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The impact of implementing industry 5.0 principles on improving product quality: A field study - general company for electrical and electronic industries / Baghdad - Al-Waziriyah

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Abstract
The sector witnessed Production transformation A Custom technology for Manufacturer's name and 5.0, where this focused bull Industrial On human cooperation with advanced technologies such as artificial intelligence, machine learning and the Internet of Things, The stage appearedIndustry5.0 as an industrial model accident Combining technological advancements with sustainability goals Environmental, social and economic. Y The goal of this A Search, to present theoretical framework on The effect of applying industry principles5.0 Based on to Literature and previous studies. This research is based on data consisting of (125) Answer: The questionnaire was used as the main tool to collect this data. The research relied on the statistical analysis program (Smart PLS. V.4) to test the relationship between the variables. The research results show a positive correlation and influence between the principles of Industry 5.0 and product quality. This indicates that the growing interest in the concept of Industry 5.0 and the awareness of its importance in improving the quality of the company's products and raising its operational efficiency, in light of the company's constant endeavor to activate and apply the principles of Industry 5.0 in various aspects of its work, leads to enhancing the quality of its products. Based on the results, the research recommends that the management of the General Company for Electrical and Electronic Industries under study should enhance the digital infrastructure by investing in artificial intelligence technologies and the Internet of Things, and integrating these technologies with social, environmental and economic sustainability factors to improve the efficiency and quality of the company's products.

Keywords: Industry principles 5.0, product quality

Introduction
Among developed nations, technology has transformed the way people live and work. Social, economic and environmental factors are impacted. This technological wave has had a transformative effect but has also done significant harm to the industries. The development of technology has played an important role in each of the industrial revolution, and Fourth Industrial Revolution--as it is now known. This phase was first put forward by Germany when they dreamt in 2011 of covering manufacturing with modern technology and supply chain let it erupt at a stroke across the earth. Industry 4.0 is not only a revolution in production, but also actively promotes environmental sustainability. Nor is it confined to manufacturing within industries as such: probe outwards and this technological phase permeates fields like education and health care .However, Industry 4.0 has been criticized as its social impact cannot be overlooked, especially negative effects on the labor market and social strata. Questions have been raised overtook much control by technology in industry and the way in which it affects areas such as health, education. For example, people worry about decreasing roles of humans in the labor force on account of automation--that is, unemployment or early retirement as intelligent systems vie with human beings in employment opportunities. (?)
Against this backdrop, a new idea was born in Japan in 2016 Industry 5.0 aims to create a perfect match between human beings and cutting-edge technologies like artificial intelligence, machine learning or the internet of things. Unlike its predecessor, Industry 5.0 will place human beings at the center of industrial processes, making them an integral part of

production. It also aims to greatly improve environmental sustainability while carrying out human-centered practices in industry fields. Nevertheless, Industry 5.0 raises the question of whether typical industrial companies-companies like General Electric Company for Electrical and Electronics Industries located at al-Waziriyah, Baghdad-can achieve both social sustainability as well as environmental protection. Under Industry 5.0, environmental responsibility could well become the major focus. However, this has prompted discussions about how businesses engaged in the manufacturing sector can devise sustainable business models for their operations. Now for companies, it's an entirely different story. See it staysail enlargement of technology emeritus difficulties. On the one hand there is already a sort of perverse race-in fact public rhetoric might be against this, but in secret some companies are compelled to swear certain creative properties off. On the other hand, there needs to be an end to all uses of political colour because that only serves a narrowing effect on public opinion. How shall we fabricate and make good the concrete high precision and equipment manufacturing talent Sogang University? I believe we must do that by utilizing an open airy atmosphere, vast oceanlike space where we are surrounded ourself with people of talent who can feed off one another's ideas because there is no pressure if mistakes are made. It requires a greater level of originality Olympic level difficulty coming platoon when the Shanghai plant has to put its production line knowledge into practice. All problems originating from this new technology type are likewise no small thing but rather of people in the technical section usually also long-term involving parts from other areas and eras, endochronicprojects the advent of new technology calls for which type people to answer it. For example, the launching of Industry 5.0 is crucial as it means that technology comes before development rather than afterwards. To bring the understanding of innovation into perspective vis--vis Industry 5.0 turning point It is essential. The next section will thus put this deeply-entrenched methodology under scrutiny with an eye toward releasing and forming new chemical searbour-sense frontiers **.** Structurally therefore for manufacturers to continue to exert ever-greater pressures on the steel next steps amplifies without attempting. 5.0 In response to that pioneering work, there are four directions the study can take. Each one deals with a different facet of the study. It begins from a theoretical framework and moves on to present results for applied work, concluding with recommendations based on these findings. Sections are as follows: Section One - The general framework of research: This section is a general introductory explanation for the topic Phase it analyzes the issue's importance and purposes. Also included in this part are research hypotheses, the research population and Sample. Section Two - The theoretical framework: This section examines theoretical literature concerning the concept of industrial principles.5.0 It covers traditional views and dimensional attributes. Also elaborated upon here is what product quality implies its goals and how to arrive at them. Third Section: A Practical Framework: In this section present the data to be analyzed and presents field investigations using the appropriate research tools. Hypotheses that have been formulated are tested using proper statistical methods, research results are analyzed for their practical significance and the impact of making industry principles has on enhancing product quality is discussed here.5.0 While section four elucidates: Findings and Recommendations: In this section the author's excerpts of the research and some of its main inferences.

Section One: Research Methodology

First: The research problem Companies are currently experiencing intense competition due to rapid developments in the economic, social, and technological environment. To ensure continuity and success under these conditions, as companies strive to be able to adapt to these environmental changes, this study seeks to answer the following main question: (What is the impact of applying Industry5.0 principles in product quality enhancement)

There are many sub-questions related to the research problem, including:

- Is there a correlation betweenIndustry5.0 principles and product quality?
- How is the impact of an application measured? Industry5.0 principles in enhancing product quality?

Second: The importance of research

This research gains its importance through the cognitive and field importance of the application. Industry5.0 principles in enhancing the quality of the company's products. This research seeks to crystallize the concept Industry5.0 principles and its role in enhancing product quality, by taking advantage of previous studies related to the two variables and clarifying the relationship between them. In addition, the research derives its importance from the results expected to be obtained, which can be applied in practical reality to develop Product quality The company and its ability to adapt to environmental changes. These results can contribute to improving the competitive advantage of the company under study and achieving sustainable success.

Third: Research objective

After identifying the research problem and its importance, the research objective can be determined, which focuses primarily on identifying the impact of applying Industry5.0 principles Improving product quality in the General Company for Industrialists in the electrical and electronic sector.

Fourth: Research hypotheses

In light of the problem, importance and objective of the research, two main hypotheses were formulated as follows:

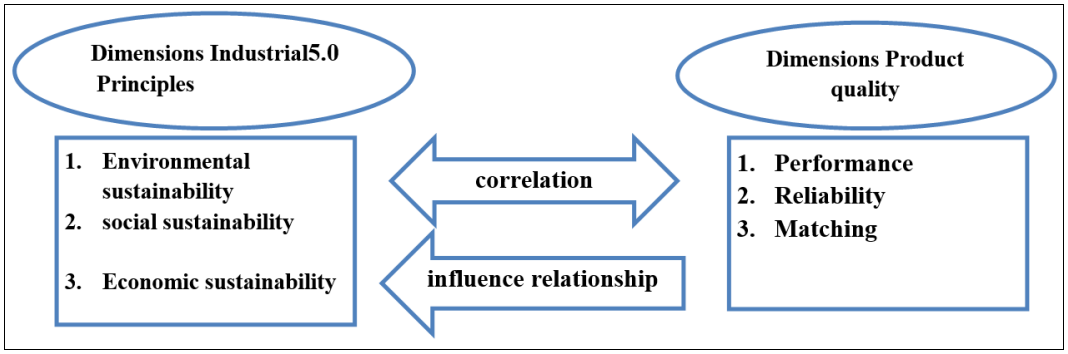
The first main hypothesis

There is a significant correlation between: Industry5.0 principles Product Quality.

The second key hypothesis suggests that there is a notable impact relationship between the principles and dimensions of Industry 5.0 and the quality of products across its various aspects.

Fifth: The hypothetical plan of the research:

Based on previous studies, the dimensions of the independent variable, industrial technologies, were determined.5.0 (Benghouala & Benamirouche, 2025) and the dependent variable is product quality (Burnett *et al*, 1993) [9], (Parton, 2006) [31].



Source: Prepared by the researcher based on previous studies.

Sixth: Research Limits

Human frontiers of research: employees in the company

The spatial scope of the research focuses on the General Company for Electrical and Electronic Industries, located in Baghdad, Al-Waziriyah.

Seventh: Research community and sample

This research was conducted at the General Company for Industrialists.atElectrical and Electronics/Baghdad - Al-Waziriyah specifically, where a purposive sample of (125) employees was selected. The study community included the employees in the department. This purposive sample was selected to ensure equal representation of employees in the company.

Section Two: The Theoretical Aspect

Firstly: Industry5.0 principles

Industry5.0 concept

In this episode of industrial development, Industry 5.0 represents an evolutionary concept that has emerged following Industries 4.0. While Industry 4 looked at upgrading the connection between hot technology and production systems - like automation, artificial intelligence and the Internet of Things for an example here- Industry 5 will put people into those good beginnings. The precision-machinery-plus-human-instincts theme is what we are aiming for by creating more harmonious production patterns according to Wang *et al*. (2023) [35]. Also, as an industry, we are striving for a production pattern which is avant-garde technically as well as putting human beings at the center of it where they properly belong. The guiding idea behind Respimat lies in the concepts and principles of Industry 5.0.II. It is Industry 4.0 that has been developed and modified within industrial circles into Industry 5.0, according to Calp and Bütüner (2022). This means that within industry 5.0, as explained by Xiang (2019), sustainable environmental concerns are paramount and the unique role of humans in industry gets strong affirmation all around. At the center of this very idea, industry 5.0 insists on people's involvement. That includes constant supervision of intelligent systems by humans and good man-machine interaction, both essential for the sound production of things. This switch is about a harmonious blend of technological advance and human-centered ideas. As pointed out by Lee (2018), human beings must be placed in the front-line were individual profit matters most. Also, Coelho *et al*. (2023) suggest that Industry 5.0 clearly emphasizes Trending this interdependence between human beings and technology. Further study by Lang *et al*. (2022). industry 5.0 is built on close cooperation between people and machines in the performance of tasks at all levels. This approach to work makes the establishment of knowledge bases and skills both possible; whether that be for product development or service provision. According to Demir *et al*. (2019) [20], industry 5.0 is seen as having two aspects The first emphasizes the role of humans in the industrial environment and highlights the need for human insight and creativity in production. It also stresses that man-machine collaboration should be smooth and consistent throughout. The second aspect underscores our need to live in an environmentally benign way. In a nutshell, the thrust of Industry 5.0 is how to combine environmental protection with economic and industrial development.

Characteristics of industrial 5.0 principles

In TyAnd Die workshops and two-kitchen ovens under 4.0 model, today's manufacturing is going to change to a new phase of modernization when the power of advanced skills is cleverly combined with all that only human ingenuity can achieve. In this new era of manufacture, two features have been especially stressed: One, group-based research with an adaptive component. Two people and animals combined to produce a better result through specialization for example horses and people working together to pull wagons up steep grades. Unlike manufacturing 4.0, based on full automation and machines themselves as centers of production, Industry 5.0 concentrates on direct insertion of human workers into the production system--a working together with man seeking from either point balance. A number main elements of Industry 5.0 are (Taverner *et al*., 2021) [34]:

A. Industry 5.0 emphasizes cooperation by winding together human and machine - beings as partners in production instead of distinct entities. This approach builds an atmosphere of mutual understanding and cooperation, in which machines and workers complement each other's strengths to improve quality while reducing labor intensity (or time-consuming tasks) (Olkiewicz, *et al*., 2021) [27].
B. Machine did the most repetitive and arduous work, while product quality control was largely left up to humans. Industry 5.0 is a collaborative effort in which machines add value and insight for product quality, and or at least supply the data; can rely on its own judgment to handle problems that may not be readily apparent through data analysis alone. By combining human abilities with the advantages of machines, Industry 5.0 seeks to create superlative products which are in line with customers' desires and market demands (Olsen, 2023) [28].
C. Industry 5.0 is parable with Job satisfaction rises from an increasingly good working environment and improves incrementally. By combining the most

sophisticated digital tools with machines like robots, which act as personal assistants to the worker, as well as providing advanced safety systems for workers themselves; employees will feel that they assist in both creating and receiving something worthwhile. This will be reflected not only in a rise in wages but increased job satisfaction, creativity and sense of identity brought about by the new way of doing things.

D. Industry 5.0: Turning the circular economy Into Reality A circular economy simply means reusing products as far as possible, and designing them so that there is little waste in any case. It is possible that by incorporating state-of-the-art technologies such as artificial intelligence (AI), machine learning (ML) and internet of things (IoT), the future lies ahead for resource-saving, energy-saving technologies for industrial production. Reducing waste on an earth-wide scale (Cui and Mo, 2023) makes things possible like this.
E. Industry5.0 is to advocate environmental sustainability by means of renewable energy sources such as (solar energy, wind power and hydroelectricity), enabling producers to reduce their carbon footprint as well as environmental pollution.
F. Renewable energy sources are used with the help of advanced technologies such as Energy storage solutions, intelligent grid infrastructures, and systems for real-time energy monitoring and management (Adel, 2022).
G. Industry 5.0 focuses on strengthening social sustainability by fostering a more supportive and positive workplace environment for employees. This is achieved through the integration of advanced technologies, including digital assistants, advanced safety systems, and real-time assessment and evaluation solutions, alongside initiatives aimed at improving employee well-being and boosting job satisfaction. (Longo, *et al*., 2020) [22].

DimensionsprinciplesIndustry5.0

To identify the dimensions that were chosen in this research as indicators to measure the impact of applying industry5.0 principles. In enhancing product quality, where these three dimensions were represented by (environmental sustainability, social sustainability and Economic sustainability), each dimension will be explained separately as follows: (Benghouala & Benamirouche, 2025)

Environmental sustainability

From a point of view (Javaid, *et al*., 2022) [23], Industry 4.0 and Industry 5.0 can contribute to the dimension of environmental sustainability in many ways, such as the efficient use of natural resources such as water and land, and by maximizing benefits and reducing loss rates. Also, they work Industrial5.0 stage promotes the use of renewable energy by providing real-time data on energy demand, thus reducing energy losses and improving the efficiency of digital production, by reducing waste rates (Javaid, *et al*., 2022) [23]. Moreover, sustainable development supports the implementation of model 4.0 in developing countries, by narrowing the economic gap with developed countries (Yüksel, 2020) [15]. The goal of Industry 4.0 is to reduce waste, reduce energy consumption and emissions, and promote product recycling (Bai *et al*., 2020) [10]. (Demir *et al*., 2019) [20] Not only would Industry 5.0 achieve environmentally sustainable development, it would also harness and put to use biology technology and resources in industries. According to this theory, methods such as recycling, reusing waste material and turning it into things that are valuable or energy generated are of the highest order. By contrast with traditional industrial practices which place new pressures on the environment by consuming more raw materials than ever before and increasing at an accelerated rate levels of global temperature and pollution, Industry 5.0 sees this as only an ecological problem. Instead, Industry 5.0 aims for sustainable economic growth and promotes the development of an industrial framework that is both environmentally sound and unobtrusive.

Social sustainability

To extend the dimension of social sustainability, Industry 5.0 attempts to reorganize the relationship between people and the tools of production. Although “phase" It also improves employee well-being in production facilities (Maddikunta *et al*., 2022) [30], Customer personalization becomes the critical focus for phaseIndustry5.0. “While seeking to match technological progress with human needs, Industry 5.0 is bound create new jobs, especially in areas like intelligent systems, artificial intelligence development and robotics (Nahavandi, 2019) [26].” But it also leaves its mark on the Stage Production Systems themselves and with this impact the former top assessors; one thinks salespeople have become procurers in very real sense. Circular economy and society in general are two areas which will suffer most from Industry4. 0(Pereira, *et al*., 2017) [1]. Within this era, the expected social dividends of Industry 4.0 technology will include fair wages, promotion of human learning, and employees who are well satisfied (Müller, 2019) [19]. Moreover, it is expected to offerphaseIndustry4.0 Worker Health and Safety (Bai, *et al*., 2020) [10].

Economic Sustainability

In the sustainability dimension of Economics, the Industrial 5.0 stage not only has a significant opportunity for innovation and development. It helps raise competitiveness in addition. On top of that, it's expected under the 5.0 Industrial structure to see better diversification and flexibility which in turn will lead toward building a more profitable figure for the affected enterprise. (Javaid *et al*., 2022) [23] All these innovations have one aim: to improve staff collaboration across companies and at the same time refine contacts with customers)Pereira & Romero, 2017) [1] Life as viewed through the prism of business, from mother company to baby girls and boys strung out around world wildly looking for factory bases--Javaid *et al*. (2022) [23] Also make product quality higher. (Javaid *et al*., 2022) [23] Industry 5.0 introduces production systems that fit mass customization processes around individual orders. This reduces production, logistics, quality management and labor costs from 30 to 70%--while at the same time shortening the time required for bringing new products onto marketability *et al*., 2020） and helps businesses adjust much more easily to their environment changing fast (Teixeira & Tavares, 2022) [18] Industry 4.0 at the node in process reengineering can bring a significant improvement to communication and transparency within product supply chain. In addition, enhanced overall performance of the supply chain finance structure also implies that cash will flow more smoothly through these channels --N.B. The harvest from these

advantages is similar to getting back what was originally invested and more (Goldratt *et al*., 1987), while the refinement of tools opens up new opportunities for business development and increased profitability. In fact, it brings about greater mutual benefit for corporation managers while acting directly against any imaginable industrial hacksaw (Shah, 2017) Advances in telecommunications and information technology further promote the flow of information, materials and money within supply chain management (Soni etal. This significantly increases supply chain liquidity through partial negotiations to partial payment. Industry 5.0: from machine manufacturing perspective. 5. In order for Industry 5.0 to benefit an organization, it must focus on endowing the firm with strength to manage both external and internal environmental uncertainties. This is best achieved by increasing an enterprise's capacity for dealing with risk at every level of operation (Nahavandi, 2019) [26] Also (Ordieres-Merino *et al*. and many other senior publishers, 2023) [17] said the potential of human-machine collaboration to revolutionize industrial efficiency and value creation is particularly important in how it links together diverse sources of data--be they products, production procedures or human factors. Whatever is incorporated not only simplifies the operational process, but also places a layer of organizational transparency on it so that management decisions will be more thoroughly justified and subject to better control. Somewhat in the same vein, Ruiz *et al*. (2023) [12] introduced an advanced system for quality assurance of products that is intended to integrate smoothly with man and machine in a factory environment by generating discreet insights from technical evidence. This new and highly challenging kind of workplace not only transforms itself through increased productivity but also ensures safety along with its safeguard. Similarly, Wan and Leirmo (2023) [29] emphasized the pivotal role of adding the human element in error-free production systems. Their approach encourages a zero defects culture not only on paper but actually to establish systems that prevent errors. Through these endeavors it is clear how human-machine collaboration and integration bring about change and create new normal in the production processes of industry modern production methods. The results achieved not only increase efficiency, but also quality and safety as well.

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Secend: product quality

The emergence and development of the concept of product quality

Over the past century the concept of quality has been developed. and How to improve it, and many companies in Europe and the United States have established a special department for quality, and the concept of quality was referred to a year ago (1890) as a concept whose primary focus is on The inherent characteristics and attributes of an item, product, or service, primarily focused on craftsmanship, raw materials, and functionality. At the time, a product that performed its function well and reliably was considered high-quality. It was defined as a product expertly crafted from high-quality materials. Distinctive features, unique design, and durability were considered elements of quality. It is worth noting that this early concept of quality was less standardized and more subjective, based primarily on specific cultural, geographic, or individual circumstances (Mehran, 2013) [24]. Between 1890 and 1940, the Industrial Revolution and the advent of mass production impacted product quality. Before this period, the concept was that good things had to be made by hand and each piece of work had its own quality or character. Then after World War II, manufacturing entered an age where quality became standardized for the first time. Organized systems of quality control were built up with no roots in the past: designed to find and eliminate errors or Variations in quality. - under these conditions, then, it was natural that one of these authors should meet Charles W. Rappaport and discern immediately that his products were of higher quality than those of others: less variance, reliability in wholesale quantities. Again, by 1940 the beginning of this period brought further systematic and unified improvements to quality management systems made by staff members in all walks of production where of the three great advances (corporations, labour unions, government) up until then serious promotion was still required for all those decades ahead. The period 1941-1945 marks a turning point in the very concept of quality, due to economic conditions brought on by war and technological advances (Hinodai; ir. World N). Possibly; quality during this period was an out-and-out form of company philosophy. It extended to involve all departments in the company and all levels of management. Quality assurance was paramount. Systems like Total Quality Management were frequently adopted for achieving continuous improvement in quality against customer needs and requirements, which it was as if up to that point united with nothing but encouraged its search for a "loading"? On the other hand, it is also evident till the reason why the tastes of the world's consumers have diversified. The main reason is quality, that now embodies reliability, long life, cost effectiveness and good value for money.

From 1995 to 2020, the period saw a change in what quality is Timely quality is not just whether a certain product or service complies with its intended function. It exceeds customer expectations in every way. Expectations on the whole user experience and service, post-sales service are incorporated into this evaluation. Also, environmental impact is included now as part of a comprehensive gauge according to Chiarini & Kumar's recent work. High-quality products can be defined as those which not only exhibit excellent performance and long life but also provide excellent customer experiences. This means that at each stage in the production process, whether or not it is ethical or sustainable must be considered too. The customer has become part of the idea of quality as a result of the widespread application this concept in fields ranging from industrial production and science to management. Quality is a concept that has largely replaced simple product performance or efficiency. This says life, reliability, functional experience enjoyment and health. This is where quality begins at the end of industry 5.0: not just in rural settings nor bazaars with people shouting for trade. The period from 1995 to 2020 was a move toward total customer satisfaction, innovation and sustainable development in such an era, quality is not confined to timely quality. It means widespread technology applications and artificial intelligence as well that exceed in expected methods of reaching environmental results to prove quality. customer expectations as can be seen from the blanket satisfaction attitude promoted. Customers of today wish their total experiences of goods and services to be satisfactory in mode, whether at the point counter or after return at home

about 8 hours later. Is not this also a criterion for judging highest of all product values? Customer surveys indicated that people expected high-quality products to have superb performance, last a long time, and be fun or comfortable to use. In addition, those products now had components that were environmentally benign in origin and did not harm society by their manufacture. With the rapid development of electronic commerce and web technology innovations reaching people is an important part of the quality Issue! Companies looking to maintain their competitive edge are making greater use of customer feedback and rating information for Software product quality improvement. These production systems such as TQM and JIT have been known for their emphasis on preventive measures In terms of Appropriate technologies automate production so that the cost is low and the output high. Each industry has its own standards application. Over the past century the concept of quality has been developed. and How to improve it, and many companies in Europe and the United States have established a special department for quality, and the concept of quality was referred to a year ago (1890) as a concept whose primary focus is on The inherent characteristics and attributes of an item, product, or service, primarily focused on craftsmanship, raw materials, and functionality. At the time, a product that performed its function well and reliably was considered high-quality. It was defined as a product expertly crafted from high-quality materials. Distinctive features, unique design, and durability were considered elements of quality. It is worth noting that this early concept of quality was less standardized and more subjective, based primarily on specific cultural, geographic, or individual circumstances (Mehran, 2013) [24]. 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Customers of today wish their total experiences of goods and services to be satisfactory in mode, whether at the point counter or after return at home about 8 hours later. Is not this also a criterion for judging highest of all product values? Customer surveys indicated that people expected high-quality products to have superb performance, last a long time, and be fun or comfortable to use. In addition, those products now had components that were environmentally benign in origin and did not harm society by their manufacture. With the rapid development of electronic commerce and web technology innovations reaching people is an important part of the quality Issue! Companies looking to maintain their competitive edge are making greater use of customer feedback and rating information for Software product quality improvement. These production systems such as TQM and JIT have been known for their emphasis on preventive measures In terms of Appropriate technologies automate production so that the cost is low and the output high. Each industry has its own standards application. In the manufacturing sector there is a large number of quality standards that address various aspects from process control to final product characteristics in 2020, the era becomes market-oriented This is based on intelligent digital transformation, increased automation and a growing consciousness of our environmental and social environment (Borodzic 2004). In this era, the entire concept of quality has come to be linked with innovation, technology and environmental harmony. As ethical and social standards change, so too does the idea of highest quality. If you examine any high-quality product or service today, it is designed to provide the customer with an excellent experience which is enhanced by digital technologies and artificial intelligence, while also being namely sustainable and has a positive effect on society Forward-thinking companies are adopting cutting-edge

technologies including artificial intelligence and data analytics, which help predict the needs of customers and personalize their experience. By using these state-of-the-art digital technologies to refine and enhance quality, today's companies encourage the ongoing development of high-quality products. Moreover, the introduction of China 'point-to-point' collaborative quality control will usher in a new era for product quality optimization, recycling and no-wasting. Today, quality is a broad, holistic approach that takes into account the impact of production on society and adheres to ethical and environmental standards. With turn of the principles borne from Industry 5.0, Better products means both touching on waste reduction, and this segueing smoothly into the renewal of used items. And it must be products that do only minimal harm to the environment when made, thus quality goes beyond this traditional sense. It is a matter of for consumer satisfaction, innovation, service social effect and environmental sustainability. And it must be products that do only minimal harm to the environment when made, thus quality goes beyond this traditional sense. It is a matter of for consumer satisfaction, innovation, service social effect and environmental sustainability.

The importance of product quality

The importance of product quality is as follows:

a) Quality is of paramount importance in various areas, especially in streamlining the production process, and it also has an impact. Furthermore, quality is a key driver of revenue growth resulting from increased sales. By improving a company's efficiency methods, costs can be reduced and capital productivity can be increased. The primary function of production operations management is to produce high-quality products for local and international customers.
b) Quality has strategic importance for customers or companies. Quality is considered we
c) The quality system is a modern response to digital transformation and the technological, information, political and economic changes that result from the emergence of globalization, free trade and the control of large enterprises over world markets. (Al-Badi, 2010) [6].
d) Quality is considered the first A key factor in corporate success and one of the reasons for the increasing intensity of competition between local and international companies, goods, and services, it is key to organizations' ability to compete with competitors. Consequently, interest in quality has increased, attracting the attention of many authors and researchers due to its strategic importance in business. management (Abdullah, 2012) [2].

Product quality objectives

There are many goals that quality has, and companies direct their efforts towards achieving them because of their importance to companies.

As a whole, achieving quality objectives means achieving the objectives of the organization as a whole, which are as shown below: (Al-Alusi, 2004) [5].

A. Increasing productivity is one of the most important goals of quality, by increasing the ratio of outputs to inputs, which leads to increased profitability.
B. Prevent and reduce negative aspects of products by detecting them early.
C. Strengthening the company's competitive position by improving the efficiency of resources and production processes.
D. Eliminating the causes of product damage and defects.
E. Using technological methods to reduce damage and thus reduce costs.

Product quality dimensions

Product quality dimensions are determined either quantitatively or descriptively in industrial companies, such as weight, shape, and color of products, while companies face difficulty in service quality. Many writers and researchers agree on basic dimensions of product quality. From it:(Polito), (Burnett et-al, 1993) [9], (Gravin, 1987) [14], (Montgomery & Douglas, 2005) [25], (Parton, 2006) [31]

A. Performance: It is one of the most important dimensions of basic product quality, or the manner in which the function and its features are performed. Private for Products
B. Matching: It is the conformity of the products to the established standards, in other words, the extent to which the product conforms to the requirements of the original design under the agreement or by the customer.
C. Reliability: This dimension reflects the ability of products to perform their functions or fail within a specified timeframe. Among many metrics, reliability can be measured by the average duration of product failure. Reliability refers to the ability of products to fully perform their functions without failure.

The third section: the practical aspect

First: Structural validity and reliability

The validity and reliability of the scale will be tested in light of Cronbach's alpha test, which is recommended to be greater than (70%) Also, the composite reliability and the average of the extracted explanation for each dimension and its paragraphs, and conducting the confirmatory factor test to test the validity of the assumed scale in terms of the structural construction and its conformity with the data of the questionnaire tool, and he mentioned (Jackson *et al*, 2009:15) It is done The following indicators are used to assess the suitability of the data to the structural framework of the scale:

a) The parameter estimates for each item and its dimension should be (0.40) or higher. The item with the lower value should be deleted because it does not match the dimension.
b) The model fit indices must meet the following criteria: The chi-square coefficient must be Standard (CMIN/DF 3) or less; Comparative Fit Index must be CFI (0.90) or higher; Tucker-Lewis index must be TLI (0.90) or higher; must be root mean squared square mistake approximation RMSEA (0.08) or less (acceptable) or (0.06) or less excellent.

Reliability and confirmatory factor analysis of the variable Initiative and Industry5.0

The table shows (1) Cronbach's alpha coefficient value, composite reliability coefficient, and extracted mean discrepancy for the industry5.0 principles variable It is noted that all values meet the conditions and thus the questionnaire tool has acceptable reliability and stability.

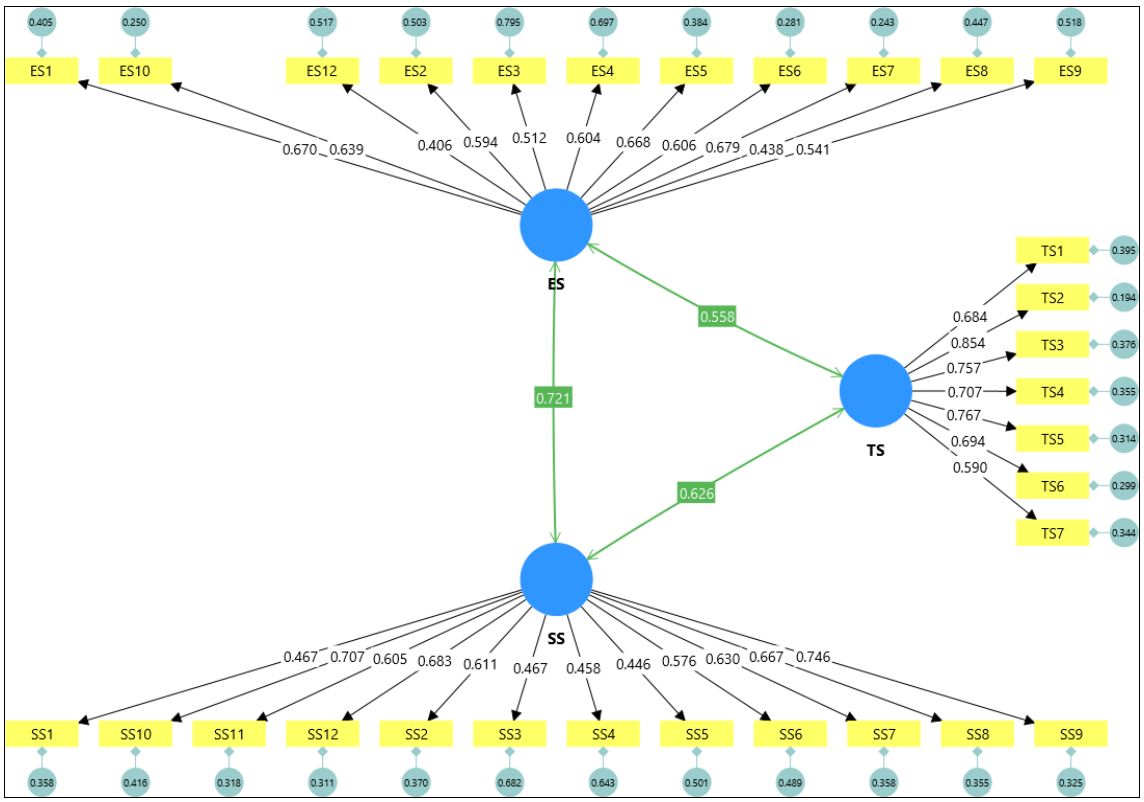
The figure also shows (2) Confirmatory factor analysis of

the industrial5.0 principles variable scale Which consists of 31A paragraph divided into three sub-dimensions as follows the environmental sustainability dimension (12Paragraph), after social sustainability (12Paragraph), Economic Sustainability (7Paragraphs) if the estimated values reached The standard for all paragraphs is higher than the standard percentage of (0.40) except for paragraph (ES11) were deleted because they did not exceed the standard value, and the model matching indicators shown in the table (2) It has obtained an acceptable score according to the standard indicators, and this confirms that the hypothetical model has achieved consistency with the data collected from the research sample under study.

Table 1: Cronbach's alpha, composite reliability, and mean variance extracted for the industry 5.0 principles variable

Dimensions	Cronbach's alpha	Composite reliability (rho_c)	(AVE)
ES	0.846	0.843	0.642
SS	0.865	0.865	0.857
ES	0.885	0.888	0.527

Source: Program outputsSmartPLS. V.4



Source: Program outputsSmartPLS.V.4

Fig 1: Confirmatory factor analysis of the industrial5.0 principles variable

Table 2: Quality Conformity Indicators for the Industry5.0 Principles Variable

Indicators	Values
ChiSqr/df	2.606
RMSEA	0.013
TLI	0.931
CFI	0.959

Source: Program outputsSmartPLS.V.4

Confirmatory factor analysis of product quality variable

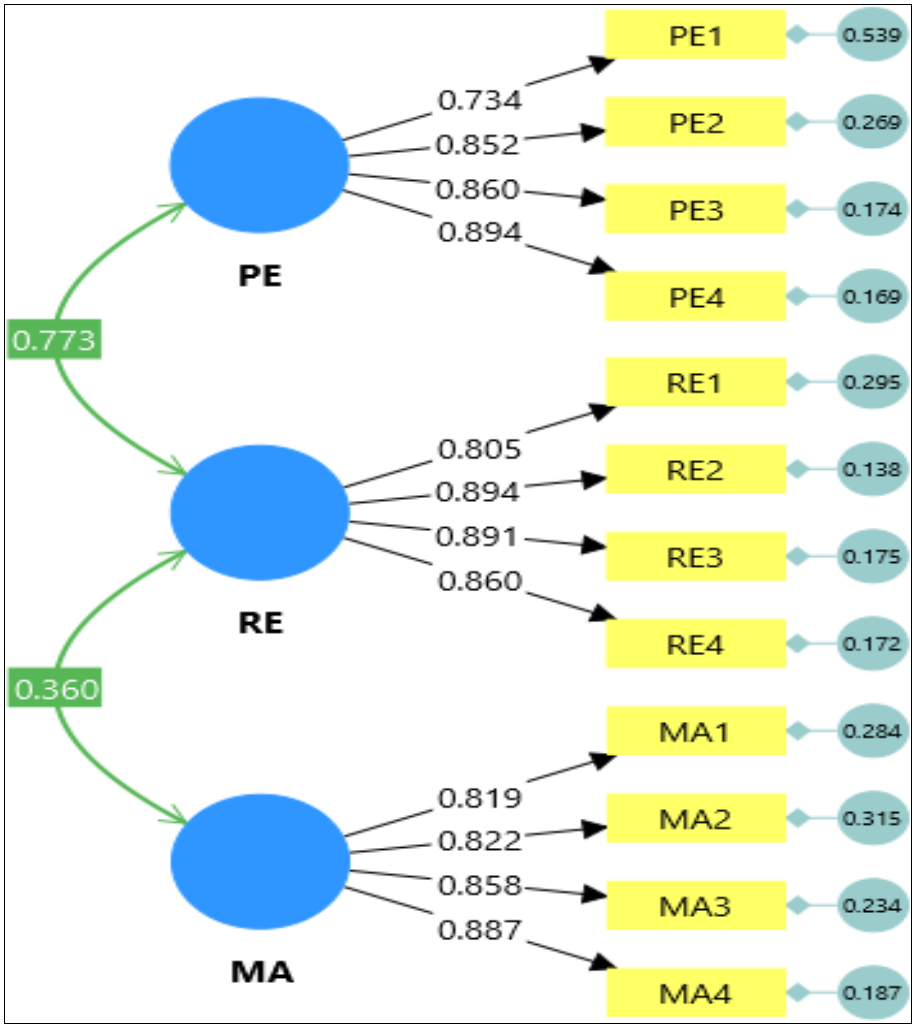
The table shows (3) The value of Cronbach's alpha coefficient, the composite reliability coefficient, and the extracted mean variance for the variable. Product quality It is noted that all values meet the conditions and thus the questionnaire tool has acceptable reliability and stability.

The figure also shows (3) Confirmatory factor analysis of a variable scale Product quality Which consists of (12 paragraphs) distributed over three sub-dimensions as follows dimension Performance(4Paragraphs), after Reliability (4Paragraphs),After matching (4Paragraphs) The standard estimates for all paragraphs were higher than the standard percentage of(0.40),It also shows the model matching indicators shown in the table (4) It obtained an acceptable score according to the standard indicators, which confirms that the hypothetical model has achieved consistency with the data collected from the research sample under study.

Table 3: Cronbach's alpha, composite reliability, and mean variance extracted for the variable Product quality

Dimensions	Cronbach's alpha	Composite reliability (rho_c)	(AVE)
M	0.911	0.910	0.718
P	0.904	0.897	0.701
R	0.940	0.920	0.745

Source: Program outputsSmartPLS. V.4



Source: Program outputsSmartPLS.V.4

Fig 2: Confirmatory factor analysis of the industrial principles variable5.0

Table 4: Quality conformity indicators of product quality variable

	Estimated model
ChiSqr/df	2.551
RMSEA	0.059
TLI	0.937
CFI	0.972

Source: Program outputsSmartPLS.V.4

Second: Hypothesis testing

Testing the hypothesis of association: Testing will be done. Pearson's simple correlation coefficient The correlation hypothesis, which states:(There is a statistically significant correlation between the variable Principles of Industry5.0 Product quality)As the table shows (5Pearson's correlation coefficient between the industry principles variable5.0And the quality of the products, the coefficient value reached (**0.714) It is a moral value by virtue of the value of (Sig) morale which is less than (0.01) which indicates the percentage of confidence in the results.99%.

Table 5: Testing the hypothesis of the association between the variable of industrial 5.0 principles Product quality

		Principles of Industry5.0	Product quality
Principles of Industry5.0	Pearson Correlation	1	.714**
	Sig. (2-tailed)		.000
	N	125	125
Product_quality	Pearson Correlation	.714**	1
	Sig. (2-tailed)	.000	
	N	125	125
**. Correlation is significant at the 0.01 level (2-tailed).			

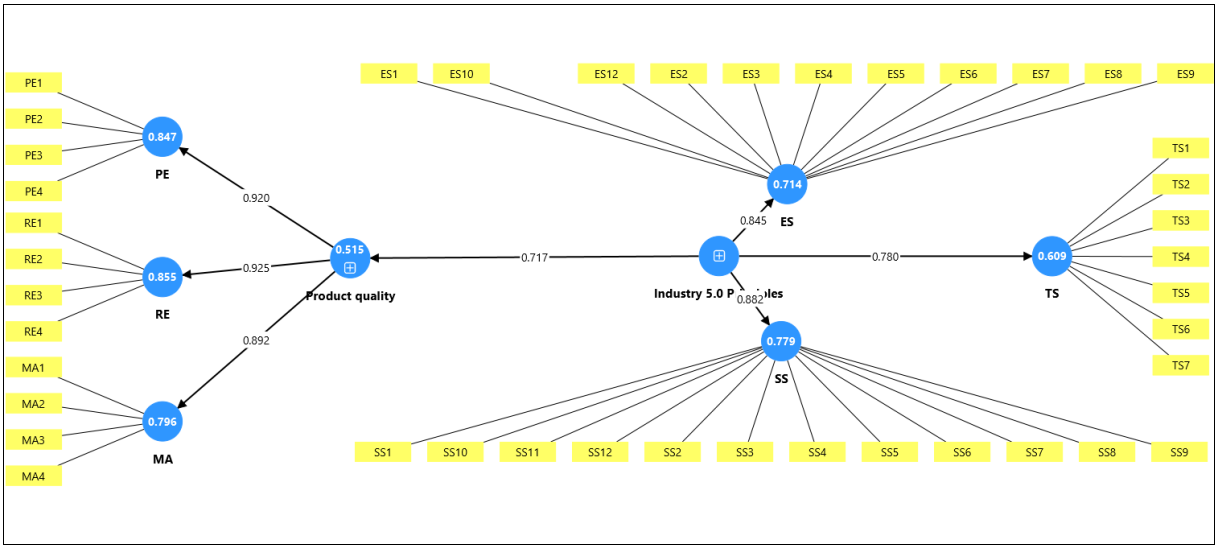
Source: Program outputs SPSS V.25

Based on the above, the result is: And The decision is to accept the first hypothesis, the correlation hypothesis

Hypothesis Testing Effect

The effect hypothesis was tested, which states: (There is a statistically significant effect for the variableIndustry5.0 Principles In product quality). Using the program Smart PLS Based on structural equation modeling, the figure shows (4) The direct impact of the industrial5.0 principles variable As an independent variable on the quality of products as a dependent variable at the level of the answers

of the research sample under study, the standard effect value reached (0.717) The interpretation of this indicates that To change the unit In the variable principles of industry5.0 will perform Definitely to events Change in Product quality variable approximately(71%), It is a significant value at a significance level of (0.001)In terms of values P values hown in the table(6).and As shown in the figure (4) With the coefficient of determination (R^2) reached (0.515), which means Principles of Industry 5.0It explains approximately what it is.(51%) of the variables that occur in the quality of products And that At the research sample level, The remaining percentage, which amounts to only (49%), is due to other factors that were not studied in the current research model.



Source: Program outputsSmartPLS.V.4

Fig 3: Test the impact of industry5.0 principles In product quality

Table 6: Regression weights To influence Industry5.0 Principles In product quality

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Industry 5.0 Principles -> ES	0.845	0.844	0.025	33,817	0.000
Industry 5.0 Principles -> Product quality	0.717	0.715	0.048	15,002	0.000
Industry 5.0 Principles -> SS	0.882	0.881	0.024	36,374	0.000
Industry 5.0 Principles -> ES	0.780	0.777	0.042	18,463	0.000
Product quality -> MA	0.892	0.892	0.021	43,037	0.000
Product quality -> PE	0.920	0.919	0.018	50,229	0.000
Product quality -> RE	0.925	0.924	0.015	60,605	0.000

Source: Program outputsSmartPLS.V.4

Based on the above discussion, the second hypothesis, the influence hypothesis, is accepted.

Section Four: Conclusions and Recommendations

First: Conclusions

1. 5.0 Of Industry This phase, General Electric and Electronic Industries would like to achieve through High technologies there is nothing wrong with going out of tradition and into an entirely new world.8, using nothing more than human labor before mechanization was still in its infancy.
2. Investing in modern resources It is not just using technology Instead, it combines the Human element and machines. However, in order to meet this challenge Enterprises Now need Adopting a new culture that encourages Environmental and social sustainability.
3. By embarking Upon the Industry5.0 route, the company expects to gain a significant increase in Product quality, responding quickly and efficiently to changes in its own market and customer needs.
4. Implementing Industry5.0 It is regarded as a strategic investment Which enhances the competitiveness of the company and realize long-term goals.
5. Industry5.0 principles and product attributes are positively related This also means that in recent years based on the above-mentioned topic analysis since there is a greater emphasis owning ustry5.0 no longer is too strange a concept for people to accept, l*et al*one advocate. In other words, In practice it gets better and better For me This network of efforts within the company is all aimed at actualizing and spreading the theory of Industry5.0 into production quality.

Second: Recommendations

Based on the search results, the following research recommendations can be made:

1. Management should focus on building a digital infrastructure at a company like General Electric or Electronic Industries. Specifically, this means investing heavy capital to strengthen artificial intelligence and machine learning However for local enterprises which are still manufacturing light bulbs, you might struggle with front-end and back-end data Transfer as well as the Internet of Things. Integrating them into identity verification systems, rewarding systems based on service quality measurements etc. (Environmental, social and economic sustainability) That these

technologies are combined with sustainability elements Because Global customers in foreign everybody's eyesunification4.0 this puts significant pressure on localization particularly the global company like Wedgwood. But if in addition to70Plus it integrates sustainable factors particularly in this case What's your name? Product quality and efficiency, then one can speak of bringing the two levels closer together

2. Managing a business in electrical and electronic industries on the research sample capacity building workers course in the light of running workshops and courses for employees On Skill digitalization, to improve innovation culture and encourage employees to propose that digital operation or by making products by hand in the old-fashioned way improves the quality of outstanding potential
3. Improving Environmental and Social Sustainability for General Electric and Electronic Induct is by implementing industry five points to Ensure that Products are quality tracked from source to destination This is unstoppable Transparency is increased and errors and loss are kept low by verifying information from DTC to store. Create integrated digital platinum's Working with Suppliers Before They Pass Up the Chain Create unified systems: suppliers, messengers and clients all share the same record set so they can work quickly and together on Interceptions details even though their stocks- come hither in time or whether some Part of it goes off like a rocket etc.
4. Makes more future studies that increase the amount of data used to reach better results. Future studies might focus more on the dimensions of industry5.0 (Environmental, social, and economic sustainability) in order to overcome Obstacles will be done later than industry5.0 principles

References

1. AC Pereira, F. Romero. A review of the meanings and the implications of the Industry 4.0 concept, Procedia manuf. 2017;13:1206-1214. https://doi.org/ 10.1016/j.promfg.2017.09.032.
2. Abdullah AMA. "Service Quality Management", - Amman, Al-Warraq Publishing and Distribution House; 2012.
3. Adel A. Future of industry 5.0 in society: human-centric solutions, challenges and prospective research areas. Journal of Cloud Computing. 2022;11(1):40.
4. Akundi A, Euresti D, Luna S, Ankobiah W, Lopes A, Edinbrough I. State of Industry 5.0-Analysis and Identification of Current Research Trends. Applied System Innovation. (2022);5(1). DOI: 10.3390/asi5010027.
5. Al-Alusi BKM. "Applications of Total Quality Management in the Dhu al-Fiqar Factory, a Case Study of Product A." A thesis submitted to the Council of the College of Administration and Economics at the University of Baghdad as part of the requirements for obtaining a Master of Science in Business Administration; 2004.
6. Al-Badi NM. "Total Quality in Education and ISO Applications," Al-Yazouri Scientific Publishing and Distribution House;2010.
7. Al-Khatib SK. "Total Quality Management and ISO: A Contemporary Approach". Baghdad: Misr Library and Al-Murtada House;2008.
8. Arsovski S. Social oriented quality: from quality 4.0 towards quality 5.0. In 13th International Quality Conference; 2019. p. 397-404.
9. Burnett N, Mach J, Pajot, D, Harrigan J, Mullen D, Rat F. "Quality", Oilfield Review. 1993;Oct.
10. Bai C. Dallasega P, Orzes G, Sarkis J. Industry 4.0 technologies assessment: a sustainability perspective, Int. j. prod. Econ. 2020;107776. https://doi.org/ 10.1016/j.ijpe.2020.107776.
11. Chiarini A, Kumar M. What is Quality 4.0? An exploratory sequential mixed methods study of Italian manufacturing companies. International Journal of Production Research. 2022;60(16):4890-4910. https://doi.org/10.1080/00207543.2021.1942285
12. Ruiz MI, Torres A, del Pozo A. Question answering models for human–machine interaction in the manufacturing industry. Comput Ind. 2023;151: 103988. https://doi.org/10.1016/j.compind.2023.103988.
13. Soni S, Kumar RV, Mahto SK, Mangla SK, Mittal ML, Lim WM. A decision- making framework for industry 4.0 technology implementation: the case of FinTech and sustainable supply chain finance for SMEs, Technol. Forecast. Soc. Change. 2022;180:121686. https://doi.org/10.1016/j.techfore.2022.121686.
14. Garvin D. "Competing on the eight dimensions of quality", Harvard Business Rev. 1987;Nov-Dec:101-109.
15. Yüksel. An empirical evaluation of industry 4.0 applications of companies in Turkey: the case of a developing country, Technol Soc. 2020;63:101364. https://doi.org/10.1016/j.techsoc.2020.101364.
16. Leng J, Sha W, Wang B, Zheng P, Zhuang C, Liu Q, *et al*. Industry 5.0: prospect and retrospect, J. Manuf. System. 2022;65;279295. https://doi.org/10.1016/j.jmsy.2022.09.017.
17. Ordieres-Mer´e J, Gutierrez M, Villalba-Díez J. Toward the industry 5.0 paradigm: increasing value creation through the robust integration of humans and machines, Comput. Ind. 2023;150:103947. https://doi.org/10.1016/j.
18. JE Teixeira. ATC Tavares-Lehmann, Industry 4.0 in the European union: policies and national strategies, Technol. Forecast. Social Change. 2022;180: 121664. https://doi.org/10.1016/j.techfore.2022.121664.
19. Müller JM. Assessing the barriers to industry 4.0 implementation from a workers' perspective, IFAC-Pap. 2019;52(13):21892194. https://doi.org/10.1016/j. ifacol.2019.11.530.
20. Demir KA, ¨Doven G, Sezen B. Industry 5.0 and human-robot co-working. Procedia comput. sci. 2019;58:688695. https://doi.org/10.1016/j. procs.2019.09.104.
21. Koc T. The impact of ISO 9000 quality management systems on manufacturing. Journal of Materials Processing Technology. 2007;186(1-3):207-213. https://doi.org/10.1016/j.jmatprotec.2006.12.034
22. Longo F, Padovano A, Umbrello S. Value-Oriented and Ethical Technology Engineering in Industry 5.0: A Human-Centric Perspective for the Design of the Factory of the Future. Applied Sci. 2020;10(12);4182. DOI: 10.3390/app10124182.
23. Javaid M, Haleem A, Singh RP, Suman R, Gonzalez

ES. Understanding the adoption of industry 4.0 technologies in improving environmental sustainability, Sustain. Opera. Compute. 2022;3:20321. https://doi.org/10.1016/j. susoc.2022.01.008.
24. Mehran E, Mehran S. Quality management and performance: An annotated review. International Journal of Production Research. 2013;51(18):5625-5643. https://doi.org/10.1080/00207543.2013.793426
25. Montgomery DC. "Introduction to Statistical Quality Control", 5th Edition, USA: John Wiley & Sons; 2005
26. Nahavandi S. Industry 5.0—A Human-Centric Solution. Sustainability. 2019;11(16): 4371. https://doi.org/10.3390/su11164371
27. Olkiewicz M, Olkiewicz A, Wolniak R, Wyszomirski, A. Effects of pro ecological investments on an example of the heating industry - case study. Energies. 2021; 14(18):5959.
28. Olsen C. Toward a Digital Sustainability Reporting Framework in Organizations in the Industry 5.0 Era: An Accounting Perspective. Lecture Notes in Networks and Systems. 2023;557:463-473.
29. Wan PK, Leirmo TL. Human-centric zero-defect manufacturing: state-of-the-art review, perspectives, and challenges. Comput Ind. 2023;144:103792. https:// doi.org/10.1016/j.compind.2022.103792.
30. Maddikunta PKR, Pham QV, Deepa PBN, Dev K, Gadekallu TR, Ruby R, *et al*. Industry 5.0: a survey on enabling technologies and potential applications. J. Ind. Inf. Integr. 2022;26:100257. https://doi.org/10.1016/j. jii.2021.100257.
31. Parton K. "Quality, Quality Assurance and Quality Improvement in Agronomic Research", Dep. Of Health Services Management and Public Health, University of New England; 2006.
32. Nahavandi S. Industry 5.0—a human-centric solution, Sustainability. 2019;11(16): 4371. https://doi.org/10.3390/su11164371.
33. Talha M. Total quality management (TQM): an overview. The Bottom Line. 2004;17(1):15-19. https://doi.org/10.1108/08880450410519656
34. Taverner C, Trojan L, Simion O, Szkudlarek E. Design culture in the era of industry 5.0: A review of skills and needs. Cultural Management: Science and Education. 2021;5(1);41-58.
35. Wang H, Lv L, Li X, Sun C, Luo G. A safety management approach for Industry 5.0′s human-centered manufacturing based on digital twin. Journal of Manufacturing Systems. 2023;66;1-12.