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The impact of information technology on the effectiveness of supply chain management in the economic institution: An applied study on the ENAFOR Companies Algeria

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Abstract---This study aimed to measure the impact of information technology and its dimensions on the effectiveness of supply chains at the National Exploration Company (ENAFOR). A questionnaire was used as the main tool, and statistical processing was conducted using SPSS to carry out this study. The study population consisted of the employees of ENAFOR, with a sample of 34 individuals from various departments, focusing on administrators and employees. The study concluded that there is a strong correlation between information technology and supply chains, as information technology plays an effective role in improving supply chain management. The study also found a good level of supply chain management, as well as the application of information technology in the company under study.

Keywords---Information Technology, Networks, Supply Chain Effectiveness, Information System, ENAFOR.

Jel Classification Codes: M15; L23; M00

Introduction

Information and communication technologies have become a powerful lever for economic and social development. They are a source of continuous innovation at

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the core of the growth of the economy, especially at the level of the economic institution. Their uses have expanded at the level of the institution itself, in the various functions and roles in which the latter is active.

Among the functions that are witnessing a transformation and a great trend towards benefiting from these technologies, we find supply chain management, which is considered as the key to business operations and a source of building competitive advantage. It works on linking, interacting and integrating the various functions of the institution from knowing the needs of customers, then supplying (by ensuring quality and speed of delivery), storage and production to marketing and distribution, as it relies on planning for each stage and function and then implementing it, to ensure greater efficiency and better performance between the various functions in one institution and between the member institutions in the supply chain.

In light of these advantages offered by the great technological and digital transformations taking place in the business environment, especially the Algerian business environment, we are witnessing a great trend for most companies and institutions towards the adoption and adoption of these technologies in their various functions and operations. Among the first institutions towards this trend are petroleum institutions and institutions working in the field of energy, headed by the Algerian National Drilling Company (ENAFOR). This trend is important and necessary, but it carries with it great challenges that must be faced, foremost of which is the ability to use, apply and shift to them smoothly and quickly, followed by the challenge of benefiting from them effectively and efficiently. In light of this new trend and the challenges it poses, the features of our problem in the following question:

To what extent does the use of information technology affect the management of supply chains in the Algerian National Drilling Company (ENAFOR) in Hassi Messaoud?

To answer this problem, we put forward the following hypothesis:

There is a high use of information technology at the level of the National Drilling Corporation in its various dimensions (equipment, software, human resources, networks, databases), which ultimately leads to a positive impact on the management of its supply chains in terms of (relationship with suppliers, relationship with customers, relationship with intermediaries, level of information exchange, quality of information exchanged, operations).

1. Study objectives:

- Highlighting the impact of information technology on supply chain management in the National Drilling Corporation ENAFOR;
- Provide recommendations to the corporation on enhancing the use of information and communication technology in supply chain management.

2. Study methods and tools:

To analyze this relationship, and achieve these goals, we use a quantitative approach using two variables: information technology as a dependent variable

and supply chain management as an independent variable. we will use spss.22 program.

3. Study Structure:

This paper consists of 4 main sections including the introduction which included its basic elements in addition to the literature review on the impact of information technology on the effectiveness of supply chain management in the economic institution as well as information and communication technology used in supply chain management, Section 2 Methods and materials. Section 3 Results and discussion. Section 4 Conclusions and recommendations.

I.1. Literature review

There are many studies that have addressed the impact of information technology on the effectiveness of supply chain management. We will list them from oldest to newest. (R Derrouiche, 2006) This study aimed to identify the most important applications of modern information and communication technology used in the supply chain, as well as the role it plays in raising productivity rates, and rates of cooperation and coordination between various members of the supply chain, as it relied on the results of a study conducted by the European Commission (Entreprise DG-), in October 2001, entitled The Impact of Modern Information and Communication Technology on Supply in Commercial Enterprises.

It concluded that 90% of European institutions have invested in at least three applications of modern information and communication technology (NTIC), and that the use of modern information and communication technology affects the organizational structure of three out of four institutions. This study also found that information and communication technology contributed to reducing 8 to 10% of costs in the institution.

(A Gunasekaran, 2004) This study aimed to clarify the impact of IT practices on building competitive advantage at all stages of the supply chain through a survey of 76 industrial companies in Greece. The researchers in this study attributed competitive advantage to the capabilities that provide the necessary basis for the organization to differentiate itself from its competitors, as they relied on price/cost, quality delivery, product innovation and time to market as critical sources of competitive advantage. The study concluded that IT practices play a crucial role in creating a sustainable competitive advantage based on supply chain management.

(Mahshid Mashreghi, 2018) This study aimed to investigate the impact of information technology on the performance of the supply chain in terms of integration and flexibility of 50 automotive parts companies in a province of Iran. The sample of the study was 86 questionnaires distributed to the employees of these companies. The results show that information technology, which in this research includes the Internet, organizational network systems and the collection system, has a positive and direct impact on integration and flexibility. The use of information technology also increases the safety and flexibility of the components of the supply chain and improves communication between them.

(Niu, 2010) This study aims to provide a framework for the extent to which IT can facilitate/inhibit supply chain management. An empirical study was conducted using survey-based data collection, and a simulation model was built to investigate the mechanisms through which IT-based knowledge management activities affect supply chain performance. The study found that IT capability in the supply chain positively influences knowledge management capability in the supply chain.

The set of successive stages of production and distribution of a product from a producer's supplier to their customers' customers. That is, all the functional logistics activities repeated several times, through limited channels, during the transformation of raw materials into finished products with the addition of tangible value to them in the eyes of the customers who receive them.

I. 2. Information and communication technology used in supply chain management:

Supply chain refers to the set of successive stages of production and distribution of a product from a supplier of producers to their customers (LEFEBURE, 2005, p.08) That is, it is all the functional logistical activities repeated several times, through limited channels, during the transformation of raw materials into final products with the addition of tangible value to them in the eyes of the customers who receive them.

Supply chain management is closely linked to information technology tools and means, as the latter provides many systems and software that contribute to connecting, planning, and executing the elements of the chain, where it Supply management software allows the division of information between suppliers and customers, and in addition to helping in decision-making related to internal and external supply chains, it is a tool that helps managers improve customer service, reduce the costs of storing finished products, and gain efficiency at the purchasing level. Among the well-known supply areas are: purchasing management, order management, inventory management, and strategic planning calendar management, among this software we mention:

First: Electronic Data Interchange (EDI)

Electronic data interchange is one of the most important topics in the field of computer applications concerning the supply and procurement process. Many have agreed on defining electronic data interchange as the exchange of business-related matters and technical data within a single organization or between organizations through computers, relying on agreed-upon standards (John Gattorna, 2008, p.195)

Second: Tracking and Automatic Identification Technology:

It is based on various technologies for identifying products such as barcoding, Radio Frequency Identification (RFID), Global System for Mobile Communications (GSM), and Global Positioning System (GPS). These applications provide the advantage of real-time and regular tracking of the product, its location, and its

historical sequence. Among the most common applications used in institutional supply chains are: barcoding and RFID (Frazelle, 2001, p.296).

Third: Integrated management software (PGI or ERP)

It is commonly known by the English term Enterprise Resource Planning (ERP) which emerged in the early 1990s. Its origin was the Material Requirements Planning (MRP) systems, functioning as an information system that includes various metrics, allowing for the management of different areas within the organization. This product was developed by specialized designers (Oracle), and integrated management software is an adaptable information application to the nature of the organization, multi-dimensional and integrated for various processes in organizational management, providing a reference for standards and management principles (Reix, 2011, p.96-97).

The first global vendors of ERP are: SAP, Oracle, PeopleSoft, JD Edwards, Baan, SSA, JBA, INTENTIA, QAD, Mapics, IFS, SYMIX. Among the software available in the market today that has gained popularity is SAP, particularly in its supply chain version MYSAP SCM.

Fourth: Advanced Planning Systems (APS)

is an application aimed at the supply chain, allowing for the analysis of resource capacities and constraints to provide a detailed and flexible schedule for optimal production. It encompasses all functions of the supply chain as follows (Reix, 2011, p.96-97)

- Demand: **determines the number of products manufactured;**
- Purchasing: **checks the availability of raw materials and components according to product labels;**
- Production: **analyzes and assists in creating an optimal production plan;**
- Storage: **helps determine the necessary storage space;**
- Transportation and distribution: **rationalizes costs while ensuring the quality of service provided to customers.**

Fifth: Manufacturing Execution System (MES)

It is an information system aimed at collecting real-time production data from all or part of the production. This information is gathered and sent to execute a number of productivity activities. This system covers the main areas of production monitoring and allows all members from different departments related to production to process their areas in a single, homogeneous, and interconnected data system. (technologies, p.02) It is designed to obtain a comprehensive and immediate view of production with all its resources (materials, equipment, people), and a system for better management in manufacturing and production that responds to a set of topics or problems raised, for example (McClellan, JUNE 12-14, 2000, p.03):

- Tracking and tracing products;
- Allocating resources (materials, equipment, people) according to their conditions;
- Distributing manufacturing orders by quota;
- Quality management and statistical processes;
- Managing maintenance indicators and equipment performance, etc.

Sixth: Warehouse Management System (WMS)

It is an essential part of SCM systems, primarily aimed at controlling the movement and storage of materials within warehouses and the associated processes, including receiving, loading, shipping, and distribution within the warehouse.

It relies on the use of automatic identification technology in managing its operations, which we previously discussed regarding barcode scanning and radio frequency identification, to collect and relay the necessary information for managing the movement of products and materials within warehouses. As for the functions of this system, they include (Guide, 2024):

- Receiving, inspecting, and verifying quality;
- Renewal or repackaging;
- Labeling, shipping, and tracking;
- Inventory management, periodic counting, and physical inventory.

Seventh: Transportation Management System (TMS)

It is a program designed to process shipping and physical distribution operations. One of its features is the ability to handle the organization's network of routes, partners, and service providers, allowing for the planning and control of all physical flows used. The purpose of the transportation management system is to reduce time and cost and improve distribution channels. Among its functions are (Stanley E. Griffis, 2007, p.19):

- **Planning and decision-making:** The system determines the appropriate shipping methods based on the existing data with high efficiency. These choices depend on the importance of delivering materials to the customer.
- **Shipping tracking:** The transportation management system allows for tracking any administrative or physical information (movement of materials within warehouses related to shipping, such as specifying the shipment's location in detail from point A to point B, including customs declarations, receiving goods, invoices, and shipping reservations, sending alerts about shipping situations (delays, accidents, unexpected stops, etc.);
- **Measurement:** It must include a KPI performance matrix to issue necessary performance reports.

Eighth: Customer Relationship Management (CRM)

Customer relationship management is a marketing term that is an integral part of integrated management software that manages all relationships with customers. The customer relationship system encompasses several areas: managing marketing attachments, sales force information, daily customer relationship tracking via the web, call centers, etc. (RENI LEFEBURE, 2005, p.54) CRM is considered a strategic center for the customer that uses software tools to improve the organization's profitability and customer satisfaction, as well as its relationship with other institutions and supply chain systems, aiming to provide a complete view of the organization's activities and operations. CRM applications aim to perform the following functions (AYERS, 2001, p.175)

- Direct customer contact management;
- Customer historical sequence;
- Collecting information from data mining extracted from customer trends;
- Supporting decisions related to sales campaigns, etc.

Among the key components in its back office are: supply chains, human resources, accounting, and finance.

Ninth: Supplier Relationship Management (SRM)

is a complementary approach that monitors operations in the organization with the institutions that market goods and services to it. The goal of this system is to improve the effectiveness of operations between the organization and its suppliers, similar to CRM, which pertains to supplier relationships. Its aim is to enhance the relationship with suppliers and increase the efficiency of operations related to purchasing and materials processing (PwC, 2013, p.07).

Tenth: Vendor Managed Inventory (VMI)

is a delegation granted by the supplier to its customers to monitor the inventory of materials and goods supplied to them. This process requires extreme accuracy in information about estimates and transparency of information among partners, as well as synchronization in the transfer of information.

II- Methods and Materials:

The study relied on a descriptive-analytical approach, where a questionnaire was used as the primary tool for collecting the necessary data for the study. The questionnaire was designed based on previous studies and theoretical literature, and it included three parts as follows:

Part One: Statements measuring the information technology variable in all its dimensions used in this study;

Part Two: Statements measuring the supply chain management variable;

Part Three: Includes general and demographic information about the study sample, which included the following variables: gender, age, job, and professional experience.

After completing the formulation of the questionnaire, it was distributed to a random sample of employees and managers. The National Exploration Institution, where approximately (40) questionnaires were distributed, and (34) valid questionnaires for use and analysis were retrieved, which represents the final sample size of the study. Table (01) illustrates the demographic characteristics of the study sample. The collected data was processed using the (22spss) program, relying on the following statistical methods:

- 1- Cronbach's alpha coefficient for measuring reliability;
- 2- Descriptive statistics measures to describe the study sample and show its characteristics, including frequencies, percentages, means, and standard deviations to answer the study questions and rank the statements of each variable in descending order;
- 3- The Kolmogorov-Smirnov test to examine the nature of the distribution of the dependent and independent variables;
- 4- Correlation matrix to understand the correlational relationships between the independent and dependent study variables;
- 5- Regression analysis to test the validity of the study model and the effect of the independent variable on the dependent variable (Supply Chain Management);

6- T-test and One-Way ANOVA analysis to test the effects of personal variables on the dependent variable.

The reliability of the questionnaire statements was verified through Cronbach's alpha coefficient as shown in Table (02). From the table, we notice that the Cronbach's alpha coefficient for the Information Technology scale was estimated at 0.949, indicating that 94.9 percent of respondents would remain consistent in their responses if retested, which indicates the reliability of the scale. The Cronbach's alpha coefficient for the Supply Chain Management scale reached 0.956, meaning that 95.6 percent of respondents would remain consistent in their responses if retested, indicating the reliability of the scale. The results reflect an excellent level of confidence and reliability, suggesting a high degree of stability in the questionnaire results

III- Results and Discussion:

The results of the study showed that there is a good level of usage and significant interest from the institution in information technology elements represented in its main dimensions (equipment, software, human resources, networks, and databases). After reviewing the results presented in Table (03), it is clear that all dimensions came with a high percentage, with an overall average of (2.75) indicating a high rating. The highest element is the equipment (2.89), while the average for human resources was (2.45), which is the lowest average among the elements. This indicates that the institution possesses modern technology and provides its employees with the necessary training to manage it periodically.

The results obtained in this study also indicated that the level of interest of the institution under study in the dimensions of supply chain management and its implementation and application is high and sound, particularly concerning the dimension of relationships with suppliers, customer relationship management, intermediary relationship management, the level of information exchange, the quality of exchanged information, and operational aspects.

After analyzing the study results, we noticed that the institution under study is concerned with managing relationships with customers, as the intensity of competition drives it to focus on customer satisfaction and work to gain their loyalty by increasing trust, commitment, continuous communication, and addressing their problems. We also observed that the institution is interested in strategic partnerships with suppliers and diversifying them, but to a greater extent, in order to enhance work quality and build strong relationships with suppliers. The institution is also concerned with the quality of exchanged information due to its importance in decision-making, as well as the operations and the level of information exchange, which indicates the development of the information and communication systems used. The communication used coordinates between various stakeholders. As for the relationship with intermediaries, we observed a moderate interest in this aspect since the institution focuses on direct dealings, which is due to the nature of the work in the institution.

We also found that the mean level of supply chain management, through the aspects of the relationship with suppliers, customer relationship management, relationship with intermediaries, level of information exchange, quality of exchanged information, and operational aspects, in the institution reached 2.43, indicating a high degree as shown in Table (04).

Regarding the impact of adopting and using information technology in supply chain management, it was measured through correlation analysis. The results presented in Table (05) show that the linear correlation coefficient between information technology and supply chain management is (0.721), indicating a strong positive correlation between the two variables. The accuracy in estimating the dependent variable is (0.519), meaning that (51.9) percent of supply chain management is attributed to the impact of information technology, while the remaining (48.1) percent is due to other factors affecting supply chain management.

From the previous results and based on the analysis of linear regression variance between the information technology variable and supply chain management, as shown in Table (06), the following can be deduced:

- The total sum of squares for regression is 2.987, the total sum of squares for residuals is 2.766, and the total sum of squares is 5.754;
- The degrees of freedom for regression is 1, and the degrees of freedom for residuals is 32;
- The mean square for regression is 2.987, and the mean square for residuals is 0.086;
- The value of the ANOVA test for the regression line is 34.557;
- The significance level of the test is 0.000, which is less than the significance level of the null hypothesis of 0.05.

We can accept the study's hypothesis which states that: there is a high use of information technology at the level of the National Exploration Institution in various dimensions (equipment, software, human resources, networks, databases), which ultimately leads to a positive impact on supply chain management in terms of (relationship with suppliers, relationship with customers, relationship with intermediaries, level of information exchange, quality of exchanged information, processes).

IV- Conclusion

This study has addressed the posed problem and tested the validity of the presented hypotheses, using various statistical methods and techniques, after discussing the theoretical and practical literature on the subject and its main variables, followed by a field study on a sample of employees of the National Exploration Institution aimed at measuring the level of adoption and use of information technology in the institution, focusing on the following dimensions (equipment, software, human resources, networks, databases). The level of quality in supply chain management within the institution was also measured, focusing on the following dimensions (relationship with suppliers, relationship with customers, relationship with intermediaries, level of information exchange, quality of exchanged information, processes). The results indicated a strong trend

towards the use of information technology and an effort towards investing in acquiring various technologies as well as training on the proper utilization of these technologies as significant challenges in this context. It also showed that there is an acceptable level regarding supply chain management in its various dimensions, and there is diligent work by the staff and supervisors to improve the performance process of supply chain management. Accordingly, the study recommends that the institution continues to recognize the concept of technology information technology and the necessity of applying it, which gives it greater flexibility in facing challenges, especially in using and benefiting from it, especially those related to improving the performance of the supply chain in all its dimensions and elements.

Recommendations:

Based on the results of this study, we Suggested some Recommendations:

- Continuing to pay attention to all dimensions of supply chains, which are the method that links and interacts between the various functions of the institution and builds strong relationships with customers;
- Continuing to provide technical and technological support teams of workers and specialists in implementing data collection and analysis operations, as they are components of the infrastructure of this technology;
- Train employees and develop their skills by providing training programs to enhance employees' skills in using technology.
- Supply Chain Sustainability: Adopting environmentally friendly practices and using technology to improve efficiency and sustainability.

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Appendices:

Table (1): the demographic characteristics of the study sample

Statement		Frequency	Percentage%	Statement		Frequency	Percentage%
Gender	Male	29	85.9	The scientific qualification	Specialized formation	5	14.5
	female	5	14.7		University formation	24	70.6
Total		34	100		Postgraduate	5	14.7
age	30<	2	5.9	Total		34	100
	30 to 40	13	38.2	Job title	Deputy Director	02	5.9
	40 to 50	11	32.4		Head of department	06	17.6
	<50	8	23.5		employee	26	76.5
Total		34	100	Total		34	100

The Source: Prepared by the researcher based on SPSS.22

Table (3): Reliability coefficient using Cronbach's alpha Coefficient

Scale	Number of Statement	Cronbach's Alpha Coefficient
Information Technology	25	0.949
Supply Chain Management	35	0.956

The Source: Prepared by the researcher based on SPSS.22

Table (4): Mean, standard deviation, score and rank of the IT variable

Dimensions	Rank	Mean	Standard Deviation	Score
Equipment	1	2.89	0.37	High
Software	2	2.83	0.42	High
Human Resources	5	2.45	0.52	High
Networks	4	2.79	0.42	High
Databases	3	2.80	0.40	High
Information Technology		2.75	0.35	High

The Source: Prepared by the researcher based on SPSS.22

Table (4): Mean, Standard Deviation, Score and Rank for Supply Chain Management

Dimensions	Rank	Mean	Standard Deviation	Score
Supplier Relationship	4	2.39	0.50	High
Customer Relationship	5	2.35	0.48	High
Intermediary Relationship	6	2.32	0.55	Average
Information Exchange Level	2	2.53	0.51	High
Quality of Shared Information	3	2.43	0.54	High
Processes	1	2.56	0.51	High
Supply Chain Management		2.43	0.42	High

The Source: Prepared by the researcher based on SPSS.22

Table (5): Linear correlation coefficient between information technology and supply chain management

Model	Correlation Coefficient (R)	Determination Coefficient (R-squared)
A. Independent Variable: Information Technology B. Dependent Variable: Supply Chain Management	0.721	0.519

The Source: Prepared by the researcher based on SPSS.22