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THE ROLE OF SMART MANUFACTURING IN PROMOTING GREEN MARKETING: AN EXPLORATORY RESEARCH IN THE UNION COMPANY FOR FOOD INDUSTRIES LTD. IN BABYLON

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ABSTRACT

The research aims to identify the role of smart manufacturing in promoting green marketing at the Union Company for Food Industries in Babil Governorate, and in order to achieve this, the dimensions of smart manufacturing were adopted (operational cognitive intelligence, operational technological intelligence, smart manufacturing environment, operational environmental intelligence), The dimensions of green marketing were also adopted (abolishing or reducing the concept of waste, redesigning the product, clarifying the relationship between price and cost, making the environmental orientation profitable), and Al-Ittihad Company for Food Industries Limited was chosen as one of the largest and most advanced food industry companies in Iraq and one that follows production methods Al-Haditha is an exploratory and analytical field for research by distributing a questionnaire that included (90) respondents from the administration managers and heads of departments and divisions and their units for the research sample factories. The research concluded with a number of recommendations, the most prominent of which was the need to employ the dimensions of the independent variable, smart manufacturing, in enhancing the positive impact relationship between it and the dimensions of the dependent variable, green marketing, within the industrial sector, and in line with continuing to create products of strategic value for industrial enterprises and achieve Environmental sustainability by keeping abreast of developments and seizing opportunities to ensure continuity, growth and survival in the labor market.

Keywords: smart manufacturing, green marketing.

INTRODUCTION

Today, business organizations are facing technological challenges using methods, machines, and means of production that are unprecedented in development and modernity. On the other hand, environmental problems and the climate have increased, and it has become pressure on individuals and organizations by giving climate great importance to avoid more negative climate changes. Therefore, smart manufacturing played an important and pivotal role in modern industrial organizations and many other practices. Technology for these organizations by providing a smart environment and integrating knowledge with operational intelligence to produce products with unique and advanced technical and technological specifications to meet the needs and desires of customers on the one hand. It is related to the obligation to use environmentally friendly techniques and mechanisms to achieve environmental sustainability

in its operations and in order for organizations to achieve sustainable competitive advantage due to their consideration of environmental aspects.

2. METHODOLOGY

2-1 Research problem

The current research problem can be formulated in the form of questions as follows:

a. What is the level of availability of the dimensions of the independent variable, smart manufacturing, in the researched organization?

B- What is the level of availability of the dimensions of the approved variable, green marketing, in the researched organization?

c. What is the nature of the relationship between the current research variables, which are smart manufacturing and green marketing?

T. What is the nature of the impact of smart manufacturing in green marketing?

2-2 Importance Of Research

The importance of the research can be traced from the nature of the variables dealt with in the current research, namely smart manufacturing and green marketing, both of which represent two variables; They are very important and necessary for any modern organization that seeks to achieve renewal and keep abreast of rapid global and local developments and issues that occupy global, regional and local public opinion alike, which are climate changes, environmental sustainability and taking into account environmental aspects, as well as its pursuit of growth and prosperity and ensuring the continuity of its existence in a competitive environment characterized by many challenges. Uncertainty and instability, and the main problem of the research lies in the extent to which the surveyed organizations are aware of the importance and role of smart manufacturing and how to invest and employ their technical and human capabilities to promote green marketing to achieve environmental sustainability. The solution to the problem lies by answering the following questions:

1- What is the nature of the relationship between the research variables, which are smart manufacturing and green marketing within the work of the researched organization?

2- Is there an impact of smart manufacturing in achieving the elements of green marketing?

3-2 Research objectives

The current research seeks to achieve the following:

a. Identifying the interest of the research sample organization in the dimensions of smart manufacturing.

B. Determine the level of interest of the management of the organization, the research sample, in the importance of applying green marketing.

T. Identify the nature and type of relationship and measure the level of influence that links the two research variables.

Research hypothesis

According to what was mentioned in the research problem and in order to achieve the objectives envisaged by it, the following main hypothesis H0 was formulated: (There is no significant effect

of smart manufacturing in green marketing), and four sub-hypotheses branch out from it, namely:

• There is no significant effect of smart manufacturing after eliminating or reducing the concept of waste.

• There is no significant effect of smart manufacturing in the dimension of product re-design.

• There is no significant effect of smart manufacturing in the dimension of clarity of the relationship between price and cost

• There is no significant effect of smart manufacturing in the dimension of making the environmental approach profitable

The second main hypothesis, H1: (There is a significant effect of smart manufacturing in green marketing), and four sub-hypotheses branch out from it, namely:

• There is a significant effect of smart manufacturing after eliminating or reducing the concept of waste.

• There is a significant effect of smart manufacturing in the product redesign dimension.

• There is a significant effect of smart manufacturing in the dimension of clarity of the relationship between price and cost

• There is a significant effect of smart manufacturing in the dimension of making the environmental approach profitable.

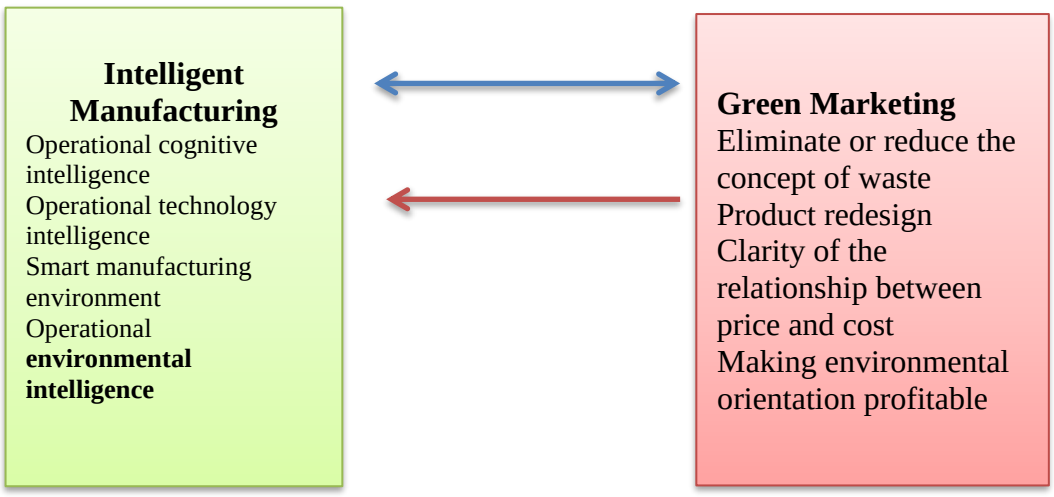
5-2 Research Limits

Temporal limits: The time limits of the research extended from December 2022 to June 2023.

Spatial boundaries: The spatial boundaries were represented by Al-Ittihad Company for Food Industries Ltd. in Babil Governorate.

Human limits: The research sample included (a random sample) of the administration managers and heads of departments, divisions and units of the company, the research sample, and (90) questionnaires were distributed, while the number of retrieved and valid forms for analysis reached (81) forms, i.e. with a retrieval rate of 90%

The Hypothetical Scheme For The Research Variables



The first topic - the theoretical framework of the research

First: Intelligent manufacturing

Concept Of Smart Manufacturing

The roots of manufacturing in the modern era go back to the past half century. The great progress has been made in computer-operated machine technologies, as this technology eventually led to automation technology in manufacturing, whereby tools are operated automatically by computer programs instead of human operators, and materials and components are transported by systems Automated material handling and storage in automated storage and retrieval systems. Depending on the scope and degree of automation of the manufacturing floor and the integration of different functional areas of production, various terms have been used to describe automation in manufacturing since the 1980s, ranging from flexible manufacturing cells and flexible manufacturing systems to computer integrated manufacturing and intelligent manufacturing. The latter term was coined around 1990 with the establishment of The Journal of Intelligent Manufacturing and the publication of the book Intelligent Manufacturing Systems (Kusiak, 2018:509), since the inception of Industrial Revolution 4.0 in 2012, emerging technologies have made it possible to obtain volumes of data from sources as diverse as automated tools, powerful and affordable sensor systems with advanced information models, and data sources. Other within Smart Manufacturing Systems (SMS). As a result the amount of data available in manufacturing settings has exploded, allowing data-hungry tools such as artificial intelligence and machine learning to be leveraged. Time series analysis has been successfully applied in a variety of industries, and that success is now being carried over into applications for pattern recognition in manufacturing to support higher quality products, flawless manufacturing, and improved customer satisfaction. However, the diverse landscape of manufacturing presents a challenge for success in solving problems in industry (Farahani et al, 2023:1). One of the goals of the Fourth Industrial Revolution aims to change manufacturing models from automation to intelligence due to the huge demand for quality, productivity, safety, efficiency, sustainability and reliability in various industries. Industrial fields (Juma, 2023:27), smart manufacturing is an approach to manufacturing that includes advanced technologies such as artificial intelligence, the Internet of things, the use of robots, as well as big data analytics to improve production processes and increase efficiency. Therefore, the complexity of the production environment is rising dramatically, and the tasks involved in manufacturing are becoming increasingly specialized (Soori et al, 2023,2). The application of agile production is necessary to implement smart manufacturing technologies, and this does not exclude that smart technologies can mediate the relationship between agility. And performance at the same time and in essence and necessarily mean within this context because a certain level of smart technology implementation cannot exist without a certain level of lean implementation (Bokhorst, 2022:2), there is no generally accepted definition of smart manufacturing. According to the National Institute of Standards and Technology (NIST), smart manufacturing is an integrated system of collaborative manufacturing that responds in a timely manner to meet demands and meet changing conditions in the factory, in the supply network, and in customer needs. Smart manufacturing integrates modern manufacturing assets with sensors, computing platforms, communication technology, and modeling. Data-intensive, control, simulation, and predictive engineering. Intelligent

manufacturing uses the concepts of cyber-physical systems, the Internet of Things (and everything), cloud computing, service-oriented computing, artificial intelligence, and data science. Once implemented, these overlapping concepts and technologies will make manufacturing the hallmark of the next industrial revolution (Kusiak, 2028:509). Mass production to customization, where technological developments led to paradigm shifts throughout history known as the industrial revolutions when mechanical manufacturing facilities that operate with water and steam were introduced called the first industrial revolution, and when work was separated from mass production it was introduced with electricity called the second industrial revolution) and the industrial revolution The third was characterized by electronic systems, information technology, and manufacturing automation, while the fourth industrial revolution was characterized by the growth of the Internet of Things, and over the past 200 years of human history, the rate of industrial revolutions in operations increased, and with each industrial revolution, the complexity of production methods increases (Abdullah et al, 2023: 1).

Importance Of Smart Manufacturing

Nowadays, value creation in knowledge creation based organizations has become a factor of increasing interest. It is due to the need to face the various changes created in the environment, especially at the level of technology. This is why formal intelligence systems have been stabilized because of their diversity. This is in order to identify internal capabilities and environmental changes through data transformation with knowledge of strategic value. Among the types of intelligence that have begun to be implemented are competitive, economic, organizational, commercial, and technology. Although there are slight differences among them, they are particularly directed towards the same goal: to enhance the competitive advantage of organizations. It mainly consists of dynamic systems of negotiation that the sect relies on its sources of information and specific goals [5]. In this way, technological intelligence emerges with (Castellanos, 2010: 1). Intelligent manufacturing systems (SMS) are software systems that identify opportunities for automating manufacturing processes using IoT devices and services connected to machines. The active challenge of SMS is to meet the ever-changing conditions of industries, supply networks, and needs. Customers (Ochoah et al, 2023:1), in order to maintain their competitiveness, companies are constantly searching for new concepts that can improve important performance in their industry. Including manufacturing techniques combined with the principles of lean production (Bokhorst et al, 2022: 1), and to improve industrial sustainability, cleaner production has become increasingly important in industrial organizations and manufacturing process flows. Productivity incurs high energy costs and causes severe environmental pollution. Therefore, continuous improvement in energy efficiency can provide it and greatly improve its competitiveness. With regard to this, the implementation of sustainability in smart manufacturing is imperative in achieving the required sustainability and efficiency (Ma et al, 2022:2). Sustainable smart manufacturing, which is a model that integrates data analytics with modern information to support operations and decision-making with the ultimate goal of achieving a response to dynamic markets and includes improving economic and environmental aspects and improving

intelligence in decision-making (Alkan Chinnathai & Alkan 2:2023, 2023). In smart manufacturing, information technology is used Advanced manufacturing technology to improve the production situation in general, as well as contribute to enhancing production efficiency, quality, and service level for the entire industrial production chain (Chen et al, 2023:1). new opportunities. This is enabled by taking advantage of innovative technologies such as artificial intelligence (Giacomo et al, 2023:1 De).

Requirements for setting up smart manufacturing

Among the basic requirements for establishing smart manufacturing are: - (Ismail: 110, 2023)

A - Full integration of heterogeneous software and hardware systems within an organization, a virtual organization, or across a supply chain.

b. An open system architecture to accommodate new subsystems (software or hardware) or decommission existing subsystems "on the fly"

C - Efficient and effective communication and cooperation between departments within the institution and between institutions

D - the embodiment of human factors in manufacturing systems

C- Rapid response to changes in external demand and unexpected disturbances from the internal and external manufacturing environments

h) Full tolerance at the system level and at the subsystem level in order to detect and recover from system failures and minimize their effects on the workflow environment

Dimensions Of Smart Manufacturing

- **Cognitive Operational Intelligence** : Smart manufacturing (SM) is described as "the dense application of data and information technology at the store floor level and above to enable smart, efficient and responsive operations. The three basic principles of smart manufacturing are connectivity, virtualization, and the use of data at its core. Smart manufacturing combines Operations technology (OT) and information technology (IT) to obtain data through sensor systems and advanced data analytics to improve manufacturing processes or the supply chain level in general, product and process information and data (Lenz, 2023:2), and the focus on managing changing demand is consistent with common definitions Fluid intelligence, which is defined as involving "deliberate but flexible control of attention to solve new, 'immediate' problems that cannot be implemented by relying solely on pre-acquired habits, schemas, and scripts" (Birney & Beckmann, 2022: 2).
- **Operational Technology Intelligence:** Smart Manufacturing (SM) is a modern manufacturing model whereby machines are fully networked, supervised by sensors, and monitored by advanced computational intelligence to enhance system productivity, product quality, and ensure sustainability while reducing costs. The recent development of the Internet of Things provides artificial intelligence and related technologies to enhance solutions to improve modern manufacturing, and the adoption of new technologies in the manufacturing sector leads to improved data collection and processing at various stages of manufacturing (Haricha et al, 2023:1), and smart manufacturing includes many technologies, Including but not limited to Cyber Physical Production Systems (CPPS),

Internet of Things, Robotics/Automation and Big Data Analytics and Cloud Computing to achieve the vision of a data-driven connected supply network. Special focus on human ingenuity in accomplishing the required actions, and humans cannot simply be replaced by artificial intelligence, but their capabilities are enhanced (Thoben et al, 2017:6).

- **Intelligent Manufacturing Environment:** Intelligent manufacturing development is an effective mechanism for fault diagnosis that can accurately identify, diagnose, isolate, and recover abnormal operating conditions. Therefore, it receives fault detection, diagnosis, and prediction in a more intelligent way (Yan, 2023:1), and from this a framework is presented that combines between big data analytics, additive manufacturing, and smart sustainable manufacturing technologies. Its framework, named Sustainable and Intelligent Additive Manufacturing based on Big Data (Chinnathai & Alkan, 2023:2), offers an integrated system smart manufacturing system with a self-contained ability to adapt to unexpected changes such as changing market demands, technological changes, social needs, etc. However, intelligent production systems consist of sub-systems such as automatic production systems (technological, supervisory, transportation) and the sub-systems must be equipped with auxiliary means, which give specific sub-systems a certain level of intelligence that can be considered as a higher stage of flexible production systems. (Rajput et al, 2012: 3).
- **Operational Environmental Intelligence:** Operational intelligence is always carried out in the context of a set of objective facts that represent the conditions and climate in which the operation is carried out and a final limit is achieved closer or further through the management of operational intelligence, as is the case in the final limits set that are possible to achieve and how to reach them (Manojlović et al, 2011:194), and business process intelligence improves the operational efficiency necessary to achieve business goals, as well as facilitating the acquisition of competitive advantage. Since the organization is a group of business operations, the operations in one business process affect or are related to business operations. other. Thus, from the point of view of operational intelligence, insights from one business process may have its origin or effects on the performance of some other business processes (Kaula, 2020:1).

Green Marketing

Concept Of Green Marketing

Green marketing is well recognized as a broader concept by the scientific community and is defined in various ways throughout the world. Polanski (1995), in his research, defines green marketing as the marketer's attempt to develop strategies that target consumers who care about environmental aspects. Green marketing has also been described as the organized efforts to design, promote, price and distribute products that will not harm the environment in the first place. The overall management responsible for identifying and anticipating meeting the needs of customers and society in a profitable and sustainable manner. The green consumer is the focus of this type of marketing. The green consumer can be defined as the person who avoids any product that may harm any life of any organism or/and cause environmental degradation during the manufacturing process or During the process of use, a large amount of non-renewable energy is consumed (Osman et al, 2016:2), along with the Go Green campaign that is being promoted on the community, the term is called green

consumption and according to Smith (Retnawati 2011), in the long run In the long term, the goals of companies and marketers were focused, in addition to achieving profits, on many marketing strategies and policies to encourage consumers to buy green products. Besides, environmental movements have greatly influenced consumer behavior patterns, environmental concerns, and green products so many companies are now using different media platforms to advertise their products to attract untapped customers and invest increasingly in green marketing (Nekmahmud et al, 2022:2) The application of new marketing techniques amplifies the opportunities for marketing managers to obtain and understand market data, and thus make more informed decisions. At the same time, the challenges of the infinite data set complicate the decision-making process and require a lot of cognitive effort when pursuing meaningful and correct interpretations to reach appropriate conclusions (Nordin & Ravald, 2023:2), that green marketing enhances consumer awareness through social and environmental values, word-of-mouth campaigns and dissemination of information related to quality of performance and companies that have a green marketing strategy have transparent and collaborative corporate performance and are committed to sustainability and treat stakeholders like allies and with this kind of transparent corporate communication and collaborative performance and building Community trust may directly lead to brand success (Sandoval et al, 2022:3).

Reasons For The Emergence Of Green Marketing

Since the 1970s, many prominent scholars have promoted the use of persuasive marketing tools and customer understanding as a means of increasing the adoption of sustainable consumption behaviors and offering environmentally friendly and ethical products that can reduce threats from climate change, resource depletion, pollution, and resource inequality (Olson, 2022:1). And Ellen MacArthur warned that if the world does not change course, by 2050 there will be more plastic in the sea than fish. Undoubtedly, plastic plays an important role in everyday life because it is an affordable and versatile material. However, plastic (more than 90%) is produced from fossil fuels and its lack of decomposition causes serious environmental problems (Confente et al 2020:1). Environmental pressures have made it imperative for manufacturing companies to incorporate sustainability into their operations and policies to gain support from stakeholders. These companies must adhere to regulations and policies that promote environmental sustainability Stakeholders expect companies to provide functional value, sentimental value, and societal value Consumers consider environmental impact of products and tend to favor environmentally conscious brands The Global Green Procurement Report reveals that at present approx. Of the consumers, 67% are aware of environmental issues and about 54% consider aspects of environmental sustainability in consideration, including product packaging, when making purchasing decisions. Therefore, environmental sustainability is a central concept for consumers, and companies can apply it in their value proposition to gain a competitive advantage. Therefore, companies must include environmental issues in their strategies and comply with environmental standards in their value proposition (Ismail et al, 2023:2). For entrepreneurship" and with regard to marketing that respects environmental standards more, the professional literature uses several terms such as "green", "organic", "ecological"

or "ecological marketing", and these terms tend to be used as synonyms for green marketing (Majerova, 2015: 2).

Importance Of Green Marketing

The importance of marketing emerges as one of the strategic areas that companies can use to achieve current and future social welfare and respect for the environment compatible with their operations. Green marketing focuses on developing and marketing products and services that meet customer needs, taking into account environmental sustainability, which allows building a bridge between what markets, customers and environmentally friendly companies want (Simao & Lisboa, 2017: 2), that the future of business depends on primary and consequential compliance with sustainability. The term "sustainability" is widely used across various disciplines, including engineering, social sciences, liberal arts, sciences, and various business sectors, which provides a long-term future vision that focuses on It builds on ethical values and principles and directs harmonious and responsible actions to integrate environmental, societal and economic objectives. Each discipline defines sustainability based on its contribution to the common goal of a sustainable future. Sustainability has merged with marketing and extended to operational and social issues, and it follows a complex approach and adapts to the changing needs of sustainability (Jung & Kim, 2023:2).

Dimensions Of Green Marketing

- **Eliminate Or Reduce The Concept Of Waste**: green consumption is defined as "the use of individual consumer preferences to promote products and services that are less environmentally harmful". The interesting thing about this definition is that green consumerism arises from the individual consumer's awareness and formation of preferences towards the product they want to consume (Soelton et al, 2020:2). Customers are now familiar with terms such as ozone-friendly, eco-friendly, recycled materials and green products. Due to the perception of the high value that customers associate with the concept of green marketing, green marketing trends (GMS) have developed among companies that want to maintain their competitiveness in their own business. Many organizations are working to increase the environmental footprint of their business activities. Some organizations have achieved this by including features Environmentally friendly products and services. In addition, green marketing is a philosophy that involves expanding promotional activities that draw attention to environmentally friendly products and services (Fahmi, 2023:269).
- **Re-Concept Of Product Design**: green marketing is the marketing of products that are supposed to be environmentally safe. Thus, it includes a wide range of activities, including product modification, changes in the production process, packaging changes, as well as modification in advertising in a way that does not harm the environment. However, defining green marketing is not a simple task, as several meanings intersect and contradict each other. The definition of green marketing refers to a process Selling products and / or services based on the benefits of their environment, and this product or service may be environmentally friendly in it, or be produced and / or packaged in an environmentally friendly manner (Bukhari, 2011:375).

- **Clarity Of The Relationship Between Price And Cost:** green marketing is defined as "the effort a company makes to design, promote, price and distribute products in a way that promotes environmental protection." Therefore, green marketing is part of the major movements in modern business sustainability although their primary concern has always been revenue And profits and companies that focus on the natural environmental balance in their entire operations are more environmentally friendly while maximizing profits, as they reduce environmental pollution, preserve natural resources and protect the environment. Thus, they gain a unique competitive advantage and develop new markets as they improve the image of their companies, their reputation, and the image of their products from the consumer's perspective (Suki et al, 2016:2). Green advertising and marketing includes the development and promotion of services and products that meet customers' desire and need for quality, performance, reasonable prices, and convenience without the need for Harmful inputs to the surrounding environment, and the main challenge for companies and customers these days is to defend the earth's natural and limited resources, as the production and consumption of products around the world has led to the emergence of a wide range of environmental problems (Gill et al, 2023:6613).
- **Making The Environmental Orientation Profitable:** the goal of green marketing is to meet the needs and desires of customers and to preserve the long-term social and environmental gains that can be gained through the effectiveness of green marketing. And building a new market and the growing concerns of humanity can be met by companies by adopting strategies that constitute supportive and environmentally friendly resources in the entire steps of the company's value chain (Zulfiqar & Shafaat, 2015:115).

practical side

The Union Company for Food Industries Ltd. in Babylon was selected as a research community. The sample size was (90) workers distributed among the departments, divisions and departments of the factories. As (90) questionnaires were distributed, and the number of retrieved forms was (81), where the response rate was 90%.

stability of the questionnaire: The stability is about the consistency of the research scale and the stability of the results that can be obtained from the scale over a different period of time, and the structural stability of the measurement tool is verified by the Cronbach alpha coefficient.

Table (1) Metrics used in the research with (Cronbach alpha) values

The variable	Cronbach's alpha value of the variable	Dimensions	Cronbach's coefficient Alpha for all after
Intelligent manufacturing	0.909	Operational cognitive intelligence	0.898
		Operational technological intelligence	0.890
		Intelligent manufacturing environment	0.878
		Operational environmental intelligence	0.881
Green marketing	0.820	Eliminate or reduce the concept of waste	0.733
		Product redesign	0.712
		Clarity of the relationship between price and cost	0.825
		Making the environmental orientation profitable	0.814

Source: Prepared by the researcher based on SPSSV25

Through table (1), we notice the (Cronbach alpha) values that measure the stability of the scale, and it is clear from the table that all the values for all axes of the questionnaire were greater than (60%), which is the least statistically acceptable value in scientific and human research, and this indicates that the measurement tool is characterized by consistency and inner stability.

The practical side of research

This topic includes two paragraphs, the first includes a description and diagnosis of the research sample's opinions about its variables, while the other includes (testing hypotheses). It will be dealt with as follows: -

First: Description And Diagnosis Of The Research Sample's Opinions About Its Variables:

This research attempts to describe and diagnose the opinions of the research sample about its adopted variables, as well as presenting the data shown by the questionnaire and analyzing the sample responses regarding the independent variable, smart manufacturing and its dimensions (operational cognitive intelligence X1, technological operational intelligence X2, smart manufacturing environment X3, operational environmental intelligence X4), and the dependent variable, which is green marketing and its dimensions (canceling or reducing the concept of waste (Y1), redesigning the product (Y2), clarifying the relationship between price and cost (Y3), making the environmental approach profitable (Y4). Frequency distribution tables for the research variables were prepared and approved for the purposes of the statistical analysis process to obtain the weighted arithmetic means, standard deviations, and percentage weights to find out the intensity of the answer achieved from the point of view of the sample members, and the hypothetical arithmetic mean of (3) was relied upon as an average measurement and evaluation tool for the degree obtained and related to the responses of the sample members.

1. Description and Diagnosis of the Independent Variable (Intelligent Manufacturing X)

We see through table (2) the descriptive statistics of the independent research variable (intelligent manufacturing), noting that the hypothetical arithmetic mean of the scale of (3) was mainly used to know the extent to which the research sample was aware of the research variables:

The following is a detailed explanation of the opinions of the research sample about the dimensions of smart manufacturing:

a. Operational Cognitive Intelligence X1: It is noted from the results of Table (3) that the weighted arithmetic mean of the operational cognitive intelligence dimension amounted to (3.550) with a standard deviation of (1.14) and a coefficient of difference (0.32). The intensity of the answer for the research sample (71%), and this indicates that the (operational cognitive intelligence) dimension was clear to the research sample. We see in this table that the weighted arithmetic mean of all paragraphs of operational cognitive intelligence is higher than the hypothetical arithmetic mean of (3). Paragraph (2) obtained the highest weighted arithmetic mean, reaching (3.69), with a standard deviation of (1.13), a coefficient

of variation (0.30), and intensity The answer is (70.8%), which indicates the consistency of the research sample's answers to this paragraph, compared to the rest of the dimensions. Paragraph (4) obtained the lowest weighted arithmetic mean, as it reached (3.36), which is higher than the hypothetical arithmetic mean (3), with a standard deviation of (1.16), a coefficient of difference (0.35), and the intensity of the answer (67.2%), which means that the organization's management has orientations To incorporate operational cognitive intelligence into manufacturing processes.

B. Operational technological intelligence X2: The weighted arithmetic mean of the operational technological intelligence dimension was (3.45). The value of the arithmetic mean is higher than the hypothetical mean, and this indicates that the researched organization possesses operational technological intelligence and exploits it in a way that enables it to make the most of the techniques of technological intelligence. . It indicates the views of the research sample regarding the aforementioned dimension. The intensity of the answer for the research sample individuals was (69.1%), and this indicates that the operational technological intelligence dimension is one of the clear dimensions for the research sample individuals as it is one of the important dimensions of smart manufacturing. Through the table, we also see that the weighted arithmetic mean for all items of the operational technological intelligence dimension is higher than the hypothetical arithmetic mean of (3). Paragraph (3) obtained the highest weighted arithmetic mean, as it reached (3.67), with a standard deviation (1.11) and a coefficient of difference (0.30). The intensity of the answer is (73.4%), which indicates the consistency of the research sample's answers to this paragraph. While paragraph (1) obtained the lowest weighted arithmetic mean, it reached (3.24), which is higher than the hypothetical arithmetic mean (3), with a standard deviation (1.33), a coefficient of difference (0.32), and the intensity of the answer (64.8%). This indicates that the organization in question has Real directions for the presence of technological intelligence in the performance of its tasks and the production of products with high specifications.

C. Smart Manufacturing Environment X3: Respondents were asked three items in this dimension. It appears from table (2) that the weighted arithmetic mean of all items after the smart manufacturing environment was higher than the hypothetical arithmetic mean of (3). Paragraph (1) obtained the highest weighted arithmetic mean, reaching (3.92), with a standard deviation of (0.98), and a coefficient of variation (0.25) and the intensity of the answer (78.4%), which indicates the consistency of the research sample's answers to this paragraph. The total weighted arithmetic mean of the smart manufacturing environment dimension was (3.547) with a standard deviation of (1.11) and a coefficient of difference (0.31). Which means the management of the organization seeks to adopt a smart manufacturing environment to accomplish the work entrusted to it.

D. Operational Environmental Intelligence X4: The weighted arithmetic mean of the Operational Environmental Intelligence dimension reached (3.44). The value of the arithmetic mean is higher than the hypothetical arithmetic mean, and this indicates the

strength of the organization's interest in the process of adopting operational intelligence, which helps in building and developing business, and supports that, the value of the standard deviation was (1.20), as it indicates the convergence of the views of the research sample regarding the aforementioned dimension, and the intensity of the answer was (68.7%).It is noted in this table that the weighted arithmetic mean of all items of the Operational Environmental Intelligence dimension is higher than the hypothetical arithmetic mean of (3), and the paragraph got (1) has the highest weighted arithmetic mean, as it reached (3.70), with a standard deviation (1.31), a coefficient of variation (0.36), and the intensity of the answer (74%), which indicates the consistency of the research sample's answers to this paragraph, while paragraph (2) got the lowest The weighted arithmetic mean was (3.29), which is higher than the hypothetical arithmetic mean (3), with a standard deviation (1.14), a coefficient of variation (0.35), and the intensity of the answer (65.8%). .

At the macro level, the smart manufacturing variable achieved a weighted arithmetic mean of (3.50). The value of the arithmetic mean is higher than the hypothetical arithmetic mean, which means, in actual terms, the strength of the availability of smart manufacturing dimensions in the organization, the research community, and what supports this is that the standard deviation reached (1.16), which is a small value that indicates the convergence of the answers of the research sample regarding smart manufacturing. The intensity of the answer was (70%).

Table (2) Description and diagnosis of smart manufacturing X1, X2, X3, X4

	Questions	Arithmetic mean	Severity of the answer	Standard deviation	Coefficient of variation
1	Q1	3.64	72.8%	1.16	0.32
2	Q2	3.69	73.8%	1.13	0.30
3	Q3	3.51	70.2%	1.12	0.32
4	Q4	3.36	67.2%	1.16	0.35
x1	Operational cognitive intelligenceX1	3.550	71.0%	1.14	0.32
1	Q5	3.24	64.8%	1.33	0.41
2	Q6	3.55	71.0%	1.15	0.32
3	Q7	3.67	73.4%	1.11	0.30
4	Q8	3.35	67.0%	1.14	0.34
x2	Operational technological intelligenceX2	3.45	69.1%	1.19	0.35
1	Q9	3.92	78.4%	0.98	0.25
2	Q10	3.45	69.0%	1.11	0.32
3	Q11	3.27	65.4%	1.13	0.34
x3	Intelligent manufacturing environmentX3	3.547	70.9%	1.11	0.31
1	Q12	3.70	74.0%	1.31	0.36
2	Q13	3.29	65.8%	1.14	0.35
3	Q14	3.32	66.4%	1.12	0.34
x4	Operational X4 environmental	3.44	68.7%	1.20	0.35
X	Intelligent manufacturing X	3.50	70.0%	1.16	0.33

Source: Prepared by the researcher based on Excel

Table (3) shows the arrangement of the dimensions of smart manufacturing based on relative importance. The operational cognitive intelligence dimension, X1, ranked first in terms of relative importance, reaching (71%), and came second after the smart manufacturing environment, X3, as the relative importance reached (70.9%). As for the operational technological intelligence X2, it ranked third with a relative importance of (69.1%), followed by the last rank after the operational environmental intelligence X4, with a relative importance of (68.7%).

Table (3) Ranking the importance of smart manufacturing

Dimensions	Weighted arithmetic mean	Standard deviation	Coefficient of variation	Relative importance	Rankings
Operational cognitive X1 intelligence	3.550	1.14	0.32	71%	The first
Operational technological intelligence X2	3.45	1.19	0.35	69.1%	The third
Intelligent manufacturing X3 environment	3.547	1.11	0.31	70.9%	The second
Operational X4 environmental	3.44	1.20	0.35	68.7%	The fourth
Overall average	3.50	1.16	0.33	70.0%	

Source: Prepared by the researcher based on Excel

2. Description and diagnosis of the dependent variable (Y green marketing)

Through table (4), we see that the descriptive statistics of the approved study variable (green marketing), noting that the hypothetical arithmetic mean of the scale of (3) was relied upon mainly to know the extent of the research sample's awareness of the research variables, as shown below:

a. Eliminate or reduce the concept of waste Y1: Eight items were presented to the respondents in this dimension. It appears from table (4) that the weighted arithmetic mean for all paragraphs after eliminating or reducing the concept of waste was higher than the hypothetical arithmetic mean of (3). Paragraph (2) obtained the highest weighted arithmetic mean, reaching (3.51) and with a standard deviation of (1.17). And a coefficient of difference (0.333) and the intensity of the answer (70.2%), which indicates the consistency of the research sample's answers to this paragraph. In paragraph (6), the lowest weighted arithmetic mean was (3.25), which is higher than the hypothetical arithmetic mean (3), with a standard deviation (1.23), a coefficient of difference (0.38), and the intensity of the answer (0.0%), and this indicates that the concept of waste is canceled Or reduce it is important that supports green marketing operations. While the total weighted arithmetic mean for the dimension of eliminating or reducing the concept of waste was (3.36) with a standard deviation of (1.14) and a coefficient of difference (0.34).), and this indicates that after eliminating the concept of waste or reducing it, it is one of the clear dimensions for the sample members. This indicates that after abolishing or reducing the concept of waste, the members of the organization are ready to implement the concept of eliminating or reducing waste.

B. Product redesign Y2: We see from Table (4) that the total weighted arithmetic mean of the product redesign dimension was (3.38) with a standard deviation of (1.15) and a coefficient of difference (0.34). The intensity of the answer for the research sample individuals was (67.6%), and this indicates that after redesigning the product is one of the clear dimensions for the research sample members as it is one of the important dimensions of green marketing, as it indicates that the sample has a conviction of the interest of those in charge of redesigning the product in accordance with green environmental requirements. It is noted from table (4) that the weighted arithmetic mean for all items after work skills was higher than the hypothetical arithmetic mean of (3). Paragraph (3) obtained the highest weighted arithmetic mean, reaching (3.71), with a standard deviation of (1.15), and a coefficient of variation (0.31) and the intensity of the answer (74.2%), which indicates the consistency of the research sample's answers to this paragraph.

c. Clarity of the relationship between price and cost Y3: The weighted arithmetic mean of the dimension of clarity of the relationship between price and cost was (3.59). The value of the arithmetic mean is higher than the hypothetical arithmetic mean. Concerning this dimension with a kind of convergence, this is supported by the value of the standard deviation was (1.17), which indicates the convergence of the views of the research sample regarding the aforementioned dimension.The intensity of the answer was (71.8%).It is noted in this table that the weighted arithmetic mean for all paragraphs after implementation The discipline is higher than the hypothetical arithmetic mean of (3). Paragraph (5) obtained the highest weighted arithmetic mean, as it amounted to (3.73), with a standard deviation of (1.19), a coefficient of difference (0.32), and the intensity of the answer (74.6%), which indicates the consistency of the answers of the research sample. On this paragraph, while paragraph (4) obtained the highest weighted arithmetic mean, it amounted to (67.2%), which is higher than the hypothetical arithmetic mean (3) with a standard deviation (1.21), a coefficient of difference (0.36), and the intensity of the answer (67.2%), and this indicates The organization works to follow clear policies regarding pricing and the existence of a clear relationship between it and cost.

D. Making the environmental orientation profitable Y4: The weighted arithmetic mean of the dimension of making the environmental orientation profitable was (3.41) with a standard deviation of (1.14) and a coefficient of difference (0.33). 68.3%, and this indicates that after making the environmental orientation profitable is one of the clear dimensions for the respondents, as it indicates making the possibility of environmental orientation profitable and economically feasible. While the arithmetic mean of all paragraphs after making the environmental orientation profitable is higher than the hypothetical arithmetic mean (3), as paragraph (1) obtained the highest weighted arithmetic mean, reaching (3.67) with a standard deviation of (1.13), a coefficient of difference (0.31), and the intensity of the answer (73.4%).) While paragraph (3) obtained the lowest weighted arithmetic mean, it reached (3.09), which is higher than the hypothetical arithmetic mean (3), with a standard deviation (1.12), a coefficient of difference (0.36), and the intensity of the answer (61.8%).

At the macro level, the dependent variable green marketing achieved a weighted arithmetic mean of (3.42). The value of the arithmetic mean is higher than the hypothetical arithmetic mean, which means, in actual terms, the strength of the availability of green marketing dimensions in the organization, the research community, and what supports that is that the

standard deviation reached (1.15). It is a small value that indicates the convergence of the answers of the research sample regarding the aforementioned variable, and the intensity of the response was (68.5%).

Table (4) description and diagnosis of green marketing Y

	Questions	Arithmetic mean	Severity of the answer	Standard deviation	Coefficient of variation
1	Q20	3.38	67.6%	1.14	0.34
2	Q21	3.51	70.2%	1.17	0.333
3	Q22	3.20	64.0%	1.17	0.37
4	Q23	3.36	67.2%	1.11	0.33
5	Q24	3.45	69.0%	1.19	0.35
6	Q25	3.25	65.0%	1.23	0.38
7	Q26	3.46	69.2%	1.05	0.30
8	Q27	3.26	65.2%	1.08	0.331
Y1	Eliminate or reduce the Y 1 concept of waste	3.36	67.2%	1.14	0.34
1	Q28	3.26	65.2%	1.13	0.35
2	Q29	3.35	67.0%	1.08	0.32
3	Q30	3.71	74.2%	1.15	0.31
4	Q31	3.14	62.8%	1.16	0.37
5	Q32	3.51	70.2%	1.12	0.32
6	Q33	3.22	64.4%	1.18	0.37
7	Q34	3.46	69.2%	1.13	0.33
Y2	Y2 Product redesign	3.38	67.6%	1.15	0.34
1	Q35	3.57	71.4%	1.20	0.34
2	Q36	3.60	72.0%	1.12	0.31
3	Q37	3.70	74.0%	1.13	0.31
4	Q38	3.36	67.2%	1.21	0.36
5	Q39	3.73	74.6%	1.19	0.32
Y3	Clarity of the relationship between price and costY 3	3.59	71.8%	1.17	0.327
1	Q40	3.67	73.4%	1.13	0.31
2	Q41	3.09	61.8%	1.12	0.36
3	Q42	3.48	69.6%	1.11	0.32
Y4	Making the environmental Y orientation profitable 4	3.41	68.3%	1.14	0.335
Y	Green marketing Y	3.42	68.5%	1.15	0.34

Source: Prepared by the researcher based on Excel

Table (5) shows the arrangement of the dimensions of green marketing based on relative importance. It occurred after the relationship between price and cost became clear, first in terms of relative importance, reaching (71.8%), and came second after making the environmental orientation profitable, as the relative importance reached (68.3%).) After redesigning the product, it ranked third in terms of relative importance, amounting to (67.6%),

and after making the environmental orientation profitable, it occupied the fourth and last rank, with relative importance amounting to (67.2%).

Table (5) ranking the importance of green marketing

Dimensions	Weighted arithmetic mean	Standard deviation	Coefficient of variation	Relative importance	Rankings
Eliminate or reduce the Y1 concept of waste	3.36	1.14	0.34	67.2%	The fourth
Y2 Product redesign	3.38	1.15	0.34	67.6%	The third
Clarity of the relationship between price and costY3	3.59	1.17	0.327	71.8%	The first
Making the environmental orientation Y4 profitable	3.41	1.14	0.335	68.3%	The second
Overall average	3.42	1.15	0.34	68.5%	

Source: Prepared by the researcher based on Excel

Statistical Aspect And Hypothesis Testing

A group of methods have been relied upon for the purpose of testing the hypotheses, which are the correlation matrix (Pearson correlation coefficients) and simple regression analytics. The matrix of simple correlation coefficients was used for the purpose of verifying the strength and direction of the correlation relationships between the dimensions of the research variables, while simple regression analyzes were used for the purpose of testing the effect relationships between the dimensions of the main research variables.

First - hypotheses of influence

• **The first main hypothesis H0: (There is no significant effect relationship to the dimensions of smart manufacturing in green marketing)**.

Four sub-hypotheses are derived from this hypothesis:

• The first sub-hypothesis: - **There is no significant effect relationship of operational cognitive intelligence in green marketing**.

We see through Table (6) that there is a significant effect of operational cognitive intelligence X1 in green marketing. And the estimated regression equation was Y = 1.480 + 0.551X1, and it explains 67.3% of the nature of the relationship between X and Y, meaning that 67.3% of the changes that occur in green marketing result from a change in operational cognitive intelligence. The value of F calculated for the simple regression model was (80.973).) with a significant level of F (0.000 = Sig), and thus the decision is to reject the null hypothesis and accept the alternative hypothesis, which is the existence of a significant effect of operational cognitive intelligence in green marketing.

• The second sub-hypothesis: - **There is no significant effect relationship of operational technological intelligence in green marketing.**

We see from table (6) the presence of a significant effect of operational technological intelligence in green marketing. And the estimated regression equation was Y = 1.435 + 0.580X2, which explains 72.1% of the nature of the relationship between X and Y, meaning that 72.1% of the changes that occur in green marketing are caused by a change in operational technological intelligence, and the value of F calculated for the simple regression model was (106.120).) with

a significant level of F (0.000 = Sig), and thus the decision is to reject the null hypothesis and accept the alternative hypothesis, which is the existence of a significant effect of operational technological intelligence in green marketing.

• The third sub-hypothesis: - **There is no significant effect relationship to the smart manufacturing environment in green marketing**.

We see through Table (6) that there is a significant impact of the smart manufacturing environment in green marketing. And the estimated regression equation was Y = 1.572 + 0.525X3, which explains 64.8% of the nature of the relationship between X and Y, meaning that 64.8% of the changes that occur in green marketing are caused by the change in the smart manufacturing environment, and the value of F calculated for the simple regression model was (71.093).) with a significant level of F (0.000 = Sig), and therefore the decision is to reject the null hypothesis and accept the alternative hypothesis, which is the existence of a significant effect of the smart manufacturing environment in green marketing.

• The fourth sub-hypothesis: - **There is no significant influence relationship of operational environmental intelligence in green marketing.**

Table (6) shows that there is a significant effect of operational environmental intelligence in green marketing. And the estimated regression equation was Y = 1.621 + 0.528X4, and it explains 71.6% of the nature of the relationship between X and Y, meaning that 71.6% of the changes that occur in green marketing are caused by a change in operational environmental intelligence. The value of F calculated for the simple regression model was (102.944).) with a significant level of F (0.000 = Sig), and thus the decision is to reject the null hypothesis and accept the alternative hypothesis, which is the existence of a significant effect of operational environmental intelligence in green marketing.

From table (6), we notice a significant impact of smart manufacturing on green marketing. And the estimated regression equation was Y = 0.736 + 0.771X, and it explains 84.2% of the nature of the relationship between X and Y, meaning that 84.2% of the changes that occur in green marketing are caused by the change in smart manufacturing, and the value of F calculated for the simple regression model was (238.422). At the level of significance of F (0.000 = Sig), and therefore the decision is to reject the null hypothesis and accept the alternative hypothesis, which is the existence of a significant effect of smart manufacturing in green marketing.

Table (6) Estimating the parameters of the simple linear regression model to measure the effect of smart manufacturing dimensions X on green marketing Y

The dependent variable / The independent variable	Green marketing Y		The calculated value (t) of the regression coefficient	The calculated value (F) of the regression model	Sig	R^2
	β	Constant				
Operational cognitive intelligence X1	0.551	1.480	8.998	80.973	0.000	0.673
Operational technological intelligence X2	0.580	1.435	10.301	106.120	0.000	0.721
Intelligent manufacturing environment X3	0.525	1.572	8.432	71.093	0.000	0.648
Operational environmental intelligence X4	0.528	1.621	10.146	102.944	0.000	0.716
Intelligent manufacturing X	0.771	0.736	15.441	238.422	0.000	0.842

Source: Prepared by the researcher based on SPSSV25

CONCLUSIONS

1- The dimension of creativity, operational cognitive intelligence, which is one of the dimensions of the independent variable, smart manufacturing, got the highest percentage of the rest of the dimensions, with a relative importance of 71%, which indicates that the researched organization attaches great importance to this dimension, which is a good indicator. 70.9%, which means the availability of an industrial environment with smart orientations, followed by operational technological intelligence with a relative importance of 69.1%, and finally followed by operational environmental intelligence with a relative importance of 68.7%.

2- Whereas, after the clarity of the relationship between price and cost, it came in the first place within the dimensions of the dependent variable, which is green marketing, as it got 71.8% of relative importance, while it came after it, after making the environmental orientation profitable, in the second place of relative importance, with a rate of 68.3%, while it came after The rest of the dimensions came in succession in terms of relative importance, and they are both after redesigning the product and after eliminating or reducing the concept of waste. This is a good indication that the researched organization attaches great importance to the green marketing variable in its operations.

3- The strength of the influence of the smart manufacturing variable, which is the independent variable, reached 84.2% in the dependent variable green marketing, which indicates the strong influence of this variable on green marketing in the researched organization.

4- While the influence of the operational technological intelligence dimension, which is one of the dimensions of the independent variable, smart manufacturing, reached 72% in the dependent variable, green marketing, as it ranked first in influence, which indicates that the researched organization has a good operational technological intelligence system and is in continuous development.

5- While the rest of the dimensions, including the environmental operational intelligence dimension, ranked second in terms of influence, followed by the dimensions of operational cognitive intelligence in the third rank, and finally after the smart manufacturing environment in the last rank.

6- It is good that there is a clear relationship between cost and price, as it ranked first among the dimensions of the dependent variable, green marketing, as it is the cornerstone of environmental sustainability implementation and evidence of clear pricing policies by the researched organization.

RECOMMENDATIONS

1- The need to employ the dimensions of the independent variable, smart manufacturing, in enhancing the positive impact relationship between it and the dimensions of the dependent variable, green marketing within the industrial sector, in line with continuing to create products of strategic value for industrial enterprises and achieving environmental sustainability by keeping pace with developments and seizing opportunities to ensure continuity, growth and survival in the market. the job.

2- The need to work on increasing interest in modern manufacturing methods, including smart manufacturing, in industrial organizations as an excellent means of adapting to the surrounding environment and keeping pace with the rapid technological developments.

3- The necessity of working to increase attention to the environmental aspects of organizations and issues of environmental sustainability as an urgent necessity because of their great importance to the environment and the reputation of the organization, including green marketing, especially in industrial organizations to avoid negative effects on the environment.
4- That the operational cognitive intelligence dimension has the first rank of relative importance within the dimensions of the independent variable (smart manufacturing) confirms that the researched organization follows modern methods of production and its continuous pursuit of possessing smart technology in the production process.
5- The need to strengthen the rest of the dimensions of the independent variable (smart manufacturing), including operational environmental intelligence, operational technological intelligence, and operational environmental intelligence because of the great importance of these dimensions in implementing the smart manufacturing strategy.
6- The need to enhance the dimensions of the approved variable (green marketing) and the rest of the issues of environmental sustainability because of their great importance in the reputation of modern organizations.
7- The need to enhance the dimension of making the environmental orientation profitable within the dimensions of the dependent variable, green marketing, because of its great importance to the future of the organization, as well as the need to enhance the dimension of product redesign because it is one of the important dimensions in accomplishing the tasks adopted by organizations, especially industrial organizations in the research environment.

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