



Integrating Nanotechnology into Digital Supply Chain to Increase Productivity and Reduce Environmental Pollution

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One of the most important factors that play a significant role in the distribution, shelf life and sale of goods is packaging. Currently, new technologies, such as nanotechnology, have come to the help of packaging experts, to play an important role as one of the important links in the supply and distribution chain, in maintaining and maintaining the quality of materials, improving the health of consumers, and improving production. Nano technology can be used in cases such as increasing resistance to penetration in coatings, increasing wall properties (mechanical, thermal, chemical and microbial), increasing heat resistance, expanding antimicrobial surfaces. In this article, the types of packaging whose characteristics have been improved by using nanotechnology are discussed regarding the role they can play in the food supply and distribution chain. In recent years, the increasing growth of communication has brought the countries of the world closer together, on the other hand, the environmental pollutions that have arisen as a result of the quality and type of human production and consumption are among the issues that have been repeatedly addressed by the organization active in this field as a threat They are known to mankind. Some of the industries have taken the necessary steps to reduce the destructive effects on the environment by applying measures. One of these measures includes the digital supply chain. In this way, the development of the environment of marketing activities requires the use of environmental-social responsibility maps of organizations. Due to the importance of this topic, the aim of this article is to examine the impact of the digital supply chain on the organization's social, economic, and environmental performance. Therefore, the present research in terms of the goal; It has been applied, it is in the category of descriptive survey research. The sampling method is simple random sampling using a questionnaire, the Cronbach's alpha was calculated as 0.987. The statistical community includes all managers and employees of 8 industrial organizations in Iraq. The results showed that the digital supply chain with an environmental approach can reduce environmental problems while increasing the company's productivity and lead to the production

of green products.

Keywords: Nanotechnology, Nano sensor, nanocomposite, Digital supply chain, Productivity, Reducing environmental pollution, Industrial companies.

1. Introduction

Nano and green management is one of the topics that can lead to the growth and improvement of factory productions in accordance with environmental laws with the efforts of university researchers. The present research is about the relationship between Nano and reducing costs and environmental crimes, which is one of the topics of green management and is usually carried out by manufacturing companies in the effect of environmental pollution is created. The foundation of environmental economics and prevention of environmental anomalies in industries was established during the 1960s. The origin of this new approach dates back to the beginning of the first modern wave of green thinking and its political perceptions in developed countries, which is known as environmentalism [1]. The meaning of promoting pollution is the process of growth, reproduction and invasion of environmental pollution in different places, and in this article, it means the positive entropy that happened in the sustainable supply chain of the cement industry due to the occurrence of undesirable outputs and the emergence of bad environmental conditions. . Accordingly, in this article, the important indicators of the sustainable supply chain of this industry are identified, and by considering their importance and prioritization, the emergence and promotion of environmental pollution can be prevented. The three main processes (extraction, processing or production and consumption) all involve the production of wastes that are ultimately returned to the environment (air, water or land). The presence of a lot of waste in the place, the traditional production process and the lack of attention to social issues in the production and operation process will cause biological changes in the environment, which themselves cause damage to animals, plants and the ecosystem [2]. The main goal of environmental sustainability is to create a balance between economic activities and environmental effects by considering all their costs and benefits [3]. In Iraq, based on Article 59 of the Fourth Development Plan Law, the necessity of calculating environmental values and costs and including these values and costs in the feasibility process of development and industrial plans, or in other words environmental economics, has been emphasized [4]. The business environment of current societies is such that it has forced organizations to turn to new managements such as supply chain management for survival and continuous development in search of gaining competitive advantages [6]. But these complex spaces have caused many problems for both organizations and human society. To solve these problems, organizations have been led to use new management methods. One of the new models of environmental management is green supply chain management, which was coined as a common scientific and managerial term [7] to describe a hierarchical control system for materials, information and financial flows in a multidimensional network. The potential of independent decision-making institutions was introduced.

Sustainability management is defined as strategic business activities for minimizing environmental, economic and social sustainability risks, maximizing corporate value,

including shareholder value in the supply chain, and consequently environmental economics [8]. In [9] pointed out that competitive priorities in a sustainable supply chain [6] refers to the goals of production units that enable companies to compete, achieve proven capabilities for operations and strengthen the company's competitive advantage. In [10] stated that dynamic flexibility in operations is a competitive requirement for companies in managing the environment and achieving a sustainable supply chain. In [11] noted that sustainable development in supply chain management is not only a limiting factor but also an approach to improve performance. This affects the company's competitive power and the organization of its supply chain. In sources related to sustainable supply chain management, greening the supply chain increases efficiency and synergy between partners and facilitates environmental performance, reducing waste and saving money. Therefore, sustainable supply chain management requires the combination of economic, environmental and social perspectives of business operations [12]

Many studies propose comprehensive sustainable supply chain management frameworks. For example, [13] attempts to address sustainable supply chain management including product design, material sourcing and selection, manufacturing process, product delivery. Final to the customer and end-of-life product management after useful life. In [14] presented a sustainable supply chain management framework and made assumptions based on resource dependency theory, transaction cost economics, population ecology, and the resource-oriented perspective of the firm to consider the key dimensions of support that are required to carry out operations. Sustainable supply chain management has been proposed. The goal of sustainable supply chain management is to ensure that suppliers work with social and environmental requirements and expectations and that the environmental economics framework is respected.

This work is often extensive, complex and challenging. The innovation of this article is that it deals with the sustainable supply chain from four dimensions and identifies related indicators and proposes the ranking method in order to implement these indicators and measure their effectiveness. One of the strategic industries of the country, which has a very important contribution to the development and plays a role in the environmental cycle, is the cement industry, and for this reason, it is necessary to examine its position in the environmental economy and rank its sustainable supply chains. Because the pollution released from these industries will be the most important reason for the occurrence and promotion of pollution. The purpose of this research is to identify the effective performance indicators in the sustainable supply chain of the industry, which can be prevented to a large extent from the occurrence and promotion of environmental pollution by paying full attention to them. And secondly, determining the degree of importance of these indicators and ranking the supply chain of industries. To achieve this goal, factor analysis approach and decision making technique are used. Therefore, in this article, we seek to improve the performance of the sustainable industrial supply chain by carefully studying the previous studies and benefiting from the above integrated approach, and the weight of the indicators and the ranking of the supply chains of the active factories based on their activities in Identify a sustainable supply chain. One of the new technologies that has attracted a lot of attention from industrialists in recent decades is nanotechnology. The purpose of this research is to investigate the effects of nanotechnology on the value chain in the

environmental issues of manufacturing companies. The findings indicate that there is a significant relationship between nanotechnology and environmental concerns. In this research, a questionnaire was used to collect information, and to document the results of the statistical analysis and to analyze the questions and assumptions, to present the final solutions, the researcher used the statistical method using SPSS software, and at the end, the interpretations and conclusions of the research and a series of suggestions have been proposed.

2. Method

The direct and indirect effects of nanotechnology on the environment and air pollution can be investigated from different aspects. The use of this new technology is very wide. Today, in the world, nanotechnology is referred to as a key and influential technology on science, technology and industry. Nanotechnology uses various sciences and technologies such as physics, chemistry, biology and bioengineering. These actions include; Green marketing can be environmentally friendly. With the concept that the development of the environment and marketing activities, the use of environmental-social responsibility maps of organizations for the purpose of sustainable development. The measures that organizations should take in their activities in distribution, advertising, production, pricing where there is, that is, products should be examined in ways that minimize environmental damage, and customers' behavior environmentally friendly driving. These methods and consequences are examined in this study [5].

The ecological goal in designing products leads to reducing the consumption of resources and pollution and increasing the survival of scarce resources. In [8] defines green packaging as the outer layer of the product that protects the product from spoilage, allows efficient distribution, and the packaging environment. It creates comfort, and increases durability in the store, makes easy use possible, informs the consumer and helps the products to be in a competitive place. The digital supply chain process is illustrated in figure 1.

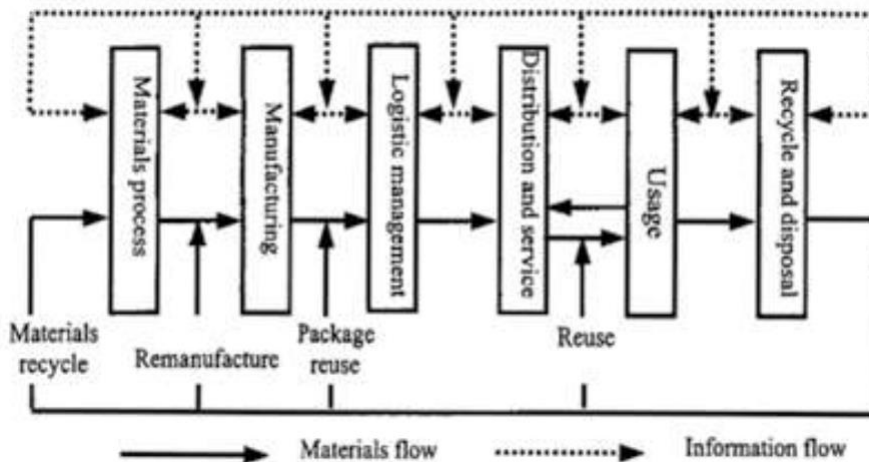


Figure 1: digital supply chain procedure

The current research is classified as a survey descriptive research in terms of its application goal and research method. The information was collected by library and field method. The simple random sampling method was collected using a standard questionnaire in the form of a Likert scale. The statistical community also includes all managers and employees of 10 industrial companies in Iraq. In order to determine the number of samples, Cochran's formula was used; Based on Cochran's formula, the required statistical sample size was determined to be 440 cases.

Multiple-selection queries and a 5-nodes Likert scale were utilized to determine the variables. Also to being a standard data collection tool, it has been used to ensure more of a logical narrative method (by professors and other experts available). In this article, after the preliminary study (pilot) in one example 25 people and the queries return. The obtained data are entered into Spss software and it was determined that the article queries are highly reliable, since the observing the Cronbach's alpha, the amount of this factor for the standard queries is generally equal to 0.987. Distribution of queries and factors and their Cronbach's alpha is stated in table (1)

Table 1: Distribution of queries and factors and their Cronbach's alpha

	Variable	questions	series of Cronbach's alpha	Combined reliability
1.	Economic	1-8	0.912	0.601
2.	Social	9-11	0.903	0.791
3.	Performance	12-14	0.889	0.801
4.	Green shopping	15-17	0.893	0.623
5.	Green production	18-22	0.922	0.689
6.	Green Marketing	23-25	0.933	0.723
7.	Digital distribute	26-27	0.904	0.803
8.	IoT-AI	28-29	0.881	0.755

For analysis and inferential analysis of the paper data and in order to examine the impact of multiple independent factors on the dependent ones, the structural equation model approach was employed in the SmartPialas (PLS) software Factor loading coefficients are 0.4 [9] in the present article, it is obvious from table (1), factors indicate the appropriateness of this criteria.

3. Results

Toxic gas absorbent nanotubes

Carbon nanotubes are the first generation of nano products that were discovered and released to the world in 1991. These pipes are very long and thin and have stable, resistant and flexible structures. Nanotubes are the strongest known fibers and are up to 100 times stronger than the unit weight of steel and can replace ordinary ceramics, aluminum and even

metals in the construction of airplanes, gears, bearings, machine components, medical devices, sports equipment and industrial food production devices. Recent studies suggest that carbon nanotubes be used for biological purposes such as crystallization, proteins, and making bioreactors and biosensors.

According to extensive research, carbon nanotubes are the most suitable means for absorbing toxic pollutants such as dioxins and other pollutants in the exhaust gas from the chimneys of incinerators. Dioxin-type toxic substances are generally a byproduct of many industrial processes, which, while being very stable, cause long-term pollution of air, soil, water, and finally the food chain of living organisms. Some dioxins are carcinogenic and many of them cause disturbances in the human immune system. Although many countries have strictly controlled the production of this material in recent years, its environmental hazards are still considered threatening. Although carbon nanotubes are the most suitable means for absorbing toxic pollutants such as dioxin, they have a very high price.

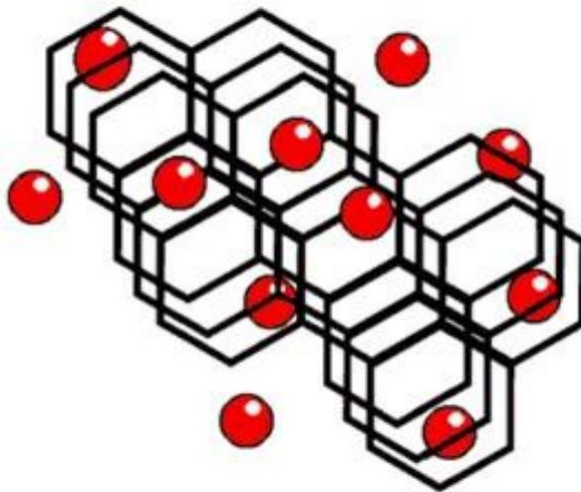


Figure 1: Nanotubes performance in Toxic gas absorbent

In structural equation model approach in AI-PIs, three factors of convergent, reliability, validity and divergent were employed to control the fitness of model. Regarding the [12], reliability in the PLS approach is determined utilizing factor loading parameters, Cronbach's alpha factor and integrated reliability. The hidden factor and the linked manifest factor analyzed the procedure of path and links of each variable.

The fitting of the structural equation model approach employing T-test is such that these factors of t-test must be higher than 1.95 to be able to approve their significance at the 95% confidence level. Figure (2) depicts that all the links among the model variables are approved and their link are significant.

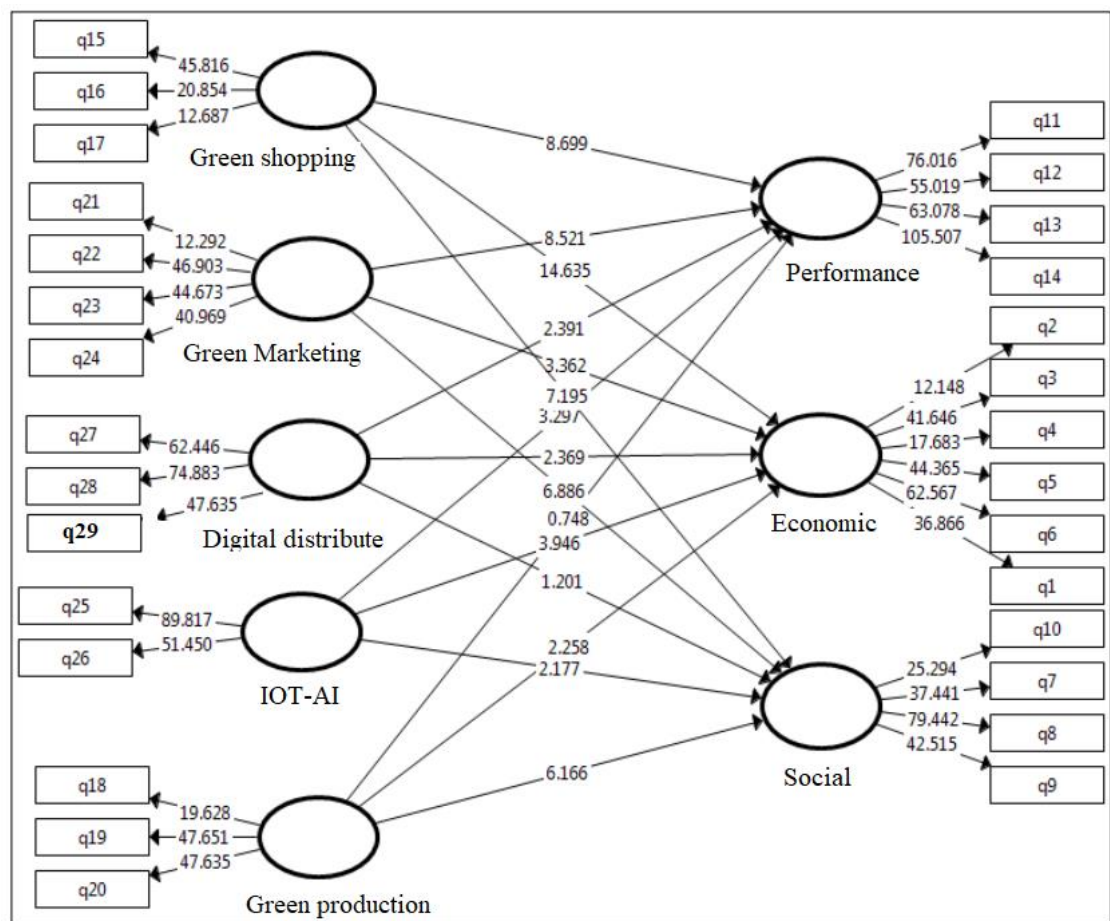


Figure 2. T-test results

4. Conclusion

According to the results of the research, the implementation of policies to reduce air pollution has an effect on increasing security with the use of nanotechnology, and the reduction of air pollution and security has a significant and positive relationship with the mediating role of nanotechnology. Also, reducing air pollution and increasing security, reducing air pollution and nanotechnology, nanotechnology and increasing security have a significant and positive relationship. During the last three decades, the amount of public attention to environmental issues has increased significantly. In this regard, one of the important issues is to identify indicators related to environmental sustainability issues in supply chains by Nano technology. Undoubtedly, paying attention to the forward-looking approach and increasing awareness of environmental protection and pushing this important issue in all production and industrial activities and drafting laws and regulations around this issue has caused commercial and industrial organizations to be more Pay attention to the optimal use of resources and reducing environmental pollution. Undoubtedly, paying

attention to these considerations will bring better profitability and work efficiency for these organizations in the long run. In this article, the environmental impact indicators that lead to the phenomenon and promotion of pollution in sustainable industrial supply chain by Nano technology from production (nanotubes) and packaging (Nano products) were identified and industrial supply chains were ranked based on them. Accordingly, in this article, 42 industrial factories were selected as case studies and evaluated. In this evaluation, 4 important levels of sustainability, strategic, process and operational were determined as the basis for selecting key performance indicators. 36 indicators were selected for confirmatory factor analysis with the studies conducted. The results of the factor analysis led to the selection of 8 effective indicators in order to rank the sustainable supply chains of this industry. According to the understanding of the stable supply chain situation, each of these factories can identify their strengths and weaknesses and try to avoid weak factors and indicators and put themselves in normal and suitable conditions. Meanwhile, part of their energy should be spent on maintaining the factors and indicators that are still in a favorable condition. However, in order to achieve a sustainable environmental economy, supply chains are the first factor that industries should pay attention to in order to have less undesirable output. Managers of these industries should focus on the fact that the best catalyst in any industry is the sustainable supply chain of that industry. It is hoped that in the macro and strategic plans of the Ministry of Interior, attention will be paid to the rational economy of the environment based on a sustainable supply chain. According to the indicators determined in this article and determining the importance of each of them, it is suggested to rank and evaluate the performance of the sustainable supply chain with other models. The practical suggestions of the current research are presented below:

These industrial companies should be very careful in choosing their suppliers. Because the raw materials used in their production products can play an important role in creating pollution. Also, the Nano materials products and raw materials that are prepared can be recycled. Less toxic and harmful substances for the environment and society should be used in them. The purchase of green and environmentally friendly primary products which integrated by Nano technology can lead to the improvement of the environmental, economic and social performance of these two organizations in the automotive industry. On the other hand, they should make the issues related to the environment the model of their work and teach the employees about environmental issues and environmental protection. If these industrial companies pay special attention to the quality of their work, they will pay attention to environmental issues even in their agenda. In the matter of using consumables and energy, they should make the necessary savings so as not to harm the environment by integrated digital supply chain and Nano-technology.

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