THE IMPACT OF THE INTERNET OF THINGS ON THE STRATEGY OF VALUE CHAIN (AN APPLIED STUDY ON A NUMBER OF INDUSTRIAL FACTORIES)

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ABSTRACT *This study aimed at identifying the impact of the internet of things on the strategy of value chain (an applied study on a number of industrial factories) in Yanbu Industrial zone. The study population consisted of (250) employees working in (23) factories in Yanbu Industrial zone in the kingdom of Saudi Arabia, of those working in different industrial sectors according to the companies' manual issued by the Saudi industrial development fund in (2021). The study sample consisted of (250) workers in information technology, production, sales, marketing and supplies in (23) factories. In order to achieve the study objectives, the researcher developed (5) hypotheses. The study depended on an inquiry list developed by the researcher to collect the primary data. The study used Cronbach alpha to verify the reliability of the study scales, while the methods of path analysis and structural equation modeling (SEM) were used to test the study hypotheses and the study model. The results showed that there is a positive impact of the internet of things on the strategy of value chain for the investigated Saudi industrial organizations.*

Keywords:Internet of Things, Strategy of Value Chain.

INTRODUCTION:

The internet of things resulted in more development in the technology of grid computing which has become possible due to the availability of several factors, including computers and micro sensing devices, where mixing those types of devices results in a distinctive and unfamiliar future domain. Therefore, the technique of the internet of things is considered as one of the most important technological concepts during the latest years.

The internet of things is a concept that has been cited since the late 1990s, and several definitions confirm the various domains of this issue. According to [1], the internet of things can be described as a novel model that is characterized by speed within the context of modern cordless communication. Researchers suggested that the main idea for this concept is based on the existence of a set of things or entities, such as the defined relationships for the radio frequencies, remote sensing devices and mobile phones, and other entities that can interact and cooperate to achieve the shared objectives. 27]defined the internet of things as the interconnection of the daily cordless network, that is often well-equipped everywhere. The internet of things is also considered as a part of the future internet, which is viewed as a dynamic global network that depends on interconnected standardized communication protocols; in this vein, the physical and hypothetical elements have hypothetical characteristics and use intelligent interfaces that are well-integrated in the information grid. In short, the main idea for the internet of things is based on assuming that the daily things that are provided by appropriate sensing devices can make connections to implement certain tasks [26]

THE STUDY PROBLEM:

The current era is characterized by the regular development and updating in the various domains. Indeed, information institutions are amongst the entities that are interested in constant development, since they always aim to cope with the technological developments and invest in the advantages of those developments in a way that improves and enhances the information services provided to users. In fact, users have many choices and methods to gain information away from the usual information institutions which, in turn, urge those information institutions to invest

in any technological development and investigate the possibilities of using it in developing their mechanisms and providing their customers with the required information appropriately and in the suitable time[3, 12, 20].

The internet of things allows the possibility of connecting things and transferring data using sensing devices which, in turn, enables these things to interact with each other and open more communication channels among people. Given the importance and characteristics of the internet of things in the various domains of the human activity, including the work strategy for the value chain during the latest years, organizations seriously thought of the methods of making advantage of the internet of things applications. Therefore, this study aims to identify the impact of the internet of things on the strategy of value chain.

THE STUDY OBJECTIVES:

In addition to responding to the study hypotheses, this study aims to:

- Identify the impact of the internet of things on the strategy of value chain.
- Contribute to enriching the Arabic thought productivity about the topic of the internet of things in the strategy of value chain.
- Highlight the suitable applications of the internet of things concerning the strategy of value chain.
- Demonstrate the methods and mechanisms that organizations can use to make advantage of the internet of things.

THE STUDY IMPORTANCE:

The importance of this study lies in highlighting the most important correlation domains between the internet of things in the strategy of value chain- a domain that only received a little attention by researchers. Therefore, it is necessary to address this topic and demonstrate the domains of benefit from the internet of things in advocating the strategy of work

related to value chain in organizations. Also, the results of the current study are expected to improve the services provided by organizations, where they could become more dynamic and interactive. The study results will also contribute to enriching the theoretical and cognitive domain about this topic.

THE THEORETICAL FRAMEWORK:

The topic of the internet of things received a wide investigation, where authors suggested the possibility of applying the internet of things applications by information institutions, especially in relation to services and administration. The processing in this topic started in 2011; however, the conducted Arabic studies in this domain are still few. The most important studies cited in this domain are:

The role of implementing the internet of things in inventory management and its importance in supply chain. The results revealed that the internet of things provided all the elements within inventory management with the ability to communicate and interact with each other through (FRID) technique and sensing networks. This, in turn, created a big amount of data and transformed them into information that helps in the process of decision making. The results revealed that the internet of things improved the system of inventory management by tracking products, predicting demand, obtaining information in the actual time after each process and reducing the human errors. [7] suggested that the internet of things contributed to improving the system of inventory management through efficiency and speed in satisfying customers' needs and getting rid of the jobs that waste the value within inventory. Also, the integration of the information required for the constant updating of the inventory status improved the management of requests and the accuracy in tracking the product.

In the same vein, [8] suggested that any organization with inventory should focus on four main requirements for inventory management, these are efficiency, speed, accuracy, and security. It is difficult to save these requirements in the light of using the traditional methods of inventory management. Therefore, implementing the technique of the internet of things improved inventory management through the mechanism of inventory management system in order to achieve the auto control, provide data in the suitable time, and send them to the database to store and process them. [13] designed a suggested frame to develop a primary model for the program of supply chain to facilities in South Africa. The study aimed to the capacity of (FRID) technique and (WSN) networks related to enabling communication between things and the possibility of transferring the generated data across the Internet. The results revealed that the process of data-access has become easier after implementing the internet of things. As for the potentials of the technique of the internet of things in updating the management system of value chain and smart inventories, [16, 25, 4] suggested that the objective of communication between things to control inventories lies in providing and exchanging data in the suitable time based on intensive sensors that have the ability to capture, collect and transfer data in the appropriate time across the Internet which, in turn, makes it smarter. In this vein, these data provide decision makers with the required flexibility, allow them to track the activities in inventories, and improve the management's vision concerning the product's cycle.

[17, 22, 2] conducted a study which aimed at identifying the main role played by the internet of things in storing, sensing and processing data and its ability to analyze and process data, conclude ideas from them and improve the effectiveness of energy consumption.

[21, 24] proposed a new frame for the integration of the internet of things with cloud computing, given the rapid growth in value chain. The results revealed that the cloud storage has a high ability to store and analyze data and access them from a remote distance. Therefore, the cloud computing as a service adds value to the facilities applying the internet of things by saving the storage capacity and processing power to help in the processes of control and analysis which, in turn, enables the organization to establish strategies to develop the processes and manage risks.

THE STRATEGY OF VALUE CHAIN:

Digital economy has an effect on networks; therefore, it was important to understand how organizations can make advantage from the opportunities provided by digitization. In order to obtain an organized structure for that, it was necessary to find a model for value chain that represents the basic process in creating value for customers. Indeed, digitization affects the various elements of creating value, as it affects productivity more than any other thing. However, we shouldn't overlook the organization's activities that support establishing value, and how those activities can make advantage from the achievements of digital industry.

The value chain represents the structure that an organization develops to reduce costs and identify the various instruments used to facilitate and implement its strategy [15].

Value chain is also used to identify the basic processes and resources, where it represents power and logic that are necessary for improvement, and provides opportunities to developthe competitive advantage [14]. The concept of value chain [19] suggested that we can't consider the company's competitive advantage in general, in that we should understand the company's internal structure; i.e. how the elements of individual activities contribute to offering products and services to customers in the least prices and highest quality. Indeed, one of the possible functions for the approach of value chain is "organizing the activities inside the networks and finding the source of competitive advantage related to the different value chains in the various industries, where these value chains are established by each company working in the same industry. Furthermore, the structure depends on the company's strategy, the way of implementing the strategy and the traditions adopted by companies in that industry. The value established by the chain represents the amount of the product or service. Therefore, the price should exceed the cost and understand the service that is based on value, and this is the basis for maintaining the company's strategy.

THE COMPONENTS OF VALUE CHAIN:

The method of value chain is based on dividing the company into a number of activities about establishing value, where these activities can be classified into primary activities and supporting activities, as follows:

*The primary activities: these are five activities:

- Internal supplies: these are the activities related to receiving, storing, and delivering the required inputs for the product, and includes handling materials and inventories, and control over inventories.
- Production: they are activities related to transferring inputs to products, and includes operating machines, collecting, packing and maintenance of machines.
- External supplies: these are the activities related to collecting, storing and distributing products to customers, and includes storing ready products, handling materials, as well as the processes of implementation and scheduling of requests.
- Marketing and sales: these are the activities related to providing the methods for motivating the customer to buy the product, and includes advertising, promotion, salespeople, and public relationships… etc.
- Services: these are the activities related to offering services by supporting or maintaining the value of the product, and includes after-sale services, correction, training, and spare parts.

*The supporting activities, and includes four activities:

-The basic infrastructure: it includes activities, such as administration, legal aspects, financing, strategic planning, as well as all the other basic and supporting activities to operate the value chain as a whole.

-Managing the activities of human resources: these are necessary activities to ensure the processes of hiring, training and developing the workforce, and includes: all the activities relating to human resources, and thus the activities of human resources management are prevalent across the whole cycle.

- Technological development: they are the activities relating to the design of the product as well as the way of performing the various activities within the value cycle, and includes the required technological inputs, procedures and knowledge for each activity related to the value.

-Supply: these are the activities related to obtaining the necessarily-purchased materials, either as raw materials, services or machines. In this way, this function penetrates through the whole value cycle, since it supports each activity in the case of purchasing.

THE STUDY HYPOTHESES:

The main hypothesis: there is a statistically significant impact for the internet of things on the strategy of value chain at (0.01):

The first sub-hypothesis: there is a statistically significant effect for data-collection in the strategy of value chain at (0.01).

The second sub-hypothesis: there is a statistically significant effect for the system of tracking and control in the strategy of value chain at (0.01) .

The third sub-hypothesis: there is a statistically significant effect for data-sharing in the strategy of value chain at (0.01).

The fourth sub-hypothesis: there is a statistically significant effect for the sensors of the internet of things in the strategy of value chain at (0.01).

The fifth sub-hypothesis: there is a statistically significant effect for the inserted data in the strategy of value chain at (0.01).

THE STUDY METHODOLOGY:

In order to achieve its objectives, the study used two approaches. The first one is the analytical descriptive approach to identify the features of the problem, describe it scientifically, and refer to the relevant literature and previous studies to cite the theoretical framework and make comparisons. The second approach is the field survey, which was used to cover the applied domain of the study, answer the study questions, test hypotheses, and determine the relationships between the variables using the appropriate statistical analysis based on (SPSS v. 20) and (PLS).

Testing the validity and reliability of the study instrument:

The reliability of the study instrument was verified by calculating the instrument's correlation coefficient based on the suitable statistical equations. The researcher used Cronbach alpha, where the correlation coefficient of the study instrument was calculated and had a high level of reliability, with a value of (0.89);indicating a high reliability for the scale.

POPULATION AND SAMPLING

The population size of this study consists of (23) factories, with totality of (250) employees, working in information technology, production, sales, marketing and supply. Yanbu industrial city was chosen, since it was originally constructed to be an industrial city. manual issued by the Saudi industrial development fund in (2021)

The appropriate sample size for a population size of 250 is 152. According the recommended [18], as suggested by [23], sample size . In order to lessen sample size error and putting into consideration the occurrence of non-response by some respondents, the sample size was increased by 40 percent of the required size as suggested by [23]. Therefore, the sample size of this study had become by (152 + 60 = 212). Hence, 212 questionnaires distributed to the targeted. was 200 questionnaires were retrieved. the Valid questionnaires for analysis 196 questionnaire.

TESTING THE HYPOTHESES:

In order to test the study hypotheses, the researcher used smart PLS-SEM, where the linear and causal models are tested theoretically using multivariate analysis methods from the second generation, and unknown sets can be modeled using the methods of (Bootstrapping). The significance level is tested using the values of (T) and (P).Seven hypotheses were tested in this research. Table (1) shows the results of testing the hypotheses.

Table (1) The results of testing the hypotheses

Path	Std Beta	StdError	T-value	p-value	R	R^2
The Internet of Things in the value chain strategy	0.663	0018	2.354	0.000	0.992	0.782
Data collection in the value chain strategy	0.221	0.092	3.416	0.000	0.745	0.721
Tracking and control systems in the	0.365	0.078	1.994	0.000	0.845	0.716
Sharing data in the value chain strategy	0.243	0.068	2.596	0.000	0.836	0.694
The Internet of Things sensors in the	0.121	0.031	1.973	0.000	0.980	0.717
The inserted data in the value chain strategy	0.516	0.010	2.413	0.000	0.849	0.821

Source: developed by the researcher based on the outcomes of smart PLS Table (1) revealed that all the (T) values are above (1.97), and (P) values are less than (0.05) at a significance level of (0.01). This indicates that there are statistically significant causal relationships that allow testing the main and sub hypotheses between the variables, where the hypotheses stated:

The main hypothesis: there is statistically significant effect on the chain value strategy at (0.01). This hypothesis tests the impact of the internet of things on the integration of chain value strategy, where the effect of the internet of things is high. (T) value was (2.354), indicating a high degree of confidence of more than (99%). Accordingly, we accept the hypothesis, (p, 0.663= P<0.01).

- The first sub hypothesis: there is statistically significant effect of data collection in the chain value strategy at (0.01). This hypothesis tests the impact of data collection in the chain value strategy, where the effect of data collection is high. (T) value was ,(3.416)indicating a high degree of confidence of more than (99%). Accordingly, we accept the hypothesis (p, 0.221= P<0.01).
- The second sub hypothesis: there is statistically significant effect of tracking and control systems in the chain value strategy at (0.01). This hypothesis tests the impact of tracking and control systems in the chain value strategy, where the effect of tracking and control systems is high. (T) value was (1.994), indicating a high degree of confidence of more than (99%). Accordingly, we accept the hypothesis (p, 0.221= P<0.01).
- The third sub hypothesis: there is statistically significant effect of sharing data in the chain value strategy at (0.01). This hypothesis tests the impact of sharing data in the chain value strategy, where the effect of sharing data is high. (T) value was (2.596), indicating a high degree of confidence of more than (99%). Accordingly, we accept the hypothesis (p, 0.221= P<0.01).
- The fourth sub hypothesis: there is statistically significant effect of the internet of things sensors in the chain value strategy at (0.01). This hypothesis tests the impact of the internet of things sensors in the chain value strategy, where their effect is high. (T) value was (1.973), indicating a high degree of confidence of more than (99%). Accordingly, we accept the hypothesis (p, 0.221= P<0.01).
- The fifth sub hypothesis: there is statistically significant effect of the inserted data in the chain value strategy at (0.01). This hypothesis tests the impact of the inserted data in the chain value strategy, where their effect is high. (T) value was (3.555), indicating a high degree of confidence of more than (99%). Accordingly, we accept the hypothesis (p, 0.221= P<0.01).

CONCLUSION:

Undoubtedly, we can say that the internet of things has the potential of creating better interactive solutions, with the advancement in technology, and it will result in a big difference in the way through which value chain operates. Also, the internet of things will guide the manufacturing and supply chains towards the path of digital transformation, and will continue changing the processes of value chain alongside with the increased clarity of the advantages of integrating the internet of things in the existing processes. Moreover, many organizations will extend the capabilities of the value chain to be more effective, productive and sustainable, and achieve the concept of digital chain value in the digital economy system in the future. The internet of things is considered as one of the most promising techniques that control the integration of chain value strategy that contribute to the success of any industrial organization. Therefore, the internet of things attracted the attention of many organizations which seek to improve their performance and reputation, and thus attract more customers and achieve more profits. The challenges will emerge with the transformation of the product's value chain in the future, where the distinction between products will be too important for manufacturers. In this vein, manufacturers will need effective developmental abilities in terms of cost in order to cope with the rapid changes. If value chains were administered properly with regard to implementing and integrating the systems of the internet of things, companies will become more flexible and cope well with the rapidly-changing industrial context. The companies that invest in the techniques and instruments of the internet of things will achieve more success in the future. Indeed, the solutions of the internet of things will enable companies to come up with new innovative services more quickly and with less risks to customers. The internet of things will allow permanent competitive advantage, and provide the value chains with more ability to manage their processes in a better way, beginning from production, up to delivering the products. Also, this technique provides the data related to machines, vehicles, inventory and digital automation in the appropriate time. Additionally, the Internet of things gives more opportunity to solve problems before they affect partners and customers.

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