0.77 0.59 83.792 5, 294 3.01 0.000	

As Table (11) proves, the MRA resulted in the R of 0.77 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 0.59% of the total factors in OP level. Hence, 41% 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 (12) MRA Results for Big Data (Velocity) and OP

Big Data (Velocity)	Beta	R	R ²
1. The organization creates its data quickly to suit the nature of its work.	0.364**	0.716	0.512
2. The information systems in the organization absorb the data that is generated at high speeds.	0.102*	0.452	0.204
3. The organization needs to sort the data quickly after obtaining it from its sources.	0.180**	0.658	0.432
4. The organization works to analyze the data available to it immediately and without delay.	0.260**	0.678	0.459
5. The time period that the organization needs to examine the data after its analysis is very short.	0.053	0.522	0.272
<ul style="list-style-type: none"> ▪ MCC ▪ DC ▪ Calculated F ▪ Degree of Freedom ▪ Indexed F ▪ Level of Significance 		0.80 0.63 99.526 5, 294 3.01 0.000	

As Table (12) proves, the MRA resulted in the R of 0.80. 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 (13) MRA Results for Big Data (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.	0.263**	0.534	0.285
2. Information systems in the organization have the ability to deal with a large amount of data daily.	0.165**	0.382	0.145
3. The organization has the ability to discover data regardless of its size.	0.292**	0.549	0.301
4. The organization has the ability to analyze a large amount of data once it is obtained.	0.008	0.208	0.043
5. The organization has the ability to examine a large amount of data after its analysis.	0.192**	0.440	0.193
<ul style="list-style-type: none"> ▪ MCC ▪ DC ▪ Calculated F ▪ Degree of Freedom ▪ Indexed F ▪ Level of Significance 		0.69 0.45 47.501 5, 294 3.01 0.000	

As Table (13) proves, the MRA resulted in the R of 0.69 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 0.45% of the total factors in OP level. Hence, 55% 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 (14) MRA Results for Big Data (BD Analysis) and OP

Big Data (BD Analysis)	Beta	R	R ²
1. After analyzing the data, the organization can identify work-related events.	0.685**	0.684	0.467
2. After analyzing the data, the organization can know the period of work-related events.	0.193**	0.057	0.001
3. After analyzing the data, the organization can know the details of work-related events.	0.003	0.248	0.061
4. After analyzing the data, the organization can predict future events or problems.	0.285**	0.321	0.103
5. After analyzing the data, the organization can identify what is the best solution for each problem.	0.075*	0.279	0.077

▪ MCC	0.77
▪ DC	0.60
▪ Calculated F	84.849
▪ Degree of Freedom	5, 294
▪ Indexed F	3.01
▪ Level of Significance	0.000

As Table (11) proves, the MRA resulted in the R of 0.77. 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 60% 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.

9.7. The Correlation between BI and OP

Table (15) Correlation Matrix between BI and OP

Research Variables	1	2	3	5
Technology	1			
People	0.648**	1		
Strategic Alignment	0.654**	0.736**	1	
Operational Performance	0.780**	0.848**	0.929**	1

Based on Table (15), correlation between BI (technology) and OP is 0.780 whereas BI (people) and OP shows correlation value of 0.848. Also, BI (strategic alignment) and OP is 0.929. The overall correlation between BI and OP is 0.962.

9.7.1. Business Intelligence (Technology) and OP

Table (16) MRA Results for Business Intelligence (Technology) and OP

Business Intelligence (Technology)	Beta	R	R ²
1. BI system uses accurate, error-free data.	0.100*	0.335	0.112
2. BI system provides reports for taking quick action to tackle everyday problems.	0.160**	0.619	0.383
3. BI system analyzes historical data to identify trends and detect problems.	0.391**	0.703	0.494
4. BI system has the ability to display information as requested by the system user.	0.122**	0.538	0.289
5. BI system has the ability to integrate with other information systems.	0.300**	0.609	0.370
▪ MCC	0.810		
▪ DC	0.656		
▪ Calculated F	111.997		
▪ Degree of Freedom	5, 294		
▪ Indexed F	3.01		
▪ Level of Significance	0.000		

As Table (16) proves, the MRA resulted in the R of 0.810 demonstrating that the 5 independent variables of BI (Technology) construe OP significantly. Furthermore, the value of R², 5 independent variables of BI (Technology) can explain 0.65% of the total factors in OP level. Hence, 35% 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 BI (Technology) and OP.

9.7.2. Business Intelligence (People) and OP

Table (17) MRA Results for Business Intelligence (People) and OP

Business Intelligence (People)	Beta	R	R ²
1. The organization encourages the use of the BI system by the various administrative levels.	0.362**	0.753	0.567
2. The organization is interested in making operational improvements for using BI system.	0.238**	0.729	0.531
3. The employees in the BI system have the appropriate technical skills.	0.101**	0.524	0.274
4. The BI system workers have the ability to provide appropriate solutions.	0.160**	0.714	0.509
5. The organization provides appropriate training programs for BI system users in a timely manner.	0.210**	0.607	0.368

▪ MCC	0.861
▪ DC	0.741
▪ Calculated F	168.179
▪ Degree of Freedom	5, 294
▪ Indexed F	3.01
▪ Level of Significance	0.000

As Table (17) proves, the MRA resulted in the R of 0.861. This means that BI has been significantly explained by the 5 independent variables of BI (people). As a result of the value of R², the five independent variables of BI justified 74% 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 BI (people) and OP.

9.7.3. Business Intelligence (Strategic Alignment) and OP

Table (18) MRA Results for Business Intelligence (Strategic Alignment) and OP

Business Intelligence (Strategic Alignment)	Beta	R	R ²
1. The organization takes into account the restructuring of BI processes to adapt to the available opportunities.	0.188**	0.609	0.370
2. The organization takes into account restructuring the operations of the operational divisions in order to cope with the available opportunities.	0.109**	0.651	0.423
3. The organization takes into account that BI applications are compatible with the needs of operational management.	0.244**	0.739	0.546
4. The organization takes into account that BI applications are compatible with the objectives of the operational management.	0.291**	0.825	0.680
5. The organization is keen that BI is concerned with generating information from it.	0.333**	0.809	0.654
▪ MCC	0.936		
▪ DC	0.875		
▪ Calculated F	413.404		
▪ Degree of Freedom	5, 294		
▪ Indexed F	3.01		
▪ Level of Significance	0.000		

As Table (18) the MRA resulted in the R of 0.936 demonstrating that the 5 independent variables of BI (strategic alignment) construe OP significantly. Furthermore, the value of R², 5 independent variables of BI (strategic alignment) can explain 0.87% of the total factors in OP level. Hence, 13% 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 BI (strategic alignment) 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. Telecommunication sector in Egypt do not rely on BI 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. Telecommunication sector 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 BI and competitive intelligence applications.
3. The low level of the Telecommunication sector in Egypt infrastructure to deal with the field of software that supports BI. 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 of Telecommunication sector in Egypt in the vital role played by BD technology and BI 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.
5. The interest in BI was limited to certain aspects, the most important of which is the use of BI 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 BI in the completion of activities and

processes within the organization, in addition to the lack of technical personnel necessary to manage and operate BI systems in the organization.

6. Attention has been focused on the practice of BI in specific aspects, the most important of which is the focus on ensuring that workers in the organization understand the importance of BI 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 BI 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 BI.
7. Telecommunication sector 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. Telecommunication sector 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 Telecommunication sector 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 BI 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 BI 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 BI 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 BI 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 BI in Telecommunication sector 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 BI 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 BI 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 BI systems and benefiting from them.

9. Conducting more studies and research in the field of BI and making use of it in developing, improving and diversifying the services provided by the organization.
10. The need for Telecommunication sector in Egypt to pay attention to employing BI tools in building strategic information systems and activating their role in all different areas in the organization.
11. Benefiting from the experiences of developed Telecommunication sector in Egypt and countries in building and employing BI 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 Telecommunication sector 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 BI 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 BI 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 BI 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 BI 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 BI 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 BI 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 BI, 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 BI in different sectors, (2) the effect of BI on strategic intelligence, (3) the impact of BI on organizational excellence, (4) the impact of BI on strategic success, (5) the impact of BI on organizational ambidexterity, (6) the impact of BD in improving operational performance, (7) the impact of BI in improving operational performance.

References

- i. Abai, N. Hani, N. Yahaya, J. and Deraman, A. (2016). *Business Intelligence and Analytics in Managing Organizational Performance: The Requirement Analysis Model. Journal of Advances in Information Technology*, 7(3), PP. 208-213.
- ii. Abdallah, A. Anh, P. and Matsui, Y. (2016). *Investigating the effects of managerial and technological innovations on operational performance and customer satisfaction of manufacturing companies., International Journal of Business Innovation and Research*, 10 (2/3), Pp. 153-183
- iii. Abker, A. Ibrahim, S. and Eltayeb, T. (2018). *Investigation the Relationship Between Strategic Orientation and Operational Performance in the Sudanese Service Firms. American Journal of Business, Economics and Management*, 6(3), PP.66-74.

- iv. Akter, S, Wamba, S, Gunasekaran, A., Dubey, R., and Childe, S. (2016). *How to improve firm performance using big data analytics capability and business strategy alignment? Int Journal Prod Econ* 182(1), PP. 113-131.
- v. Alawin, A. and Mayteh, M. (2014). *Proposed Ranking for Point of Sales using data mining for telecom operators, International Journal of Database Management Systems (IJDMS)*, 6(3). PP.17-31.
- vi. Al-Sa'di, A. Abdallah, A. and Dahiyat, S. (2017). *The mediating role of product and process innovations on the relationship between knowledge management and operational performance in manufacturing companies in Jordan, Business Process Management Journal*, 23 (2), PP. 349-376. <https://doi.org/10.1108/BPMJ-03-2016-0047>
- vii. Aydiner, A. Tatoglu, E., Bayraktar, E., Zaim, S., and Delen, D. (2019). *Business analytics and firm performance: The mediating role of business process performance. Journal of Business Research*, 96(1), PP. 228-237.
- viii. Azvine, B. Cui, Z. Nauck, D. Majeed, B. (2006). *Real Time Business Intelligence for the Adaptive Enterprise, IEEE Joint Conference: The 8th IEEE International Conference on E- Commerce Technology and the 3rd IEEE International conference on Enterprise computing, E- Commerce, and E-Services (CEC/EEE,06) IEEE, San Francisco, California.*
- ix. Balachandran, B and Prasad, S. (2017). *Challenges and benefits of deploying big data analytics in the cloud for business intelligence. Procedia Computer. Science*, 112 (1), PP.112-1122.
- x. Bara D. and Knezevic, N. (2013). *The Impact Of Right-Time Business Intelligence On Organizational Behavior," Interdisciplinary Management Research, Josip Juraj Strossmayer University of Osijek, Faculty of Economics, Croatia, vol. 9, pages 27-42.*
- xi. Barakat S. Al-Zu'bi H. Al-Zegaier H. (2013). *The role of business intelligence in knowledge sharing: a Case Study at Al-Hikma Pharmaceutical Manufacturing Company, European Journal of Business and Management, Vol.5, No.2, PP.237-243.*
- xii. Barbieri, D. (2012). *Business Intelligence and its Applications to the Public Administration, Journal of Business Management and Applied Economics*, PP1-9.
- xiii. Beamon, B. (1999). *Measuring supply chain performance, International Journal of Operations and Production Management*, 19 (3), PP. 275-292. <https://doi.org/10.1108/01443579910249714>
- xiv. Bento D. and Tontini, G. (2018). *Developing an instrument to measure lean manufacturing maturity and its relationship with operational performance. Total Quality Management and Business Excellence*, 29 (9-10), PP. 977-995.
- xv. Beyer, M. and Laney, D. (2012). *The importance of 'big data': a definition. Gartner, Stamford, Retrieved August, Available at: https://www.gartner.com/en/documents/2057415*
- xvi. Bharadwaj, A., El Sawy, O. Pavlou P. and Venkatraman N. (2013). *Digital business strategy: toward a next generation of insights. MIS Quarterly*, 37(2), PP.471-482.
- xvii. Boer, H., and Daring, W. (2001). *Innovation, what innovation? A comparison between product, process, and organizational innovation, International Journal of Technology Management*, 22(1–3), PP. 83-107.
- xviii. Bohdan, S. (2015). *How do organizations prepare and clean big data to achieve better data governance? A Delphi Study, Capella University, ProQuest Dissertations Publishing.*
- xix. Chae, B., Yang, C., Olson, D., and Sheu, C. (2014). *The impact of advanced analytics and data accuracy on operational performance: A contingent resource based theory (RBT) perspective. Decision Support Systems*, 59 (1), PP.119-126.
- xx. Charles, M. and Omwenga, J. (2017). *Role of Supplier Management Practices in Optimization of Operational Performance in Telecommunication Service Industry in Kenya: A Case of Safaricom Limited. International Journal of Social Science and Humanities Research*, 6(1), PP. 224-245.
- xxi. Chaudhuri, S., Dayal U., and Narasayya, V. (2011). *An overview of business intelligence technology. Communications of the ACM*, 54(8), PP.88-89.
- xxii. Chavez, R., Yu, W., Gimenez, C., Fynes, B., and Wiengarten, F. (2015). *Customer integration and operational performance: The mediating role of information quality. Decision Support Systems*, 80(1), PP. 83-95.

- xxiii. Chen, C. (2016). *Use cases and challenges in telecom big data analytics*, *APSIPA Transactions on Signal and Information Processing*, 5(1), PP.1-7.
- xxiv. Chen, P. and Zhang, C. (2014). *Data-intensive applications, challenges, techniques and technologies: A survey on Big Data*, *Information Sciences*, Vol. 275, 10, PP. 314-347.
- xxv. Cody, W., Kreulen, J., Krishna, V., and Spangler, W. (2002), *The integration of business intelligence and knowledge management*, *IBM Systems Journal*, 41(4), 697-713
- xxvi. Collier, D., and Evans, J. (2017). *OM6: Operations Supply Chain Management*. Boston: Cengage Learning.
- xxvii. Constantiou, I. and Kallinikos, J. (2015). *New games, new rules: big data and the changing context of strategy*. *Journal Inf Technol*, 30(1), PP.697-713.
- xxviii. Cosic, R., Shanks, G., and Maynard, S. (2012). *Towards a business analytics capability maturity model*. *Proceeding of 23rd, Australasian Conference on Information Systems*, Geelong, Australia.
- xxix. Damanpour, F. (2010). *An integration of research findings of effects of firm size and market competition on product and process innovations*, *British Journal of Management*, 21(4). PP. 996–1010
- xxx. Davis, C. (2014). *Beyond data and analysis*. *Communications of the ACM*, Vol. 57, No. (6), PP1-23.
- xxxi. Dayal, U., Castellanos, M., Simitsis, A. and Wilkinson, K. (2009). *Data integration flows for Business Intelligence*. *Proceedings of the 12th International Conference on Extending Database Technology: Advances in Database Technology (EDBT '09)*, Martin Kersten, Boris Novikov, Jens Teubner, Vladimir Polutin, and Stefan Manegold (Eds.). New York, USA, PP. 1-11.
- xxxii. De Mauro, A., Greco, M., and Grimaldi, M. (2015). *What is big data? A consensual definition and a review of key research topics*. *AIP Conference Proceedings*, 1644 (1), PP.97-104.
- xxxiii. Delic, K. and Riley, J. (2015). *On big science: a survey*. *Proceedings of the 15th International Conference on I-Know*, PP. 1-4, <https://doi.org/10.1145/2809563.2809622>
- xxxiv. Duan, L., and Xu L.D. (2012). *Business intelligence for enterprise systems: a survey*, *Industrial Informatics*, *IEEE Transactions on Industrial Informatics*, 8(3), PP. 679- 687.
- xxxv. Dubey, R. Gunasekaran, A. Childe, S. Luo, Z. (2018). *Examining the role of big data and predictive analytics on collaborative performance in context to sustainable consumption and production behaviour*, *Journal of Cleaner Production*, Vol. 196, PP. 1508-1521.
- xxxvi. Elbashir Z., Collier A., and Davern J. (2008). *Measuring the Effects of Business Intelligent Systems: The Relationship between Business Process and Organizational Performance*”. *International Journal of Accounting Information Systems*, (9), PP. 135-153.
- xxxvii. El-Tohamy, A. and Al Raoush, A. T. (2015). *The Impact of Applying Total Quality Management Principles On The Overall Hospital: An Empirical Study On The Accredited Governmental Hospitals in Jordan*. *European Scientific Journal*, ESJ, 11(10). Retrieved from <http://eujournal.org/index.php/esj/article/view/5409>
- xxxviii. Evans, P. (2010). *Business Intelligence is a Growing Field*. *Data Base Journal*. Retrieved January 12, 2019 from, Available at: www.databasejournal.com/features/article.php/3878566/Business-Intelligence-is-a-Growing-Field.htm.
- xxxix. Fan, S., Lau, R., and Zhaob, J. (2015). *Demystifying Big Data Analytics for Business Intelligence Through the Lens of Marketing Mix*, *Big Data Res.*, 2(1), PP.28-32.
- xl. Fleisher, C. and Bensoussan, B. (2007) *Business and Competitive Analysis: effective application of new and classic methods*. Upper Saddle River: FT Press.
- xli. Flynn, B. Huo, B., and Zhao, X. (2010). *The impact of supply chain integration on performance: A contingency and configuration approach*, *Journal of Operations Management*, Vol. 28, PP. 58-71.
- xlii. Gantz, J., and Reinsel, D. (2012). *The digital universe in 2020: Big data, bigger digital shadows, and biggest growth in the far east*. *IDC I View: IDC Analyze the Future*, <https://www.emc-technology.com/collateral/analyst-reports/idc-the-digital-universe-in-2020.pdf>
- xliii. Garmaki, M. Boughzala, I. and Wamba, S. (2016). *The effect of big data analytics capability on firm performance*, *Proceedings of 20th Pacific Asia conference on information systems (PACIS)*, 301. <http://aisel.aisnet.org/pacis2016/301>

- xliv. Gartner (2016). *Gartner Says Worldwide Business Intelligence and Analytics Market to Reach \$16.9 Billion in 2016*. Retrieved January 7, 2019 from: <https://www.gartner.com/en/newsroom/press-releases/2016-02-03-gartner-says-worldwide-business-intelligence-and-analytics-market-to-reach-17-billion-in-2016>
- xlv. Gartner (2019). *Business Intelligence (BI)*. Retrieved January 6, 2019 from: <https://www.gartner.com/it-glossary/business-intelligence-bi/>
- xlvi. Gentile, C., Spiller, N., and Noci, G., (2007). *How to Sustain the Customer Experience: An overview of experience components that co-create value with the customer*, *European Management Journal*, 25(5), PP. 395-410.
- xlvii. George, G, Osinga, CE, Lavie, D, and Scott, B. (2016). *Big data and data science methods for management research*, *Academy of Management Journal*, 59 (5), PP. 1493-1507
- xlviii. Ghasemaghaei, M. (2018). *Improving Organizational Performance Through the Use of Big Data*, *Journal of Computer Information Systems*, DOI: 10.1080/08874417.2018.1496805
- xliv. Ghasemaghaei, M., and Calic, G. (2019). *Can big data improve firm decision quality? The role of data quality and data diagnosticity*. *Decision Support Systems*. 120(1), PP.39-49.
- l. Ghosh, P. (2018). *Business Intelligence and Analytics Trends in 2018*. Retrieved February 12, Available at: <http://www.dataversity.net/business-intelligence-analytics-trends-2018/>.
- li. Glancy, F. and Yadav, S. (2011). *Business Intelligence Conceptual Model*, *International Journal of Business Intelligence Research*, 2(2), PP. 48-66
- lii. Golfarelli, M, Rizzi, S and Cella, I., (2004). *Beyond data warehousing: what's next in business intelligence?* Washington, DC, USA, 7th ACM international workshop on Data warehousing and OLAP.
- liii. Gunasekaran, A., Papadopoulos, T., Dubey, R., Wamba, S. Childe, S. Hazen, B., and Akter, S. (2016). *Big data and predictive analytics for supply chain and organizational performance*. In: *Journal of Business Research* 70 (19), PP. 308-317.
- liv. Gunday, G., Ulusoy, G., Kilic, K. and Alpkan, L. (2011). *Effects of innovation types on firm performance*, *International Journal of Production Economics*, 133 (2), PP. 662-676.
- lv. Haag, S. Cummings, M. and Phillips, A. (2007). *Management Information Systems*, 6th ed, Irwin McGraw-Hill, New York, U.S.A
- lvi. Hammer, M. (2018). *Management Approach for Resource-Productive Operations: Design of a Time-Based and Analytics-Supported Methodology Grounded in Six Sigma (Industrial Management)*, Springer Gabler ISBN: 978-3-658-22938-2, 978-3-658-22939-9
- lvii. Henshen, D. (2008). *Special Report: Business Intelligence Gets Smart*. *Information Week*.
- lviii. Ionescu, B., and Podaru, S. (2014). *Business Intelligence. A Presentation of the Current Lead Solutions and a Comparative Analysis of the Main Providers*. *Database Systems Journal*, 5 (2), PP.60-69.
- lix. Irtaimeh, H. Obeidat, A. Abualloush, S. and Khaddam, A. (2016). *Impact of Business Intelligence on Technical Creativity: A Case Study on AlHekma Pharmaceutical Company*. *European Scientific Journal*, Vol. 12(28), PP. 502. Available at: [https://doi.org/10.19044/esj,12\(28\),PP.502](https://doi.org/10.19044/esj,12(28),PP.502)
- lx. Isik O., Jones C., and Siorova A. (2013). *Business Intelligence Success: The Roles of BI Capabilities and Decision Environments*. *Information & Management*, (50), PP. 13-23.
- lxi. Janssen, M. Voort, H. and Wahyudi, A. (2017). *Factors influencing big data decision-making quality*, *Journal of Business Research*, Vol. 70, PP. 338-345.
- lxii. Jayakrishnan, M., Bin Mohamad, A., and Yusof, M. (2018). *Assimilation of Business Intelligence (BI) and Big Data Analytics (BDA) Towards Establishing Organizational Strategic Performance Management Diagnostics Framework: A Case Study*. *Journal of Digital Information Management* 16 (1), PP.22-32.
- lxiii. Jeble, S., Dubey, R., Childe, S., Papadopoulos, T., Roubaud, D. and Prakash, A. (2018). *Impact of big data and predictive analytics capability on supply chain sustainability*, *The International Journal of Logistics Management*, Vol. 29 No. 2, PP. 513-538.
- lxiv. Jin, D. and Kim, H. (2018). *Integrated Understanding of Big Data, Big Data Analysis, and Business Intelligence: A Case Study of Logistics*. *Sustainability*, 10(3778), PP.1-15.

- lxv. Johnson, J. Friend, S. and Lee, H. (2017). Big data facilitation, utilization, and monetization: Exploring the 3Vs in a new product development process. *Journal of Product Innovation Management*, 34 (5), PP. 640–658
- lxvi. Jony, R, Habib, A. Mohammed, N. and Rony, R. (2015). Big Data Use Case Domains for Telecom Operators, *IEEE International Conference on Smart City/Social Com/Sustain Com together with Data Com and SC2015*, DOI: 10.1109/SmartCity, PP.850-855.
- lxvii. Kalakota, R., and Robinson, M. (2000). *E-business: Roadmap for success*. Addison-Wesley.
- lxviii. Kamioka, T., and Tapanainen T. (2014). Organizational use of big data and competitive advantage - exploration of antecedents. In: *Pacific Asia conference on information systems*, 372(1), PP.372-379
- lxix. Kaplan R. and Norton D. (1992). *The Balanced Scorecard Measures that drive performance*, *Harvard Business Review*, January-February. www.maaw.info/artSumkaplanNorton92.htm.
- lxx. Kaplan R. and Norton D. (2010). *Le tableau de bord prospectif*, ed. Eyrolles, Paris, France.
- lxxi. Karim, A. (2011). The value of Competitive Business Intelligence System (CBIS) to Stimulate Competitiveness in Global Market, *International Journal of Business and Social Science*, Vol. 2, No. 19, PP. 196-203.
- lxxii. Kimball, R. Reeves, L. Ross, M. and Thornthwaite, W. (2005), *The data warehouse: Guide de conduit de project*, ed. Eyrolles, Paris, France.
- lxxiii. Knabke, T., and Olbrich, S. (2017). Building novel capabilities to enable business intelligence agility: results from a quantitative study. *Information Systems and e-Business Management*. 16(3), PP.493–546.
- lxxiv. Kobbacy, K. Vadera, S., and Rasmy, M. (2007). AI and OR in management of operations: history and trends. *Journal of the Operational Research Society*, 58(1), PP.10-28.
- lxxv. Kumar, P. (2012). Impact of Business intelligence in India, *Telecom Industry, Business Intelligence Journal*, July, Vol.5 No.2. poonamkumar123@gmail.com
- lxxvi. Lee, I. (2017). Big data: Dimensions, evolution, impacts, and challenges *Business Horizons*, 60(3), PP. 293-303.
- lxxvii. Lloyd, J. (2011). *Identifying Key Components of Business Intelligence Systems and Their Role in Managerial Decision making*, Master of Applied Information Management Program, University of Oregon.
- lxxviii. Lonnqvist, A., and Pirttimaki, V. (2006). The measurement of business intelligence. *Business Intelligence*, 23 (1), PP.32-40.
- lxxix. Loshin, D. (2013). *Business Intelligence The Savvy Managers Guide*, Elsevier Morgan Kaufmann Publisher, USA.
- lxxx. Luftman, J. (2000). Assessing Business-IT Alignment Maturity. *Communications of the Association for Information Systems*, 4, <https://doi.org/10.17705/ICAIS.00414>
- lxxxi. Luhn, H. (1958). A Business Intelligence System. *IBM Journal of Research and Development*, 2(1), PP.314-319.
- lxxxii. Maheshwari. (2015). *A. Business Intelligence and Data Mining*. - New York: Business Expert Press, LLC.
- lxxxiii. Mandal, S. (2019). The influence of big data analytics management capabilities on supply chain preparedness, alertness and agility: An empirical investigation, *Information Technology & People*, 32 (2), PP. 297-318. <https://doi.org/10.1108/ITP-11-2017-0386>
- lxxxiv. Manikas, I., and Terry, L. (2010). A case study assessment of the operational performance of a multiple fresh produce distribution centre in the UK, *British Food Journal*, 112(6), PP.421-435.
- lxxxv. Marín-Ortega, P., Dmitriyev, V., Abilov, M., and Gómez, J. (2014). New Approach in Designing Business Intelligence Solutions in Era of Big Data. *Procedia Technology*, 16(1), PP. 667 – 674
- lxxxvi. Massa, S., and Testa S. (2005). Data Warehouse-In-Practice: Exploring the Function of Expectations in Organizational Outcomes”. *Information Management*, (42), PP. 709-718.
- lxxxvii. Matei, G., (2010), a collaborative approach of business intelligence systems, *Journal of Applied Collaborative Systems*, Vol. 2, No 2, PP.91-101.
- lxxxviii. Matthias, O., Fouweather, I., Gregory, I. and Vernon, A. (2017). Making sense of Big Data – can it transform operations management?“, *International Journal of Operations & Production Management*, 37 (1), PP. 37-55. <https://doi.org/10.1108/IJOPM-02-2015-0084>.

- xxxix. Moreno, V. Carvalho, W., and Cavazotte, F. (2018). *Does Business Intelligence and Analytics Leverage Dynamic and Operational Capabilities? An Empirical Study in a Brazilian Telecommunications Company*. *Twenty-fourth Americas Conference on Information Systems, New Orleans*, 6(1), PP.1-10
- xc. Moss, T., and Atre S. (2007). *Business Intelligence Roadmap*. Boston: Pearson Education Inc.
- xc. Muhammad, G., Ibrahim, J., Bhatti, Z., and Waqas, A. (2014). *Business Intelligence as a Knowledge Management Tool in Providing Financial Consultancy Services American, Journal of Information Systems*, 2(2), PP.26-32.
- xcii. Mungree, D. Rudra, A. and Morien, D. (2013). *A Framework for Understanding the Critical Success Factors of Enterprise Business Intelligence Implementation, Proceedings of the Nineteenth Americas Conference on Information Systems; Chicago, Illinois, AMCIS, PP. 1–9*.
- xciii. Naraina A. (2013). *Business Intelligence, UniSa, Stu Docu, Available* <https://www.studocu.com/row/user/2640748>
- xciv. Negash, S. (2004). *Business Intelligence. Communications of the Association for Information Systems*, 13, PP. 199-195, <https://doi.org/10.17705/1CAIS.01315>
- xcv. Opresnik, D., and Taisch, M. (2015). *The value of Big Data in sterilization, International Journal of Production Economics*, 165(1), PP. 174-184.
- xcvi. Panian, Z. (2012). *The evolution of business intelligence: from historical data mining to mobile and location-based intelligence. In WSEAS International Conference on Recent Researches in Business and Economics*, PP.118-127.
- xcvii. Parra, V.M., Halgamuge, MN, (2018). *Performance Evaluation of Big Data and Business Intelligence Open Source Tools: Pentaho and Jaspersoft", in Dey, N. Hassanien, A.E. Bhatt C., Ashour, A. (Eds.). Internet of Things and Big Data Analytics Toward Next-Generation Intelligence. Studies in Big Data, doi:10.1007/978-3-319-60435-0*
- xcviii. Pirttimäki, V. (2004). *The Roles of Internal and External Information in Business Intelligence, Frontiers of E-Business Research*, PP. 385-396.
- xcix. Pirttimäki, V., Lönnqvist, A., and Karjaluoto, A. (2006). *Measurement of Business Intelligence in a Finnish Telecommunications Company. The Electronic Journal of Knowledge Management*, 4(1), PP. 83-90.
- c. Popovic A., Hackney R., Coelho S. and Jaklic J. (2012). *Towards Business Intelligence Systems Success: Effects of Maturity and Culture on Analytical Decision Making". Decision Support Systems*, (54), PP. 729-739.
- ci. Popovič, A. Coelho, P. and Jaklič, J. (2009). *The Impact of Business Intelligence System Maturity on Information Quality (December 21, 2009). Information Research, Vol. 14, No. 4, Available at SSRN: https://ssrn.com/abstract=1625573*.
- cii. Power J. (2016). *Data science: supporting decision-making systems, Journal of Decision Systems, Vol. 25, Issue 4, PP. 345-356*.
- ciii. Pratt M and Fruhlinger. J. (2019). *What is business intelligence? Transforming data into business insights. - cio.com, Available at: https://www.cio.com/middle-east/*
- civ. Ram, J., Zhang, C., and Koronios, A. (2016). *The implications of big data analytics on business intelligence: A qualitative study in China. Procedia Computer. Science*, 87(1), PP.221-226.
- cv. Ramakrishnan T., Jones C. and Sidorova A. (2012). *Factors Influencing Business Intelligence (BI) Data Collection Strategies: An Empirical Investigation. Decision Support Systems*, 52, PP. 486-496.
- cvi. Rubio, J. and Crawford, B. (2008), *An approach towards the integration of Adaptive Business Intelligent and Constraint Programming, Hyderabad, India, International Symposiums on Information*.
- cvii. Russom, P. (2011). *Big data analytics. TDWI Best Practices Report, Fourth Quarter. Retrived January 18, 2019 from: Available at: https://tdwi.org/research/2011/09/~~/media/TDWI/TDWI/Research/BPR/2011/TDWI_BPRReport_Q411_Big_Data_Analytics_Web/TDWI_BPRReport_Q411_Big%20Data_ExecSummary.ashx*

- cviii. Sangari, M. and Razmi, J. (2015). *Business intelligence competence, agile capabilities, and agile performance in supply chain: An empirical study*, *The International Journal of Logistics Management*, 26 (2), PP. 356-380. <https://doi.org/10.1108/IJLM-01-2013-0012>.
- cix. Sangari, M. and Razmi, J. (2015). *Business intelligence competence, agile capabilities, and agile performance in supply chain: An empirical study*, *The International Journal of Logistics Management*, 26 (2), PP. 356-380. <https://doi.org/10.1108/IJLM-01-2013-0012>.
- cx. Schroeck, M., Shockley, R., Smart, J., Romero-Morales, D., Tufano, P. (2012). *Analytics: The real-world use of Big Data: How innovative enterprises extract value from uncertain data*, IBM Global Business Services, Business Analytics and Optimization, Executive Report, Available at: <http://public.dhe.ibm.com/common/ssi/ecm/en/gbe03519usen/GBE03519USEN.PDF>.
- cxii. Schwertner, K. (2017). *Digital transformation of business*. *Trakia Journal of Sciences*, 15(1), 388-393. <https://doi.org/10.15547/tjs.2017.s.01.065>
- cxiii. Shafique, M. Khurshid, M. Rahman, Khanna, A. Gupta, D. (2019). *The Role of Big Data Predictive Analytics Acceptance and Radio Frequency Identification Acceptance in Supply Chain Performance*, *International Conference on Innovative Computing and Communications*, PP. 65-72
- cxiv. Slack, N., Brandon-Jones, A., and Johnston, R. (2013). *Operations Management*, 7th Ed. Pearson.
- cxv. Somya R. Manongga, D. Pakereng M. (2018). *Service-Oriented Business Intelligence (SoBI) for Academic and Financial Data Integration in University*, *International Seminar on Application for Technology of Information and Communication*, PP.1-5.
- cxvi. Stevenson, W. (2014), *Operations Management*, 12th Ed., McGraw-Hill, New york, USA.
- cxvii. Subramanian, P., and Palaniappan, S. (2015). *Telecom Data Integration and Analytics - Proposed Model to Enhance Customer Experience*. *International Journal of Conceptions on Computing and Information Technology*. Malaysia University of Science and Technology. Malaysia,
- cxviii. Sun, E. Chen, Y. and Yu, M. (2015). *Generalized optimal wavelet decomposing algorithm for big financial data*, *International Journal of Production Economics*, Elsevier, Vol. 165(C), PP. 194-214.
- cxix. Tabbitt, S. (2013). *BI Services Market Predicted to Double by 2016*, *Information Week*, (2013).
- cxx. Tabtabaei, S. (2010). *Evaluation of Business intelligence Maturity Level in Iranian Banking industry*, MASTER THESIS, Tarbiat Modares University Faculty of Engineering Department Industrial Engineering Lulea University of Technology, Iran.
- xxxi. Tan, K. C., Kannan, V. R., and Narasimhan, R. (2007). *The impact of operations capability on firm performance*, *International Journal of Production Research*, 45(21), PP. 5135-5156.
- xxxii. Torres, R., Sidorova, A., and Jones, M. (2018). *Enabling firm performance through business intelligence and analytics: A dynamic capabilities perspective*. *Information & Management*. doi:10.1016/j.im.2018.03.010
- xxxiii. Tortorella, G. Giglio, R. and van Dun, D. H. (2018). *Industry 4.0 as a moderator on the relationship between lean and operational performance*, *Proceeding 25th International Annual Eur OMA Conference*, Budapest, Hungary.
- xxxiv. Trieu, V. Cockcroft, S. and Perdana, A. (2018). *Decision-Making Performance in Big Data Era: The Role of Actual Business Intelligence Systems Use and Affecting External Constraints*. *Research-in-Progress Papers*. 38. https://aisel.aisnet.org/ecis2018_rip/38.
- xxxv. Turban, E. Liang, J. Sharda, R. (2007). *Decision Support and Business Intelligence Systems*, Eighth Edition, Prentice Hall, New Jersey.
- xxxvi. Turban, E., and Volonino, L. (2011). *Information Technology for Management: Improving Strategic and Operational Performance*, 8th Ed., Wiley, Hoboken, New Jersey.
- xxxvii. Turban, E., Sharda, R., Aronson, J, and King, D. (2011). *Business Intelligence: A Managerial Approach*, Prentice Hall.
- xxxviii. Wang, C., Chen, L., Xu, S. and Chen, X. (2016). *Exposing Library Data with Big Data Technology: A Review*, *IEEE/ACIS 15th International Conference on Computer and Information Science (ICIS)*
- xxxix. Watson H. and Wixom, B. (2007). *The Current State of Business Intelligence*, *IEEE Computer*, Vol. 40, No. 9, PP. 96-99. doi:10.1109/MC.2007.331
- xl. Watson, H (2014). *Tutorial: Big Data Analytics: Concepts, Technologies, and Applications*, *Communications of the Association for Information Systems*, 34 (65), PP. 1247-1268.

- cxxx. Watson, H. (2009). *What is new and important in Business Intelligences*, ITI'09, 31st International Conference on Information Technology Interfaces.
- cxix. Wieder, B., and Ossimitz, M. (2015). *The Impact of Business Intelligence on the Quality of Decision Making – A Mediation Model*. *Procedia Computer Science*, 64, PP.1163-1171.
- cxlii. Wilkin, C. and Chenhall, R. (2010). *A Review of IT Governance: A Taxonomy to Inform Accounting Information Systems*. *Journal of Information Systems: Fall* Vol. 24, No. 2, PP. 07-146.
- cxliiii. Wixom, B. and Watson, H. (2010). *The BI-based organization*. *International Journal of Business Intelligence Research*, 1(1), PP.13-28.
- cxliiii. Wu, L. Barash, G. Bartolini, C. (2007). *Service-oriented Architecture for Business Intelligence*, Berlin: Springer.
- cxliiii. Xu, M. and Kaye, R. (2007). *The Nature of Strategic Intelligence, Current Practice and Solutions*, In Xu, M. (Ed). *Managing strategic intelligence*. PP. 36-53. Hershey, PA: Information Science Reference.
- cxliiii. Yahaya, J. Deraman, A. Abai, Z. Mansor, Z. and Jusoh, Y. (2016). *Business intelligence and big data analytics for organizational performance management in public sector: the conceptual framework*. *Advanced Science Letters*, 22 (8). PP. 1919-1923. ISSN 1936-6612; ESSN: 1936-7317.
- cxliiii. Yan S. and Xiangjun L. (2010). *The Role of Business Intelligence in Business Performance Management*, 3rd International Conference on Information Management, Innovation Management and Industrial Engineering.
- cxliiii. Yeoh, W. and Koronios, A. (2010). *Critical success factors for business intelligence systems*, *Journal of computer information systems*, 50 (3), PP.23-32, URL: <https://pdfs.semanticscholar.org/7a66/7cdb124e404be1f0152260eade99b1f8d217.pdf>.
- cxliiii. Yeoh, W., and Popovič, A. (2015). *Extending the understanding of critical success factors for implementing business intelligence systems*. *Journal of the Association for Information Science and Technology*, 67(1), 134-147.
- cxliiii. Zeng, L. Xu, Lida, S. Shi, Z. Wang, M. and Wu, W. (2006). *Techniques, Process, and Enterprise Solutions of Business Intelligence*, SMC '06. *IEEE International Conference on, Systems, Man and Cybernetics*, PP. 4722-4726.