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The Digital Technologies That Contribute to The Fourth Industrial Revolution and Gains of Using Supply Chains in an Economic Institution

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Abstract:

This study aims to show the importance of the for the industrial revolution and the fondamental technologies used during the developments of the global economy and the importance of the supply chains to improve the performance economic system which can' t be achieved without cooperation and good coordination between these practices , which form an interconnected chain or which is called supply chain . the latter represents a network of institutions linked by common interests facilitate flowing information on and funds that are closely linked to each other.

With the new trend in manufacturing, technologies such as artificial intelligence, machine learning, Internet of Things, automation and sensors are changing the way companies manufacture, maintain and distribute new products and services, demonstrating the importance of the integrated relationship between these technologies and supply chains.

Key words: the fourth industrial revolution, digital technologies, supply chains.

JEL Classification Codes: L16, L52, O31, O32, Q11, Q55, R31.

Introduction :

From 1980s until now, amazing and accelerating global events happen in our world that accrued radical and profound transformations in the global economic and political system. As a result, important results and developments. These events put the world and people, in the twenty first century, in front of new requirements challenges, and made it looking for another ways to make it fulfill these time's needs and facing its challenges.

The basic challenge is the fourth industrial revolution, which imposes a new reality full of opportunities and challenges. Officially, the fourth industrial revolution started with the beginning of the new millennium and it is still continuing till now. Its features are the advances in genetic engineering, internet the inventions of 3D printers artificial intelligence, virtual currencies internet of things.

We can say that the fourth industrial revolution is a technological shift influences the cultures and economies in all over the world. It reflects the creation and advancement of a broad range of new technologies that move the inventions and innovations across sectors with the changement of the basic sides of the culture and the society as we know The elements of the fourth industrial revolution includes technology such as artificial intelligence, automatic learning , automatic control, internet of things, the huge data, the rules of sequential data, quantum computing, 3D printing

In 2016, the world economic forum was considered the basic driver for the fourth industrial revolution which will reform our societies, companies and the economies of our contemporary world because of the developments that accompanied it in most areas of life. Some strange ideas emerged with this related to the evolution of human being . For example, the artificial intelligence, the biotechnology, internet of things and the big data. The competition between institutions depends on the competition between supply chains which is d an integrated group of institutions accompanied to each others from suppliers, manufacturers and customers. Considering that every institution or economic company looks for the continuity with multiple options in front of the consumer that make every chain works hard, with perfection and coordination to meet consumers needs

and desires at the expense of other chains that compete in the same field of economic activity.

- **The problem :**

From what we mentioned, we can pose the following problem:

What are the digital technologies that are contributed and used in the fourth industrial revolution? And How do we activate it in the supply chains to improve the institution's performance?

- **Hypotheses of the study :** In order to answer temporarily to the question of the study, we made this hypotheses

- The fourth industrial revolution keeps pace with the current era.
- The fourth industrial revolution technologies is an obligation for contributing
- Supply chains need a lot of practices that help maintain relationships, as all institution work on continuity

- **The importance of study :**

_To show the importance of the fourth industrial revolution in light of the development that happens in the world.

_Highlight the most important techniques that the fourth industrial revolution depends on.

_The supply chains importance in the economic system performance.

2/ The fourth industrial revolution concepts:

“The fourth industrial revolution”, this concept was used in this stud. although there was other concepts as the industrial internet, the digital factory, it doesn't give a complete overview to this concept” the fourth industrial revolution”

2.1 The fourth industrial revolution “Information revolution”:

It started recently with the artificial intelligence technologies, robots, self learning machines, connecting things with each other via internet, Nano technology, 3D printing applications in the industry and the production, self driving vehicles, genes control and other biotechnologies. The fourth industrial revolution combines the digital processes, it links between digital transformation processes, integration of value chains and the products and services. Besides, information technology, machines and human being are connected to each other and they react at the right time. This led to create a flexible manufacturing method with efficient use of resources. This is equivalent to a smart create which use the internet of things.

This revolution is a great achievement for the world, speed, domain and level of complexity. Artificial intelligence, robots, the self driving vehicles, the 3D printers, the bio technology and the quantum computing (marayati, 2018, page 15_16_17)

2/ 1.1 Concepts about the fourth industrial revolution:

The fourth industrial revolution, or which is called “Tsunami of economic progress”, started in 2011, in Germany. It is considered as the most important transfers in the modern world and these are some definitions of it:

It is a mix of different physical, biological and digital activities which connect between materials and all what is digital in our daily life .

- It is the inclusive digital transformation in both industrial and services sector
- The fourth industrial revolution connected the areas of life with the intelligent digital data and the internet. Telecom, technology, the electronic government, the big data and the information revolution are among them.

- It is the impact of technology, internet and computers on various sectors of development and work .The Nano technology, 3D printing, drone, self driving vehicles, digital computing and the globalization.

To conclude, the fourth industrial revolution is the integration of the intelligent machine systems connected with the internet to make the factory managers create a network of machines that produce with the least amount of errors, they can change independently to external inputs with keeping a high degree of efficiency. It means, implementing the intelligent factories, which are managed by machines and connected to the internet and a system that can show all production stages and make decisions independently. All of this requires the use of advanced.

The fourth industrial revolution depends on the economy that based on knowledge, modern technology and advanced technologies. For example, the artificial intelligence, the computational computing, the big data, the electronic application which provide the industry and the production such as 3D printing, mart cities. adding to this the E-commerce (Arama et Latrache , 2021, page 533)

2/ 1.2The characteristics of the fourth industrial revolution:

The concept of the Fourth Industrial Revolution was coined in 2016 by Klaus Schwab, the founder of the World Economic Forum, in a book of the same name. So where better to find a good definition than within its pages? "The Fourth Industrial Revolution creates a world in which virtual and physical systems of manufacturing cooperate with each other in a flexible way at the global level". The Fourth Industrial Revolution, however, is not only about smart and connected machines and systems. Its scope is much wider. Occurring simultaneously are waves of further breakthroughs in areas ranging from gene sequencing to nanotechnology, from renewable energies to quantum computing. It is the fusion of these technologies and their interaction across the physical, digital and biological domains that make the Fourth Industrial Revolution fundamentally different from previous revolutions.

It is characterized by:

- The speed of its development, modern technology generates other newer and stronger technology.
- Increasing the amount of benefits for the individual, in this digital age, companies require a small number of employees and a small amount of raw materials to produce products with great benefits. For digital companies, storage and transportation costs decrease.
- The coordination and the integration between different discoveries becomes more common (Marayati , 2018, page 21)

the 5 advantages of industries; Here are some common benefits industrialization may offer:

- The import-export market. ...
- Availability of goods. ...
- Affordability of goods. ...
- Increased jobs. ...
- Improved medical care. ...
- Global warming and climate change. ...
- Increased income disparity. ...
- Potentially hazardous working conditions.

2/ 1.3. Effects and Advantages of the Fourth Technological revolution:

All revolutions have benefits and drawbacks, challenges and opportunities, uncertainties and certainties. In the case of the Fourth Industrial Revolution, the advantages are evident:

increased productivity, efficiency and quality in processes, greater safety for workers by reducing jobs in dangerous environments, enhanced decision making with data-based tools, **improved competitiveness by developing customised products that satisfy consumers' needs, etc.**

As far as the drawbacks are concerned, the experts point to many: the dizzying speed of change and the need to adapt,

burgeoning cyber risks that force us to ramp up cybersecurity, high dependence on technology and the so-called digital gap, lack of qualified staff, etc.

Regarding the latter, it is worth remembering that **the deep impact of Industry 4.0 on employment is one of the biggest challenges for the Fourth Industrial Revolution.**

At the start of the process, a McKinsey Global report confirmed that up to 800 million jobs will have disappeared by 2030 as a result of automation.

However, this may also be an opportunity, because, as novel technologies emerge, so will new professions that will create millions of jobs in new sectors.

2.2 supportive Technologies of the fourth industrial revolution technology:

The fourth industrial revolution based on technology and modern industries. The most important supportive technologies are:

2/ 2.1. Internet of things technologies :

It is important for future factories .This technology connects human resources, operations and data through smart sensors, data transfers via internet without needing to human reaction. We can find their application in various fields. For example Aviation industry, to detect the defect. In cities, for better traffic management .On farms, to produce higher quality crops. In hospitals, to enable doctors to monitor their patients. In homes, to reduce energy consumption and connecting home appliances to phones to control them (Ferhati and Kenniche ,2022, page 604)

2/ 2.2. Robots technology :

It is a machine used for some precise and sensitive functions that human can not do in case of his absence or the high precision that needs .Robots did a radical changes in the manufacturing processes, It achieved a great coordination between robots and human being. They worhers feed the production machines, It leads to increased production and enables people to use their energies in other things.

2/ 2.3. Wearable device technology :

It allows workers wear robotic exoskeletons enhance their strength when using machines supported by now common such as special glasses in a form of texts or

graphics, voices that require the use of a voice assistant "Siri and Alexa" , wearables sensors such as smart watches . It will take into consideration the hard working details that makes robots more widely used in manufacturing .whether in factories or offices , the new generation of human workers enhances with these technologies will be called . The ultra powerful factory 0.4 which enable people to control robots physical strength on construction sites and factories, so it reduces works accidents and fatigue

2/ 2.4. 3D printing technology :

It belongs to the field of additive manufacturing technologies .It is widely known as an approved method for industry through it, products are designed, tested, building prototypes and it is manufactured quickly in its final form and with great flexibility which markets the products faster.

2/ 2.5. Artificial Intelligence :

It is one of the gate ways to the competitiveness of industrial enterprises, using smart manufacturing technologies in industrial processes help companies to control energy and raising the level of productivity and reducing expenses through immediate control, defects and dealing with them quickly to reduce break time .Organizing the flow of processes by building advanced simulation models(Saadi,2022,page 570)

2/ 2.6. Self-driving vehicles technology :

Self-driving cars helps 90percent of accidents to reduce .It is useful for disabled, elderly, and children. In addition, it is good for the environment .Since it is powered by electricity, it reduces the harmful emissions.

2/ 2.7. The computational computing :

With the spread of its technologies, the user is no longer forced to store his data on his own devices, or need various or complex programs. All programs and files are stored in data banks that use computational applications to ensure information security.

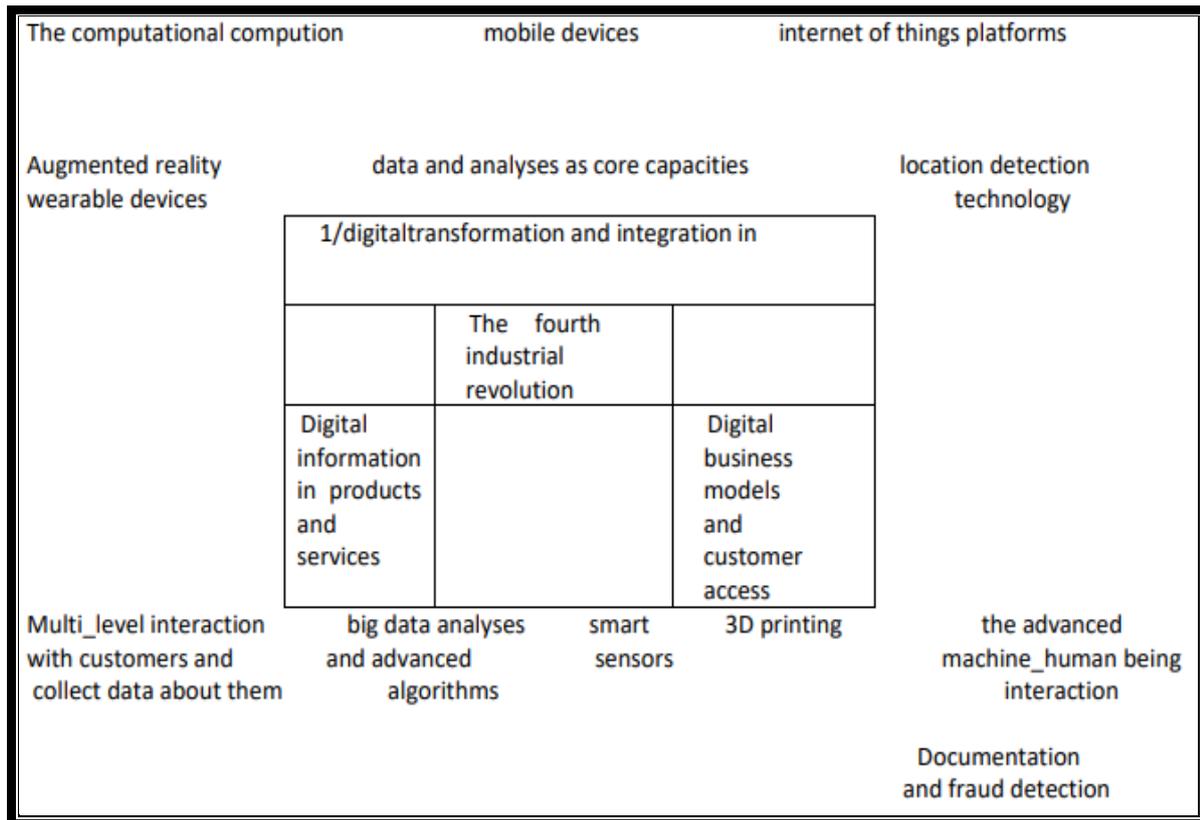
2/ 2.8. The Nano Technologie :

Nanoparticle Technology or Nano Technology .It is the science that study the processing of matter on the atomic and molecular scale. It is used to develop the manufacture of computers ,communications devices ,and all electronic devices and the

invention of cable thickness and capacitors ,field of energy, cancer and water treatment....etc.

The following figure explains and summarizes the most important digital technologies adopted by the fourth industrial revolution.

Table (1) : The industrial revolution and the most important digital technologies



Source: (middle east, 2016, page 20)

2/ 3. Industry 4.0 as the Essence of Digital Transformation

I 4.0 perfectly delineates the essence of the Fourth Industrial revolution, with the advent of cyber–physical systems facilitating automated organizational/institutional operations in intelligent factories, with significant implications for possible investments, consumption, development, jobs, and commercialization. The concept of “Industry 4.0” was first introduced in 2011 at the Hannover Fair and was brought to the attention of many governments around the world. It was co-founded by the German federal

government's initiative, which included academics and private companies and aimed to develop creative production processes to increase efficiency and productivity in industries. By its very nature, it signifies a new phase in the evolution of production systems by integrating a variety of emerging and convergent technologies that could add significant value to the entire manufacturing process. It represents a new organizational layer of managing and controlling the entire value chain for customized goods and services to adapt to the ever-changing and varying needs and wants of customers. According to Lasi et al. the following three components make up Industry 4.0.

- *Digitalization and enhanced integration across different vertical and horizontal value chains:* creating personalized products, digital customer orders, automated data delivery systems, and integrated customer service solutions.
- *Product and service digitalization:* providing comprehensive smart grid descriptions of the product and associated services.
- *Implementation of innovative digital business concepts:* High interaction within systems and technological capabilities for creating new and integrated digital business models. The foundation of the industrial internet involves the embedded accessibility and monitoring of systems throughout the entire enterprise in real time. (Alsabban, 2023, p. 3)

3/. Supply chains:

History shows technological innovation has always been at the center of business productivity and social emancipation. It brought individuals and firms to mass-produce by moving from manual and small-scale trade activities to mechanization and large-scale engineering productions. Material and services that evolved from the revolutionary innovations impacted every aspect of economic activities. Makers of goods and service providers from agriculture to factories practiced primitive forms of trades to address the challenges and conditions of their respective eras. Previous industrial transformation exacerbated economic activities and created processes and concepts suitable to describe and resolve enduring challenges. (Mayounga, 2022, p. 2)

Business concepts relating to earlier supply chain activities, procedures, and actions did not develop until later. The academia, industry, and governments described the activities associated with the phenomenon after they had already happened.

However, identifying and describing developing innovative technologies and related processes offered the supply industry concepts and procedures to structure and shape future business activities.

Supply chains is a network between a company and its suppliers to produce and distribute a product to the final buyer. It includes various activities, people, information and different resources.

3-1. Definitions :

It is a network that consists: suppliers, distributors, retailers and final consumer. There are three types of flows, information flow and financial flow (econpapers, page 480).

In other words, it is a network of institutions that participate in various processes and activities that produce value in the form of products and services provided to the final consumer. (researchgate, page 20)

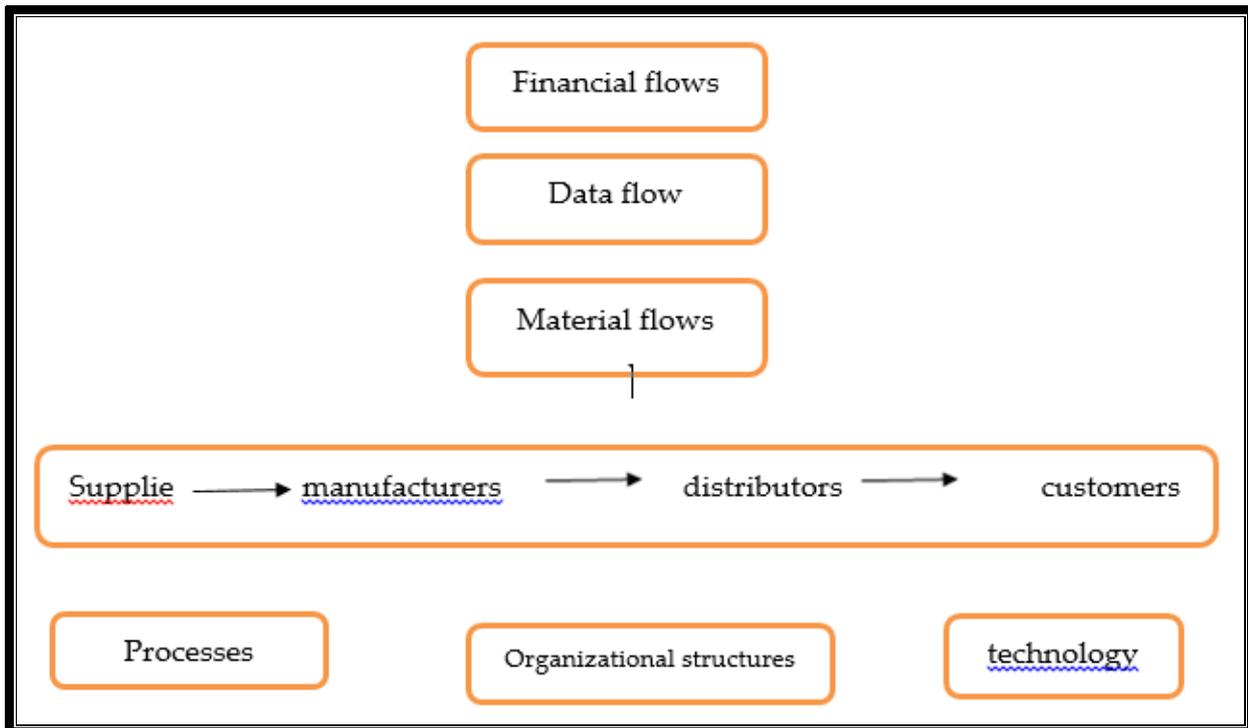
The supply network is a system of professional units. It produces, assembles, transforms and distributes goods and services from suppliers to customers according to their desires and requests. Supply chain is a link starts and finishes with the customers. All materials, products, data and deals flow via this chain. It is also a mobile network of facilities for all institutions even if they are different.

From all the previous definition, this is the main definition of the supply chain:

- It is a group of institutions interconnected through common interests to produce and delivers the products to the customers according to their desires, started with the supplies of raw material to the final customer
- It mainly includes suppliers, manufacturers and customers. This links are the main factor in the chain that influences the flow of materials, data to meet final customers requirements and the interests of the main factors in the chain (saadi, 2019, page 25_26)
- The aim every supply chain is to maximize the overall generated value, which is the difference between what the customers deserves which is represented by the final product, and supply chain costs in order to meet customer demands since the main goal is to increase customer service.

We can also illustrate the concept of supply chain through figure number (01).

Figure (01): A complete supply chain model



Source: realized by the researcher, based on Akkermans, Bogerd, Yucesan, and Van Wassenhove (2003, page 286)

The figure above shows that the supply chain consists of a succession of a group of institutions from suppliers, manufacturers, distributors to the customers, using various processes with appropriate organizational structures and technology which allow information, resources and money flow properly along the chain.

3-2 Supply chain management:

It is a process of coordinating and integrating the flow of raw materials, products and information efficiently and effectively from the source to the consumption.

Supply chain management is a set of methods used to integrate effectively the suppliers, manufacturers, warehouses and stores. So that, goods are produced and distributed accurately to the right location and at the right time. The total system cost is as low as possible with maintaining the service level requirements determining the

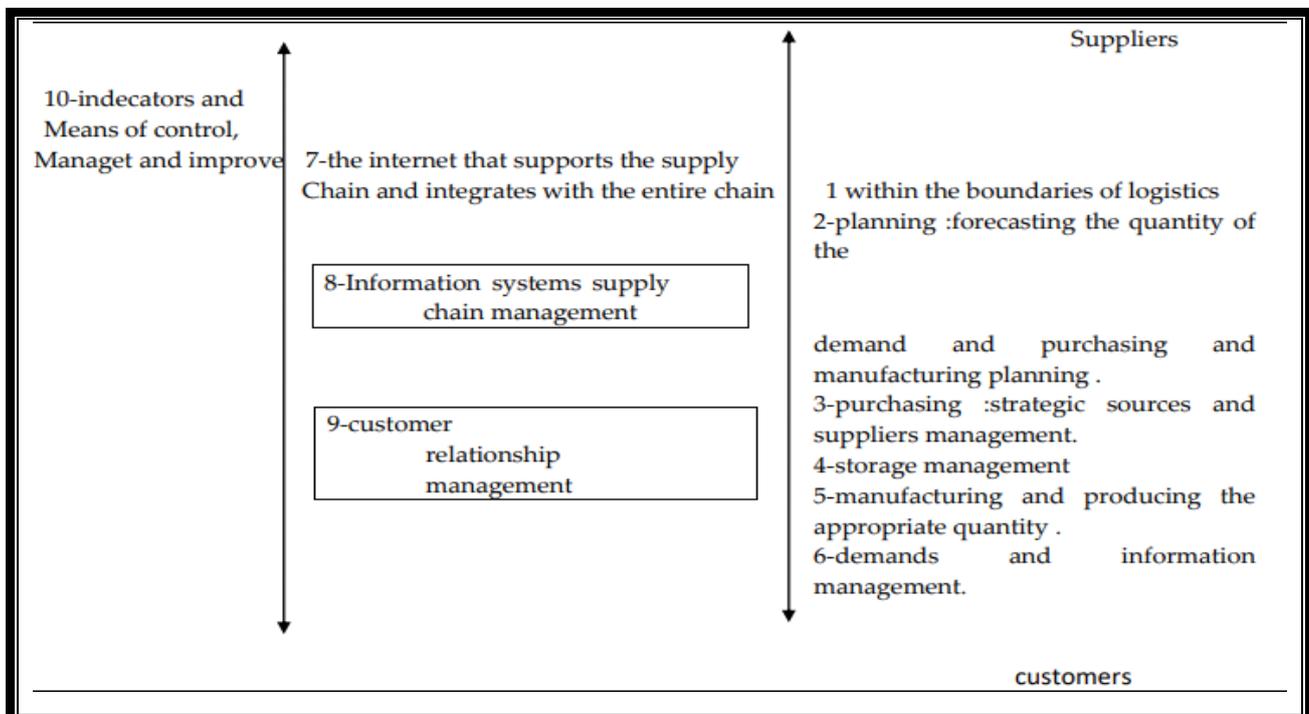
institution's ability to manage the supply network. It is located near sources supply (supplier of raw materials)or near the final consumer (retail establishment).Also, the institution's purchase of logistics services through a pledge or contract can affect the supply chain structure and the institution's location and status inside it .

From the definition, we can say that the supply chain is the development of "Logistics management concept. In the light of a re-evaluation corporate strategy to control total costs.

Among the reasons that led to the shift from logistics, management to modern supply chain management is the short life cycle of products. Besides, the increasing competition locally and internationally. In the light of new trends as globalization and information and communication technology. Furthermore, the strategic partnerships between organization.

3/ 2-1 : The main comments of the supply chain system :

Figure (02): The main components of the supply chain system .



source :realized by the researcher based on (EL-Khadif, 2012,page 64).

From figure N(02), it is clear that the supply chain links the organization with the suppliers and customers according to a system and set of management processes, starts with planning and forecasting the size of demand, planning purchasing, manufacturing and inventory management .Then, producing the appropriate quantities and information management of products and services with the good management that take care of customers, an information system and the internet to support and help manage these various processes with a control system based on a set of indicators and means of control, management and improving the performance .

These are some of the application of supply chain management features:

- Long-term contracts between all parties.
- Exchanging information about planning and other operations.
- Involving suppliers in developing and designing products .
- The supplier's commitment to continuous development
- Trust between all parties .
- Suppliers must bear full responsibility for quality to reduce the inspection and control of incoming products

3/2.2 :The importance and the aims of supply chain management :

These are the two main goals (Saadi , 2019,2020,page 31).

- How the organization maximizes the value of its products and services through the customers point of view and their satisfaction
- The organization's efficiency and how it manages its internal processes and its relationship with the rest of parties that are involved in the flow of their goods and services the organization's value to its customers .

The importance of supply chains management are:

- Increasing responsiveness to customers.
- Response during delivery time.

- Fulfilling orders in a short time .
- Reducing storing costs
- Improving the level of use
- Reducing the cost of purchasing materials
- Hiegh quality of products .
- Improving the ability to cope with unexpected incidents.
- _Rapid product development .
- Good relationship between the chain elements.

Conclusion

The fourth industrial revolution is coming and presents many opportunities and challenges.

The world is developing rapidly with widespread new industrial sectors based on emerging technologies, some of them can be acquired by developing countries with benefits. This trend represents a revolution in the future economy based on the components of this revolution that include transformations links between material and the digital virtual world as the so called "integrated smart digital industries", materials digital components and services used in industry and "smart digital factory ".

In short, we can say that the development of a business institution is specifically linked to the supply chains to reduce their costs and remain competitive in business . Supply chain management is also a crucial process because an improved supply chain reduces costs speeds up production. It can not be achieved apart from cooperation and good coordination between these parties which forms an interconnected chain , or what is called the supply chain. The latter represents a linked network of institution. They have common interests that facilitate the flow of information and money that are closely linked to the fourth industrial revolution technologies.

Industry 4.0 will have a considerable effect on the production systems, supply chains, and industrial activities. This new paradigm is changing the current industrial landscape in three ways:

- 1- production digitization,
- 2- automation, and
- 3- integrating the manufacturing site to a larger supply chain.

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