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The mediating effect of big data analysis on the process orientation and information system software to improve supply chain process in Saudi Arabian industrial organizations

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A B S T R A C T

This study aims to investigate the nature of the relationship between Big Data Analysis as a mediator in Process Orientation (PO) and Information Systems Programming (ISP) to supply chains processes in Saudi Arabian industrial organizations. A stratified random sample of 357 managers and employees working in 37 industrial companies in Saudi Arabia was tested. The study relied on the descriptive and analytical research methodology. The results indicated that there is a significant indirect effect of Big Data Analysis (Planning, Procuring, Manufacturing, Delivering) as the mediator on Process Orientation and Information Systems Programming (ISP) and (PO) to improve supply chain process as well as organizational effectiveness. The researcher made a number of recommendations for the Saudi Arabian manufacturing firms to develop analytical capabilities in managers in order to utilize big data analysis as a tool to increase efficiency and effectiveness in the organizational system. A wide spread awareness program about the benefits to adopt big data analysis and management information systems may be adopted to ensure an efficient supply chain system.

1. Introduction

Analyzing big data helps in forming institutional knowledge and enhancing efficiency by using analytical methods to make valuable decisions and accurately predict market trends. Given the complexity of supply chain performance processes, software is usually employed to simplify and standardize operations (Dehning et al., 2007; Alkliby, 2018). How to help decision makers in the companies to make the best use of the enormous volumes of data available in the supply chain management software (Richey et al., 2016)? In many cases, companies do not utilize the acquired information to control the operation of daily business operations. Big data analysis is defined in the research (Bose, 2009) is the use of advanced analytical techniques to analyze and understand large sets of data that differ in shapes and types to make better and faster decisions or to solve problems associated with supply chain management. The use of big data analysis helps build organizational knowledge, the latent knowledge with elevated central capabilities that cannot be easily transferred because it is deeply embedded in the experiences of managers and workers or in the culture of the organization. It is also a knowledge of higher value than declared knowledge and can lead to a lasting competitive advantage, as it is difficult for competitors to imitate and helps to reduce operating costs and predict market trends accurately (Hedgebeth, 2007). Organizations that have reached a high degree of maturity in supply chain practices and have high capabilities in big data analysis are considered to be able to reduce their costs faster and achieve a higher profit margin than the organizations that have not yet matured in that field (Hoole, 2005) .Advanced levels in supply chain performance practices such as raising the levels and quality of information sharing can lead to achieving competitive advantage and improving performance (Sahay & Ranjan, 2008).

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Organizations are constantly evaluating their models to ensure predictions are correct, and developing those models they have in place to ensure correct predictions. The previous studies highlight how can it be ensured that big data analysis would actually be used to improve supply chain performance? There is a great need to focus on operations and not on jobs or tasks or activities only, because processes are the link between jobs, activities and tasks and this is consistent with the study of Trkman et al. (2007). In the sense of focusing on analyzing big data using the analysis of inter-business processes and redesigning them in a way that ensures the integration of processes between jobs and this is the essence of Process Orientation. This study seeks to demonstrate the impact of information systems software and operations orientation on the performance of the supply chain. Big data analysis data acquired through a questionnaire developed to measure this effect.

Most of the previous studies have used supply chain performance as an umbrella to analyze the impact of big data analysis on performance, and it should not be forgotten that supply chain performance is a term that has multiple meanings and includes integration between organizational units and business processes along the supply chain to coordinate information, materials and financial flows in order to meet customer requirements. Therefore, the concept of supply chain performance is still a modern concept with little consensus on its concepts (Singh & Trivedi, 2016; Singh & Trivedi, 2016). It can include all business activities in an organization. Within this sense, reference must be made to how the analysis of big data affects more accurately? The Supply Chain Performance Process Model, which is made up of the four basic processes in the supply chain (Planning, Procuring, Manufacturing, Delivering) is used as a structured approach to defining, evaluating, and monitoring supply chain performance. For the supply chain, standard terms and metrics can be used for the evaluation and implementation of the supply chain (Cai et al., 2009).

The focus is on analyzing data to predict market trends for products and services. The supply procurement system is used by the agent (Agent-Based Procurement) with purchase, search, agent negotiation and evaluation model in order to improve the process of selection of suppliers, price negotiation and assessment of supplier is a method for supplier selection and evaluation. In the field of manufacturing, the correct production of each inventory item is related not only to time, but also to the volume and quantities prepared. Finally, in delivery there are many applications of big data analysis in logistics management in order to bring products to market more efficiently (Reyes, 2005). Generally speaking, any improvement in any of the four areas leads to a significant increase in the performance of the supply chain. However, this positive impact of big data analysis needs to be mediated by support for information systems software and also by process orientation (Trkman et al., 2007).

The link between the use of information systems software and business processes is vital to achieving benefit from the efforts made, and during practice it is often difficult to separate the origin in the benefit achieved or whether it arose through the use of information systems software, or the change in the process or both together. The Internet has enabled the adoption of a new generation of operations that depend on internet technology that allows to improve business processes by documenting the organization's communications with customers, suppliers and partners (Auramo et al., 2005). Despite the clarity of the impact of these two variables, information systems software and operations orientation, there is still a need to determine the impact of each of these independent factors separately, so the effect of each independent factor will be discussed separately in the next parts of this study.

Business process re-engineering projects lead to improved business processes, increased process orientation, and improved efficiency and performance, and the analysis process is usually separate in separate areas without generally considering its effectiveness (Shang et al., 2008). This raises an important question: how can we ensure that big data analysis will actually be used to improve the operation of the supply chain? Thus, one of the hypotheses of the study has been proposed that says that the orientation of operations has a mediating effect between big data analysis and performance in the supply chain and therefore, the continuous improvement of both big data and drive operations, that improves business performance and thus improves supply chain performance.

This means that organizations that have a more operations-focused approach are in a better position to benefit from big data analysis in order to improve performance. Therefore, big data analysis systems should have a high curve in their focus on operations in order to link jobs and human resource performance. There is also a need to redesign the business and incorporate inter-organizational business processes to take advantage of the benefits that supply chain strategic planning provides. Executives must carefully analyze key business processes in order to integrate business processes to redesign them, as this merging and integration is considered a best practice in the performance of supply chains (Meixell & Gargeya, 2005).

Business processes also require that they be designed in a way that reduce the costs of acquiring and imparting information and thus, improving the capabilities of processing information. The areas of information processing in business processes can create an environment suitable for efficient storage and sharing of data and results obtained by analyzing big data. In order to enable increased information-processing capabilities, fundamental organizational changes may be required to enable decision-making. Business operations are among the last remaining points that distinguish companies, and the thing that helps improve its value is big data analysis (Davenport, 2005). In order to fully benefit from big data analysis, companies must undergo comprehensive changes in business processes, implement change management practices and focus on changing decisions related to internal activities of the supply chain and business processes (Watson et al., 2009). Managers have to lead and direct the process of change in the organizational culture and thus the use of business information, big data analysis and the decision-making process becomes ingrained in the daily work method, and thus the big data analysis is more mature, and when this process is wrong, the result of the analysis is a failure. This calls for increasing the inclusiveness of the process approach,

both internal and external integration of business processes, and internal integration can be one of the basic conditions and requirements for using big data analysis in external business processes (Popovic et. al, 2009).

Hedgebeth (2007) finds that the use of big data analysis helps to build institutional knowledge by using analytical methods to provide valuable decision-making knowledge in order to reduce operating costs and accurately predict market trends. Best supply chain performance practices, such as raising the levels and quality of information sharing, can lead to competitive advantage and enhanced performance improvement. Auramo et al.(2005) indicate that the positive impact of big data analysis needs intermediate factors through software systems.

In a research study Dehning et al., (2007) indicate that adopting information systems software works to raise the level of supply chain performance that can lead to improved financial performance through improvements in inventory turnover and lower costs. In a research (Hult et al., 2004) added that the exploitation of information to improve processes or outputs is the focus of most activities in supply chain management, while the study focused on that effective practices of the supply chain, can increase the absorptive capacity of information processing. Thus, the information processing and knowledge development process is an important precedent for supply chain efficiency.

Dale Stoel & Muhanna (2009) indicate that information systems software can increase a company's ability to process information as a whole. And, companies that have information systems with superior capabilities are better able to collect, process and assimilate external and complex information and can formulate an effective response. Accordingly, the research gap in this research lies in the impact of big data analysis as a mediating variable for information systems software and directing operations to improve the performance of supply chains.

2. Literature review and hypotheses development

Storage and analysis of big data is a real challenge for industrial companies in the Kingdom of Saudi Arabia due to the increase in data growth and this leads to the difficulty of controlling it (Al-Kalibi, 2019). Difficulties faced by organizations as a result of the diversity and inflation of data in a very complex way, therefore, dealing with big data represents a great difficulty in terms of its rapidly increasing size and in terms of the need for huge storage areas that may exceed the ability of the organizations that own this data, as well as the lack of return from this data and not to use it to improve performance of supply chain. The problem of the study is that there is a deficiency in understanding how the use of process orientation and information systems software affect the performance of the supply chain, and what is the influence of the intermediary factors that are determinants of this effect? The answer lies in big data analysis, considering the previous discussion, the following main research question and the hypotheses can be formed;

What is the role of centralizing big data analysis between employing process orientation and information systems software to improve supply chain performance of the companies?

This research tests a number of hypothesis, namely:

H1: *There is no direct, statistically significant effect of the process orientation dimensions and information support systems software on big data analysis in the fields of (planning, procurement, manufacturing, and delivery) in Saudi industrial companies.*

H2: *There is no direct, statistically significant impact of the process orientation and information systems software orientation on the supply chain performance in Saudi industrial companies.*

H3: *There is no direct, statistically significant impact of the dimensions of big data analysis in the areas of (planning, procurement, manufacturing, and delivery), on the performance of the supply chain in Saudi industrial companies.*

H4: *There is no indirect, statistically significant effect of the dimensions of the process orientation and the use of information systems software on the performance of the supply chain in the Saudi industrial companies in presence of big data analysis as an intermediate variable.*

The research variables can be summarized as (independent variables are firstly; Process Orientation and secondly; Information Support Systems Software. Supply chain performance is the dependent variable and Big data analysis is the mediating variable.

Procedural definitions to be used in this research paper can be explained as under:

Process Orientation (PO): It refers to focusing on operations and leaving a view that focuses on functionalism at the strategic and tactical levels, coordination across multiple facilities and levels (Shang et al., 2008). This variable has been measured through a set of questions related to the accurate identification and documentation of supply chain processes, operations orientation to the supply chain structure, the focus of performance operations on the overall operations, the supply chain organization that focuses on customers, jobs in the supply chain are process-oriented or specific jobs.

Information System Software (ISP): (Information System Programming) an integrated set of programs for collecting, storing, processing and transmitting information (Benaroch et. al., 2007). The information systems software variable was measured through a set of questions related to the ability of the existing information system software to support supply chain operations,

support commitment to demand, support distribution management, support the manufacturing process, support the supply process, and support the demand management process.

Big Data Analysis (BDA): (Big Data Analysis) is an approach and organizational procedures tools used in combination with each other to obtain information and analyze that information to predict the outputs of solutions to problems in any field (Bose, 2009).

Performance Supply Chain (PSC): Performance in the supply chain focuses on organizational performance and the effectiveness of supply chain performance in maintaining a competitive advantage and in making decisions and solving problems in the four areas (Planning, Procuring, Manufacturing, Delivering) (Stadtler, 2005). The performance of the supply chain was measured through a set of questions related to the respondents' perceptions of the performance, and it is represented by one component for each of the four areas of the supply chain: Planning, Procuring, Manufacturing, Delivering.

The presentation of the variables is depicted below which illustrates the constructive relationships between the variables, as the analytical capabilities (big data analysis) - the mediating variable. The research model is based on the past research (Hedgebeth, 2007; Hoole, 2005; Meixell & Gargeya, 2005), which indicated the influence of big data analysis as a mediating factor in the link between process orientation and supply chain performance. Likewise, Benaroch et. Al., (2007) also used big data as a mediator in management information systems and supply chain performance.

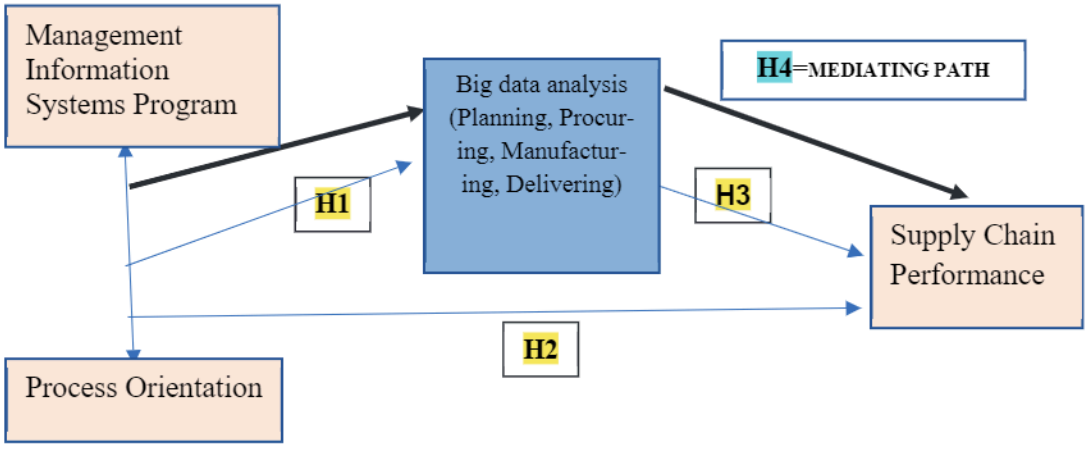

Fig. 1. The research model

3. Data collection and Measurement Test

The study used the descriptive and analytical approach based on data collection and analysis for which a questionnaire was used to collect the data from the primary sources. The study population consists of all the managers working in the administrative job sites in the industrial companies in the Kingdom of Saudi Arabia, and a stratified random sample of 37 companies was selected. The sample includes managers of companies from various industries, namely the petrochemical industries, dates, cement and iron which heavily rely on supply chains processes. The questionnaires were distributed to all the sample members from nine job sites (sales, information systems, planning and scheduling, marketing, manufacturing, engineering, finance, distribution and purchasing). Many of the respondents work in other locations, mainly in work related to the supply chain, such as "supply chain manager" or "member of the supply chain team." (420) questionnaires were distributed and (370) were retrieved with a rate of (88%) and 357 responses were found valid.

Table 1
The coefficient of stability of the internal consistency of the dimensions of the resolution (Cronbach Alpha) (n = 357)

Sr.	The Variable and Sub-elements	Number of Questions	The value of (α) alpha
1	Indicators of analytical capabilities in planning	11	0.825
2	Indicators of analytical capabilities in supply	4	0.79
3	Indicators of analytical capabilities in manufacturing	7	0.778
4	Indicators of analytical capabilities in the field of connectivity	6	0.784
5	Supply chain performance	4	0.812
6	Information systems software	6	0.768
7	Orientation of operations	5	0.837

The response rate of valid responses is acceptable (Dweekat et al., 2017). The scale used in this research was already used in various past researches including (Meixell & Gargeya, 2005; Shang et al., 2008; Hedgebeth, 2007; Hoole, 2005) which consisted of five sections: the first part related to the demographic characteristics of the study sample through (job title, years of experience, and the number of years of using information systems), the second part related to process orientation indicators, and the third part related to information systems software indicators. And the fourth section deals with indicators of analytical

capabilities - big data analysis - in the field of (planning, supply, manufacturing, and delivery), and the fifth section is related to the performance of supply chains. The scale used a Likert range from 1 to 5 in which 5=very influential and 1=ineffective such as (1 = completely disagree, 5 = completely agree). The validity and reliability of the research questionnaire was measured with Cronbach Alpha (***α*=0.79 overall)** for each scale and the results are given in Table 1.

4. Statistical Analysis and Results

The SPSS statistical program and the Structural Equation Modeling (SEM) model was used to ensure reliability of the findings (Wixom, 2018). The research question about the role of big data analysis in improving the performance of supply chains in Saudi industrial companies in presence of Process Orientation (PO) and information systems in these companies was addressed in the following Table-2;

Table 2
Arithmetic means and standard deviations for big data analysis, process orientation, information systems support, and performance in the supply chain

The dimension	Arithmetic average	standard deviation	Rank	Perception level
Analytical capabilities in planning	4.33	0.90	1	High
Analytical capabilities in supply	2.53	0.98	5	Average
Analytical capabilities in manufacturing	3.39	0.99	2	Average
Analytical capabilities in the field of communication	2.92	0.95	4	Average
Supply chain performance	1.84	0.97	7	Weak
Information systems software	2.40	1.00	6	Weak
Operations guidance	3.16	1.12	3	Average
Total marks	2.94	0.98		Average

It is obvious from Table 2 that the managers 'perceptions for analyzing big data, direction of operations, support of information systems and performance in the supply chain were average, as the arithmetic averages of the responses of the respondents reached (2.94). By analyzing the dimensions of big data analysis, it came to the planning dimension in the first related to the level of High, as for managers' perceptions of the dimensions of operations orientation, information systems support and performance in the supply chain, it was moderate in terms of operations orientation, where the arithmetic average was 3.16 in the third place, and then the information systems support, where the arithmetic average reached 2.4 with a weak level, and in the performance rank in the supply chain comes last and is weak at 1.84.

4.1 Hypotheses Testing

(H1): There is no statistically significant indirect effect of the dimensions of operations and information systems software on the analysis of big data in the areas of (planning, procurement, manufacturing, and delivery) in Saudi industrial companies. To test this hypothesis, beta values were used in the multiple regression analysis to analyze big data with its dimensions in the orientation of the processes and Table (3) shows the results of the test.

Table 3
Indirect Impact of Process Orientation dimensions on Big Data Analysis

Dimensions of Big Data Analysis (Planning, Procuring, Manufacturing, Delivering)	Beta values	Significance level
Analytical Capabilities in the Field of Planning	0.267	0.000**
Analytical capabilities in the field of Procuring	0.414	0.000***
Analytical Capabilities in Manufacturing	0.193	0.001*
Analytical capabilities in Delivering	-0.039	0.428

* Statistically significant at significance level ($0.05 \leq \alpha$)
** Statistically significant at the significance level ($0.01 \leq \alpha$)

It is clear from the Table 3 that there is a direct effect of the process orientation of the operations on the analysis of big data in the field of (planning, supply, manufacturing) only, as the beta values reached (0.267, 0.414, 0.193), respectively, with a significant level ($0.05 \leq \alpha$). This indicates the presence of a direct statistical significance. In delivering, the beta value reached (-0.39) and it is not statistically significant, so the alternative hypothesis is accepted and shows an indirect effect. Following Table 4 indicates the results of indirect impact of big data analysis on the use of information systems in Saudi industrial companies. Similarly, beta values were used in multiple regression analysis to analyze big data with its dimensions in the use of information systems.

Table 4
Indirect impact of big data analysis on the use of information systems

Dimensions of Big Data Analysis (Planning, Procuring, Manufacturing, Delivering)	Beta values	Significance level
Analytical Capabilities in the Field of Planning	0.159	0.035**
Analytical capabilities in the field of Procuring	0.247	0.033***
Analytical Capabilities in Manufacturing	0.115	0.038*
Analytical capabilities in Delivering	-0.023	0.029

* Statistically significant at significance level ($0.05 \leq \alpha$)
** Statistically significant at the significance level ($0.01 \leq \alpha$)

Table 4 values indicate an indirect effect of the dimensions of big data analysis (Planning, Procuring, Manufacturing, Delivering) beta values reached (0.159, 0.247, 0.115, -0.023), respectively with a significant level (0.05 ≤ α). Planning, Procuring and Manufacturing dimensions show a positive indirect effect whereas Delivering indicates an indirect negative insignificant effect. Given the above results, the alternative hypothesis is accepted that there is an indirect statistical significance effect at the level of significance (0.05 ≤ α) for the dimensions of information systems on the use of big data analysis in the fields of (Planning, Procuring, Manufacturing, Delivering) in Saudi industrial companies.

(H2): There is no direct, statistically significant effect of process orientations and information systems software orientation on supply chain performance in Saudi industrial companies. Table 5 shows the test results as under;

Table 5
Analysis of regression results for the direct impact of using information systems software on supply chain performance in Saudi industrial companies

The dimension	Beta values	Significance level
Process Orientations (PO)	0.509	0.044*

* Statistically significant at the significance level (0.05 ≤ a)
** Statistically significant at the significance level (0.01 ≤ a)

It is clear from the Table 5 that there is a direct effect of the use of information systems software on the performance of the supply chain, as the beta value was (0.509) with a significance level (0.05 ≤ a), it is clear that there is a strong effect of the use of information systems on the performance of the supply chain exists.

(H3): There is no direct and statistically significant impact of the big data dimensions ((Planning, Procuring, Manufacturing, Delivering) on the performance of the supply chain performance in Saudi industrial companies. To test this hypothesis, beta values were used in multiple regression analysis to analyze big data in its dimensions in the performance of the supply chain, in presence of process orientation and the use of information systems. Table 6 shows the test results.

Table 6
Analysis of the results of multiple regression of the direct impact of big data analysis on the performance of the supply chain in Saudi industrial companies in light of the presence of the orientation of the processes and the use of information systems as intermediate variables

Dimensions of Big Data Analysis (Planning, Procuring, Manufacturing, Delivering)	Beta values	Significance level
Analytical Capabilities in the Field of Planning	0.081	0.018*
Analytical capabilities in the field of Procuring	0.125	0.022*
Analytical Capabilities in Manufacturing	0.058	0.020*
Analytical capabilities in Delivering	- 0.012	0.015*

* Statistically significant at the significance level (0.05 ≤ a)
** Statistically significant at the significance level (0.01 ≤ a)

It is noticed from the Table 6 that there is a direct effect of the dimensions of big data analysis in the areas of (planning, sourcing, manufacturing, delivery), where the values of the beta reached (0.081, 0.125, 0.058, -0.012) respectively at a significance level (0.05 ≤ a). It is clear that after analyzing the big data in the field of supply, the most powerful dimensions have an impact in the use of information systems, as its beta value reached (0.12), and it possesses after analyzing the big data in the field of delivery has a negative impact, as it has a beta value of (- 0.012) meaning that after analyzing big data in the field of delivery, it negatively affects the performance in the supply chain. The above results indicate the acceptance of alternative hypothesis is accepted: There is a direct, statistically significant effect at the level of significance (0.05) for the dimensions of big data analysis in the fields of (planning, procurement, manufacturing, delivery) on the performance of the supply chain in Saudi industrial companies in presence of the process orientation and the use of information systems as intermediate variables.

(H4): There is no statistically significant indirect effect of the dimensions of operations orientation and the use of information systems software on the performance of the supply chain in Saudi industrial companies in light of the presence of big data analysis in the fields of (planning, supply, manufacturing, and delivery) as an intermediate variable.

The AMOS Version 18 statistical program was used to test the indirect effects of a process orientation and the use of information systems software on supply chain performance when mediating big data analysis in order to test the validity of error of the fourth hypothesis. It is evident from Table 7 below;

Table 7
The indirect effect exists at significance level of 0.05.

The Path Analysis	Direct	Indirect	Total Impact
Process Orientation & (MISP) → Big data analysis → Supply chain performance	0.22	0.47	0.69

* The level of significance is at 0.05.

Pictorial depiction of the results is given below in Fig. 2; information, big data analysis and decision-making process have become engraved in daily work methods. This result is in agreement with Watson et al.'s (2009) findings which indicated that, in order to fully benefit from big data analysis, companies must undergo comprehensive changes in business processes, apply change management practices and focus on changing decisions related to internal activities of the supply chain and business processes. Furthermore, the indirect effect of the dimensions of the process orientation and the use of information systems software on the performance of the supply chain in presence of the dimensions of big data analysis also found significant.

Auramo et al.(2005) also indicated that the positive impact of big data analysis as a mediating factor assisting information systems software and process orientation can improve the performance of supply chains. Procurement and increased process orientation improves efficiency and improves business performance. Big data analysis can be considered to play a mediating role in the impact of information systems software on supply chain performance. This proposed effect to support big data analysis is in line with the findings that investment in big data analysis affects improving supply chain performance by supporting information systems software for core capabilities, and an additional independent effect of big data analysis may also have on supply chain performance.

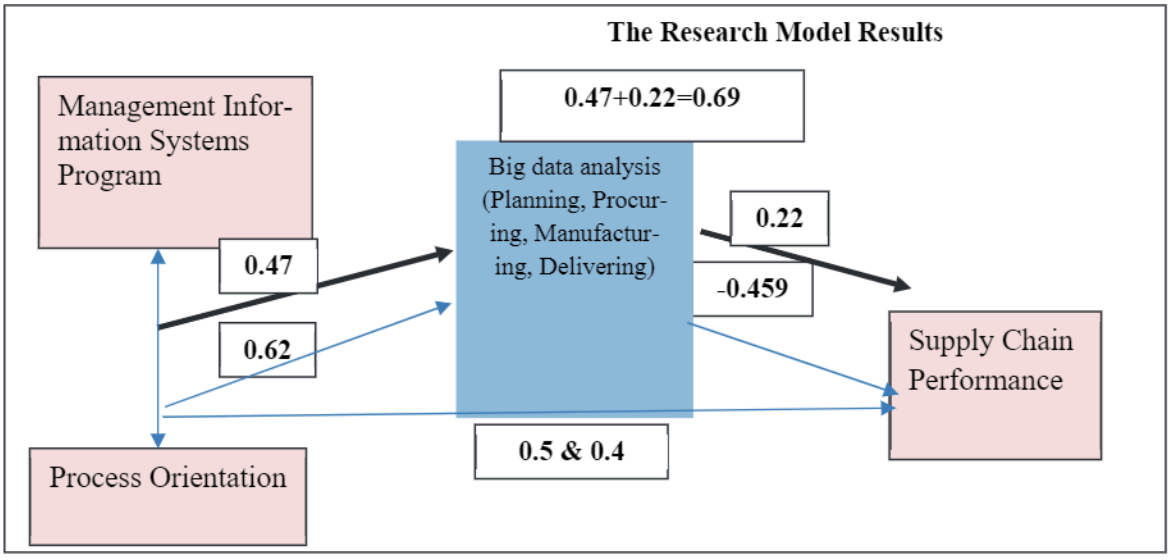

Fig. 2. The research model results

5. Discussion and recommendations

The managers in Saudi industrial companies have a narrow approach of overlooking the benefits achieved from using the big data analysis, and to employ it towards achieving desired goals such as performance and the ability to judge those dimensions. Therefore, they need to increase knowledge or employ their cognitive abilities or increase their training on how to invest in analytical capabilities and employ it as a methodology in their work in order to increase the effectiveness of the decisions they make. The findings of the research are in agreement with Sahay and Ranjan (2008) research which, indicated that many systems suffer to achieve a competitive advantage due to the absence of specific and accurate methods of measuring the realized value of the business, while this result differs with Hult et al. (2004) findings which, indicated that the process of developing knowledge about the importance of big data analysis is an important precedent for the efficiency of the supply chain. This result also differs with Hoole (2005) research that indicates the exploitation of information to improve processes and outputs is the focus of most activities in supply chain management. As for the use of information systems support, the results were inconsistent with Jothimani and Sarmah (2014) research which, indicated that decision-making in the supply chain depends on the use of large packages of internal and external data volumes, so the analysis process is only possible using the capabilities of big data analysis. Which enables the data collected in large quantities to be analyzed on a structured basis. The study indicated that there was a direct effect of statistical significance at the level of significance ($0.05 \leq a$) for the dimensions of operations orientation on analyzing big data in the fields of (planning, supply, manufacturing) in Saudi industrial companies. Business process design and increased process orientation increase with big data analysis can lead to improved supply chain performance, and both big data analysis and process orientation must mature, which leads to improved supply chain performance, and this may mean that companies that have more operational orientation These findings are in line with the previous finding in the studies of Hult et al. (2004) and Popovic et al. (2009) which highlight that big data analysis systems must have an operational curve in order to link jobs, leaving the career orientation focused on the strategic and tactical levels. There is a need to redesign the business and incorporate the inter-organizational business processes to take advantages provided by strategic planning for the supply chain, as the study by Jothimani and Sarmah (2014) indicates that executives must carefully analyze key business processes in order to integrate, manage and integrate operations. The need for industrial companies in Saudi Arabia to develop the analytical capabilities of operations managers, analyze data, and raise awareness of the benefits achieved from using the big data analysis approach as an important precedent for supply chain efficiency. This process should be undertaken by managers who have built up diverse experiences and have reached a high degree of maturity due to repeated practices of supply chain performance. This process includes redesigning processes and introducing continuous improvements from time to time whenever needed because the redesign process becomes necessary whenever the value added by activities decreases. The companies also need to support managers analytical capabilities with proper information systems in order to benefit from them in analyzing the huge volumes of internal and external data by increasing knowledge and employing cognitive capabilities by training on how to invest the existing analytical capabilities in

analyzing big data and employing it as an approach in the decision-making process. Training must be done through expert moderators in order to take full advantage of experiences and practices along the supply chain.

6. Future research

Future studies may extend an in-depth study of the impact of big data analysis and process orientation in different areas of supply chains on different measures of performance that are important in the supply chain processes such as delivery on time, quality, cost, reliability and flexibility.

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