JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2024, VOL 7, NO 3

The Effect of Continuous Process Improvement Elements on Achieving Sustainable Competitive Advantage

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Abstract
This study aims to find out how continuous improvement (CI) of production processes helps make the iron and steel factory more competitive in the long run. To achieve competitiveness, the plans of the iron and steel factory in Karbala/Iraq face a major obstacle in the form of limited financial resources, which requires searching for innovative solutions to bridge this gap. Based on the literature related to continuous improvement and competitive advantage, a theoretical framework is developed which assumes that the former is an independent variable, and the latter is a dependent variable. In this study, the researchers followed the empirical research method. The sample of the study consists of 175 workers in the iron and steel production factory in Karbala/Iraq. To analyze the data, a set of statistical methods available in the statistical program (SPSS.V.26), (SMART PLS.V.4.1.0.5) was used. The results of the study confirm that continuous improvement, which is evident in the factory's efforts to increase equipment efficiency and accelerate the introduction of new products, contributes significantly to enhancing the company's competitive advantage in the long run. The study recommends that the factory management enhances its efforts in the field of continuous improvement to ensure its survival in the market and expand its business.
Keywords: Continuous improvement (CI), sustainable competitive advantage (SCA), Iron and steel factory.

Introduction

Asian countries and in Iraq specifically, many previous studies focused either on strategic vigilance, computerized information systems, or cleaner production costs to achieve a (SCA) (Manhal & Hattab, 2018; Al-Tamimi et al., 2022; Allawi, 2023), but in sectors In various sectors, such as the financial and communications sectors, limited research has been conducted to evaluate the elements of (CI) in achieving a sustainable competitive advantage, such as (Abdel-Khaleq & Dawood, 2022; Hatem & Al-Maamouri, 2023), as the impact of the elements of (CI) in achieving a (SCA) has not been studied In iron and steel production and manufacturing sector, and this constituted an incentive and motivation supported by the spirit of will to fill part of this gap by evaluating the extent to which the elements of (CI) (Plan, Do, Check, and Act), contribute to achieving a (SCA) in the iron and steel factory in Iraq.

The world today lives in continuous development and rapid change, and this requires organizations to keep pace with these developments and determine the company’s position compared to other competing companies since industrial organizations are affected by rapid environmental changes more than the rest of the sectors of the economy, in addition to the intensity of competition, as well as the failure of many organizations and declaring their bankruptcy, this is where it came from The roles of (CI) that aim to keep

pace with changes and their relationship to achieved a (SCA) (Ingaldi & Ulewicz, 2019; Saghee & Al-Hilawy, 2024). Therefore, (CI) works to increase the organization's ability to meet its complaints, starting with the machine that the individual worker works on, through the development and improvement cases that follow it, and ending with developments and improvements to the products, and this extends to taking into consideration the work site floor and its cleanliness (Atyya & Al-Jarjari, 2011). (CI) is violated when the goal is to build a special quality system and permanently enhance it by issuing certifications (Anttila & Jussila, 2018). indicated that (Jagusiak-Kocik, 2017; Ulewicz & Lazar, 2019) (CI) is one of the eight principles of quality management, which consists of several repetitive procedures, the goal of which is to increase the organization's ability to meet requirements and ensure the achievement of a sustainable competitive advantage.

Therefore, the company's achievements can be improved by focusing on partial improvements and encouraging employees to participate in these improvements, and this in turn will reflect positively on achieving a (SCA) by focusing on organizational differentiation and cost leadership. (CI) is a continuous effort to improve products and processes, increase their efficiency, and reduce production costs While satisfying the customer's needs and desires, (CI) is nothing more than gradual, non-stop improvement to complete small tasks better and set higher standards, while slow (CI) is the one that does not end in all aspects of life, and it represents the Japanese approach to (CI) for every person and in all fields, including productivity and maintenance and inventory reduction (Krajewski et al., 2016). The goal is to reach complete mastery through (CI) in the organization's production processes. Although complete mastery is difficult to achieve, one should strive to reach it, and the strategic goal that the organization seeks to reach (through (CI)) is a serious search for good mastery of every process (Fahd & al sultane, 2023; Fahd et al., 2022). At any time, from the first step, sufficient to determine (SCA) that enables it to remain in the market or expand (Heizer et al., 2017; Oglah, & Jayan; 2024).

The problem of the current study was identified through the observation method, which indicated that the iron and steel factory in Karbala city of Iraq needs to enter the world of competition strongly, but because of the limited financial capabilities that the state allocates to this factory this in itself is a problem because researchers pointed out The lack of financial capabilities is a problem in itself and requires solutions (Ingaldi & Ulewicz, 2019). This can happen by reconsidering the improvement of current products and developing them to meet the needs and requirements of the Iraqi market, as well as gaining new customers, as well as providing new, high-quality products that It can achieve (SCA) for the researched factory and thus achieve the goals of survival in the business world by establishing elements (CI) in light of the factory's current capabilities and identifying the most important requirements to achieve a sustainable competitive advantage.

After clarifying the problem of the study, the researcher attempts to answer several questions, namely: What is the level of availability of the variable of (CI) and (SCA) in the Karbala Iron and Steel Factory? What is the availability of variable dimensions in the researched factory? What are the impact (CI) elements in achieving sustainable competitive advantage? The current study is the first of its kind that was applied in the iron and steel factory in Karbala, although some research was conducted earlier in Iraq that suggested incorporating improvement strategies (Kaizen) to achieve competitive superiority (Salih, 2017; Ali & Jablaq, 2023). As far as the researcher knows, no study has been conducted yet that focuses on iron and steel factories in Iraq or the factory investigated (Khudair et al., 2019; Fahd et al., 2024; Yasser et al., 2023). Therefore, the current research work is a valuable addition to the study community and decision-makers in organizations to revive their production strategies toward achieving a sustainable competitive advantage.

Literature Review

1.1. Elements of Continuous Improvement (CI)

The first to establish (CI) steps were (Walter Shewhart) in 1920, and they were effectively enhanced and developed by (Edward Deming) in 1950, which consisted of four steps (plan, Do, Check, and Act), which was called the (PDCA) cycle (Heizer et al., 2017; Krajewski et al., 2016). indicate that the emergence (of CI) as a concept began after World War II, when Japan was severely affected by this war and was facing a very large shortage of resources, and the industry was facing great difficulties, and Japan need in that period to apply techniques aimed at focusing Focus on the processes and not the results. The results themselves will be better if the focus is on the processes and trying to improve them constantly and at every stage of the process, so the idea (CI) crystallizes. In evaluation, analysis, participation, collaboration, adaptation, and innovation.

Hilton (2005) added in this regard that the idea of (CI) was adopted by many industrial companies, such as (Toshiba) in 1946, (Matsushita Electric) in 1950, and (Toyota) in 1951. This is to reduce production costs continuously and, as a result, achieve an (SCA) through Making gradual improvements and simple reforms in all activities and processes that the production units are going through at that time, to achieve this, consideration has been given to reducing costs for activities that add value, as well as reducing the costs of loss and damage, and reducing the time taken by the manufacturing process of the product to contribute to achieving the desired goals.

Maguire and Putterill (2000) explain the meaning of the term kaizen, as they point out that it consists of two words (kai), which means change, and (zen), which means good or better. By combining the two words, it becomes clear that (kaizen) means change for the better and continuously, and this improvement takes A form of process development, such as improving the performance of machines, reducing the level of waste, or increasing training and motivation for workers to implement additional practices that improve the quality of products or services. (Dağgöl, 2024) pointed out that organizations that do not have a clear vision about the methodology and steps for (CI) will lose their market share and thus be exposed to the threat of exiting the market. Due to the diversity and multiplicity of purposes and trends of (CI), many studies and literature have not agreed on a specific concept for it, despite the interest of this literature in the concept of (CI), which has led to different concepts and definitions. (Sammour & Al-Balkhi, 2024) defined (CI) as improvements Small incremental or radical changes as a result of new ideas or technology. As (Nagim, 2019), defined (CI) as a philosophy that works to improve all factors and elements that are related to the process of converting inputs into outputs on an ongoing basis.

Abdel-Khaleq and Dawood (2022) and Khushif (2022) agree that (CI) according to its four elements (plan, do, check, and act), achieves economic benefits for the organization, including (1) Creating a positive change in the way operations are performed, leading to outstanding performance (2) Defining the flow of product completion processes clearly and accurately (3) Eliminating activities that do not add value or impact on overall performance (4) Reducing the total cost of product quality (5) Providing defect-free products and thus creating customer loyalty. Researchers often emphasize the need for employee participation in the improvement process through organizational mechanisms such as teamwork, which implies the active participation of employees in the improvement process (Galeazzo et al., 2021; Hunter, 2024; Jauregui-Sanchez et al., 2024& Abrahams, 2024).

1.2. Sustainable Competitive Advantage (SCA)

The term (SCA) emerged in 1985 when (Porter) discussed the basic types of competitive strategies that organizations possess to achieve (SCA), while (Barney, 1991) provided the closest definition of the content of (SCA) when he considered it as sustainable profit for applying a unique strategy. It creates value

so that the strategy is not applied by any of the current or potential competitors at a time when competitors cannot imitate this strategy (Raoof & Hamdi, 2010).

(SCA) takes into account administrative and economic trends at the same time, as economists see (SCA) as representing outstanding and continuous economic performance that requires finding possible mechanisms to achieve it within the long term (Denga et al., 2022; Arslan, 2020; Kazemi et al., 2024) and consistent with the economic point of view that sustainability is centered towards sustainability of consumption, sustainability of production, sustainability of natural resources, and sustainability of the ecosystem (Amoako, 2020; Zhang et al., 2023; Abdul-Abbas et al., 2024), while efficiency is considered the basic pillar within the system. The market is based on consumption efficiency, production efficiency, and production combination efficiency (Abdulameer et al., 2021). Therefore, the organization can strive towards developing a sustainable advantage by keeping pace with the changes occurring in consumer interests towards activating production activities that keep pace with environmental concerns and producing environmentally friendly goods, which have become a demand for many consumers in various countries of the world, which represents a wide scope for organizations to achieve getting ahead of its competitors and creating a (SCA) (Shah, 2022; Asa et al., 2024; Lyu et al., 2024). (Abdul-Aziz Ahmad & Jais, 2024) defined competitive advantage as the organization's ability to carry out its activities in different ways that others cannot imitate. According to (Hamed, 2023; Ali & Jablaq, 2023; Al-Shammari, 2023), competitive advantage lies in superior skills and resources. Najm, (2024) and Alalie et al., (2019) believe that the sources leading to creating a (SCA) are represented by (financial, material, legal, human, organizational, and information resources). Therefore, (Asa et al., 2024; Lyu et al., 2024) explained that these resources must be characterized as (rare, valuable, difficult to imitate, and difficult to replace).

Porter (1985) presented three main strategies and considered them the primary source of sustainable competitive advantage, which are (cost leadership strategy, differentiation strategy, and focus strategy). The cost leadership strategy means that the organization reduces all aspects of the cost that can be reduced to ultimately be able to provide environmentally friendly and non-toxic products (Al Sultane et al., 2023; Fahad, 2024). Harmful and at lower prices compared to competitors who offer the same product with the same quality (Ong & Ismail, 2008). As for the differentiation strategy, it means owning a distinct brand, adopting a unique technology, or achieving distinct products that are better than competitors and environmentally friendly (Little et al., 2011). Sohail and Al-Ghamdi, (2012); Ahmad et al., (2024); and Surapto, 2024) explained the focus strategy as the strategy directed to a specific sector of the target market, or to a specific group of buyers and not others, or a specific industry, or products and services that are distinguished in their performance. Different from others, the organization seeks here to benefit from a (SCA) in the target segment, by providing environmentally friendly products with lower prices than competitors by focusing on reducing costs, focusing on specific customers, or providing products of distinguished quality that are not harmful to the environment.

Methodology

1.1. Building Hypotheses

Many studies have indicated that there is a relationship between the elements of (CI) and their role in achieving (SCA) (Aboodi, 2019; Al-Kawaz & Al Mayahi, 2022; Alkababji, 2023). Other studies have indicated that (CI) is an appropriate strategy for an organization to improve productivity and quality, (McDermott et al., 2022). (Dagger & Yaqoub, 2018) explained that there is a possibility to achieve continuous(CI) of factories through transferring and localizing the experiences of other advanced factories in the field of advanced materials technology (nano), which achieves efficiency and effectiveness in performance and thus obtains a sustainable competitive advantage.

Ward, (2005) discussed benefiting from the knowledge and continuous development of skills leads to supporting and enhancing (SCA) related to the economic unit and other units competing with it, as we must know the strength factors that exist among competitors to determine the economic unit's competitive work

context, optimal investment of resources, and reaping returns to achieve Success, status and competitive leadership.

Based on what was presented above, the current study will adopt the exploratory approach to analyze the elements of improvement according to (SCA) strategies. Through our review of the literature, the current study will focus on the most important areas discussed above and based on which hypotheses were developed.

First main hypothesis: There is a significant influence relationship between elements of (CI) and (SCA):

Sub-hypotheses

From this hypothesis, several sub-hypotheses branch out. The concept of sustainability is making economic and social improvements in coordination between technological progress and investment while using natural resources, as well as making (CI) to certain aspects of production processes to preserve the environment, meet the needs of the current generation, and preserve the resources of future generations (George et al., 2019; Hatem & Al-Maamouri, 2023).

Ngige (2017) and George et al., (2019) confirm that fierce competition and constant turmoil in doing business have made strategic plans important in an unstable environment. Even though planning has been widely adopted and practised in industrial and service organizations, both Foreign and Arab research and studies have failed to provide conclusive evidence over the past three decades about whether planning has an impact on competitive advantage or not. Some studies have shown that there is no relationship between plan and competitive advantage (Powell, 1992; Miller et al., 2004), However, other studies were conducted by some researchers found that there is a significant impact of the plan on competitive advantage (Gichović, 2019; Tryson, 2022; Yangailo, 2023). Rakićević et al., (2023) explain that planned production operations have a significant impact on the sustainability of the company's competitive advantage and claim some natural disasters may lead to some problems and thus a loss of position in the markets.

Second sub-hypothesis: There is a significant influence relationship between the plan and the (SCA).

After setting appropriate plans and defining the objectives accurately, the work team begins to do and accomplish these plans, follow up on the development of the targeted field, monitor the extent of progress, write down data and information as soon as possible, and measure the level of improvement accordingly (Gong et al., 2024). When the need for appropriate modifications arises, this is done by scrutinizing the tasks required to be modified in the subsequent stage, which is an important stage through which the accuracy of completion and the extent of achieving zero defects are determined. Therefore, before reaching this stage, it is required first to review the plans and steps to start completing the tasks before submitting the final outputs (Al-Bakoosh et al., 2020; Srivannaboon, 2009; Rajić et al., 2023). In the same context, (Salih, 2017) emphasized that do as one of the elements of (CI) influences sustainable competitive advantage. Here, what was planned is implemented, whether at the organization or operations level.

Third sub-hypothesis: There is a significant influence relationship between do and (SCA).

The improvement team must analyze the data and information inspired by the results achieved. It begins with implementing the first step and auditing the achieved goals and their conformity with the established plans, which provides the opportunity to develop better plans if the set goals are not fully achieved (Ferreira Costa et al., 2023; McLaughlin et al., 1992; Knight & Allen, 2012). The emergence of an opportunity to make improvements to the results achieved based on the experience of the work team or the suggestions of relevant workers, noting the necessity of stopping the task and activity completely in the event of deviations that cannot be remedied immediately, and then developing more precise plans and repeating the other stages continuously (Kudryavtsev, 2018; Santini et al., 2021). In the same context, (Salih, 2017) emphasized that check as one of the elements (CI) affects sustainable competitive advantage.

At this stage, the results obtained from the process are evaluated and checked by comparing them with the objectives and specifications previously set. This indicates that (SCA) is affected by the check processes.

Fourth sub-hypothesis: There is a significant influence relationship between the check and the (SCA).

Operations strategy has not only been implemented in the manufacturing sector, but it can also be applied in improving the service industry as a tool for (CI) and sustainable competitive advantage, and this indicates the possibility of using it in solid waste management (Magutu et al., 2010). In the same context, (Salah, 2017) emphasized that acting as one of the elements of (CI) affects sustainable competitive advantage. (CI) methodologies are important because the rate of improvement of operations determines the extent to which companies survive in the world of competition (Salah et al., 2010). This tells us that the basis of competition lies in the correct Act of plans and not in building an effective strategy, because there is no benefit to the strategy without the presence of workers who have the ability and experience to implement this strategy in sound ways, and based on that, the following hypothesis can be formulated.

Fifth sub-hypothesis: There is a significant influence relationship between Act and the (SCA)

After reviewing the above literature, which was used in building hypotheses, the following hypothetical model was developed:

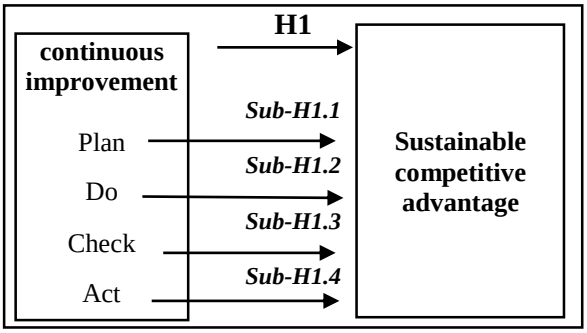


Fig. 1. Hypothetical Diagram of the Study

1.2. Sample and Data Collection

The Iron and Steel factory in Karbala city of Iraq was chosen as one of the leading factories in Karbala city, which was established in 2003. For political and governmental reasons, the factory was stopped from operating, and in 2015 it was operated again. "The implementing company is the Chinese Shan Dong Company," the factory contributes to the production of 250 thousand tons of reinforcing steel annually, and "the area of the factory in all its stages is 37 dunums and is located behind the Thermostone factory west of Karbala." The Iron and Steel Factory is considered one of the important projects in Karbala and employs more than 361 employees. It will contribute to revitalizing the economic reality in the province. "This project is not limited to the iron issue only, but even the waste will be used. It is an environmentally friendly factory and generates electricity to cover the factory's needs, and even the water used in the factory is used in an agricultural project adjacent to the factory.

After interviewing the CEO, he claimed that the factory has more than 60 trucks to transport raw materials (scrap) to the factory, and it has more than 40 trucks to transport the final product to the markets. The head of the Holy Karbala Investment Authority said that the factory produces rebar after cutting and melting the iron using modern and advanced technology to produce iron with very high specifications. He added that the factory will be developed in the future to produce shaman, and stressed that the factory is the first of its kind in the Middle East and will contribute to filling a large portion of the local need, especially since the imported (Ukrainian) rebar had been invading the Iraqi local markets, for political reasons as well as because of the war between (Russia and Ukraine) and Ukrainian factories were affected. Exports between Iraq and Ukraine were stopped, and it became necessary for there to be a local product

that filled the shortage in the Iraqi markets. Note that the factory holds the ISO 45001 certificate, which relates to the application of occupational safety and health requirements to control the risks present in the factory that may threaten the safety of workers, buildings, and their vicinity, prepare for and respond to emergencies, and how to act properly and orderly in the event of emergencies. It also holds an ISO 9001 certificate, which relates to... By applying quality standards in all processes and activities to raise the factory's ability to provide services and products of high quality. Many large companies require it to register suppliers as a basic condition for accepting the supplier, and many countries also require it to accept exports to them. The main reason for choosing the iron and steel factory / Karbala / Iraq is to know the extent of its availability of variables in the researched factory, as well as its suitability to the goal of the current study.

To conduct the study, the required approvals were obtained from the factory. The duration of the study was six months, and data was collected in (July 2024) For the end (of October 2024) from a targeted group of employees who were selected based on (Krejcie & Morgan, 1970) for a known community consisting of 360 individuals. It was 186 Employees from different departments in the factory. Data were collected through a questionnaire that was distributed to the selected sample. 175 valid answers were obtained for statistical analysis (95%). The employees were given 42 days to complete the questionnaire. Refer to Table (1) for the demographic distribution of the sample.

Table 1. Shows the Demographic Distribution of the Sample

Demographic	Categories	Frequency	percentage
Gender	Male	175	%100
	female	0	%0
N		175	%100
Age	30 years or less	57	%33
	31-40	63	%36
	41-50	31	%18
	50 or more	24	%13
N		175	%100
Education	middle school	5	%3
	diploma	13	%7
	Bachelor	96	%55
	Higher Diploma	46	%26
	Master's Degree	15	%9
N		175	%100
Work Year	1 year or less	43	%25
	2 years - 5 years	98	%56
	6 years - 10 years	25	%14
	10 years and over	9	%5
N		175	%100
Job position	Head of the Department	5	%3
	Division official	15	%9
	Unit official	22	%12
	employees	133	%76
N		175	%100

(Source: Authors)

1.3. Study scales

By reviewing the literature, the following best-approved standards were obtained.

Continuous improvement (CI)**:** For this independent variable, the scale was adopted from literature (Salih, 2017) with four dimensions: **Plan** (5) paragraphs, **Do** (5) paragraphs, check (5) paragraphs, and **Act** (5) paragraphs.

Sustainable competitive advantage: For this dependent variable, the scale was adopted from literature (Saleh, 2018) with three dimensions **cost leadership** (8) paragraphs, **differentiation** (9) paragraphs, and **focus strategy** (9) paragraphs.

A five-point Likert scale was used in all the measures with terms such as Strongly Disagree being valued at (1) to Strongly Agree valued at (5).

Statistical Data Analysis

In this study, the researcher relied on the (SMART PLS.V.4.1.0.5). Statistical program based on structural equation modeling (SEM) technology. And the statistical program (spss.v.26) to evaluate the measurement model, descriptive statistics, and the structural model.

1.1. Measurement Model

The measurement model was examined for reflective and latent variables to determine the reliability and validity of the model constructs, see Figure (2) and Table (2). To examine the reliability and validity of the construct, the Cronbach alpha test was used, while above 0.70, the composite reliability (CR), while above 0.60 should be maintained, and the average variance extracted (AVE), which must have a value greater than 0.50 (Hair and Lukas, 2014). The stability of the indicator is evaluated by calculating the Outer Loadings (OL) of the items (indicators) of the scale. (Hair et al, 2017) show that there are three cases in which the saturation of the items (indicators) can be evaluated, as follows:

- If the (OL) of the paragraph is greater than or equal to (0.70), it represents the dimension and therefore it is retained.
- If the (OL) of the paragraph is between (0.40-0.70), the researcher must ensure the effect of deleting this paragraph on raising the value of the rest of the criteria of the measurement model (Cronbach Alpha, CR, and AVE), if there is no effect on the criteria, it will be retained.
- If the (OL) of the paragraph is less than 0.40, it is deleted.

These findings in Figure (2) and Table (2) show that the study met the criteria for convergent validity and internal consistency of the measures.

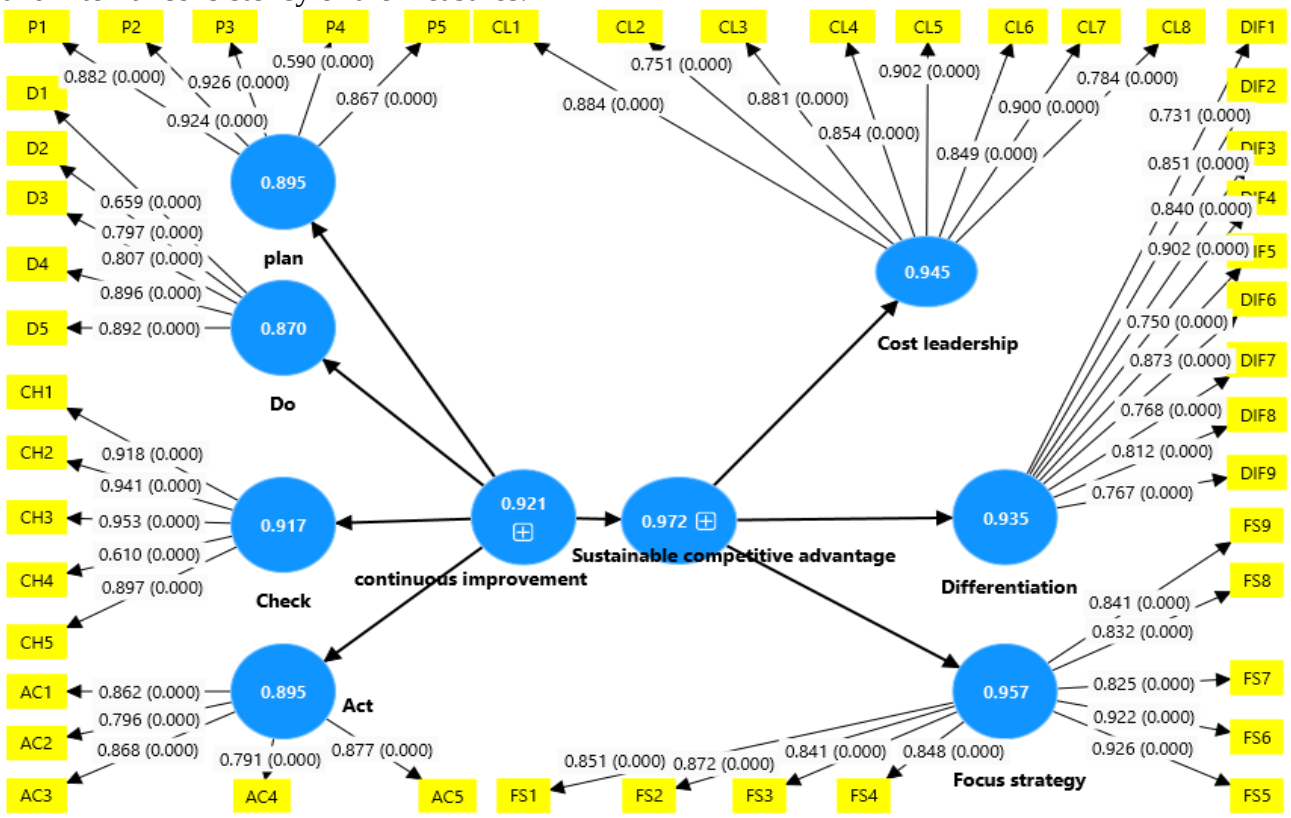


Fig. 2. Measurement mode

Table 2. Convergent Validity and Internal Reliability Consistency

Construct	Item	alpha	CR	AVE	OL
Plan	P1	0.895	0.891	0.717	0.882
	P2				0.924
	P3				0.926
	P4				0.59
	P5				0.867
D0	D1	0.87	0.876	0.664	0.659
	D2				0.797
	D3				0.807
	D4				0.896
	D5				0.892
Check	Ch1	0.917	0.918	0.763	0.918
	Ch2				0.941
	Ch3				0.953
	Ch4				0.61
	Ch5				0.897
Act	Ac1	0.895	0.896	0.705	0.862
	Ac2				0.796
	Ac3				0.868
	Ac4				0.791
	Ac5				0.877
Cost leadership	CL1	0.945	0.947	0.726	0.884
	CL2				0.751
	CL3				0.881
	CL4				0.854
	CL5				0.902
	CL6				0.849
	CL7				0.9
	CL8				0.784
Differentiation	DIF1	0.935	0.937	0.66	0.731
	DIF2				0.851
	DIF3				0.84
	DIF4				0.902
	DIF5				0.75
	DIF6				0.873
	DIF7				0.768
	DIF8				0.812
	DIF9				0.767
Focus strategy	FS1	0.957	0.958	0.744	0.851
	FS2				0.872
	FS3				0.841
	FS4				0.848
	FS5				0.926
	FS6				0.922
	FS7				0.825
	FS8				0.832
	FS9				0.841
remark: Reliability and convergent validity are attained					

(Source: Authors)

After establishing the convergent validity, the discriminant validity was examined. This aspect studied how different the structure is from other structures. Discriminant validity is usually determined by examining the Fornell Larcker criterion, which aims to ensure that the dimension in question is completely different from the rest of the other dimensions so that the dimension with itself in the matrix is higher than the rest of the values with the other dimensions (Ab Hamid, Sami and Mohmad Sidek, 2017), as shown in Table 3 shows that all seven dimensions achieved higher values with themselves than their values with the rest of the dimensions, which means that these dimensions are distinguished by the lack of overlap between

each of them with the rest of the dimensions within the measurement model of our current study, which confirms the discriminant validity of the dimensions.

Table 3. Discriminant validity (Fornell-Larcker criterion).

	Act	Check	Cost leadership	Differentiation	Do	Focus strategy	Plan
Act	**0.839**						
Check	0.499	**0.873**					
Cost leadership	0.817	0.482	**0.852**				
Differentiation	0.719	0.375	0.739	**0.812**			
Do	0.667	0.415	0.717	0.644	**0.815**		
Focus strategy	0.651	0.378	0.709	0.787	0.661	**0.863**	
Plan	0.406	0.322	0.357	0.406	0.403	0.407	**0.847**
Remark: Discriminant validity are attained							

(Source: Authors)

1.2. Descriptive Statistics

In this section, some descriptive statistics between the selected constructs are presented. It includes the arithmetic mean (M). To best determine the response levels for the sample studied, the researcher adopted the opinion of (Nakapan & Radsiri, 2012), which identified five categories to which the arithmetic means belong (1-1.80), very low, (1.81-2.60), low, and (2.61-3.40) moderate, (3.41-4.20) high, (4.21-5.00) very high. And the standard deviation (SD), as shown in Table 4. The descriptive statistics for "(CI)" were (M=3.885, SD=0.685), which are of ordinal importance (7), and for "Sustainable Competitive Advantage", they were (M=4.013, SD=0.775), which are of ordinal importance (3). The highest average among the "(CI)" dimensions was for (Do), reaching (M=4.070, SD=0.794), with an ordinal importance of (2), and the lowest average for the (Check) dimension, reaching (M=3.721, SD=1.062), with an ordinal importance of (9). The highest average among the "Sustainable Competitive Advantage" dimensions of (Focus Strategy) was (M=4.078, SD=0.826) with an ordinal importance of (1), and the lowest average was for the (Cost Leadership) dimension, reaching (M=3.960, SD=0.895) with an importance ordinal (5).

Table 4. Descriptive Statistic

Construct		M	SD	Response level	Ordinal importance
Plan	X1	3.794	1.012	high	8
Do	X2	4.070	0.794	high	2
Check	X3	3.721	1.062	high	9
Act	X4	3.957	0.830	high	6
Cost leadership	Y1	3.960	0.895	high	5
Differentiation	Y2	3.996	0.844	high	4
Focus strategy	Y3	4.078	0.826	high	1
continuous improvement	X	3.885	0.685	high	7
Sustainable competitive advantage	y	4.013	0.775	high	3

(Source: Authors)

1.3. Structural Model Assessment

Path coefficients, collinearity diagnosis, and the coefficient of determination (R2) were used. (Chin, 1998) indicates the levels of acceptance of its value as follows. If its value is less than 0.19, the explanatory power is rejected, and if it ranges between 0.19 and 0.33, it is a weak power. If it is The value ranges between 0.33-0.67, it is a moderate value, but if it is greater than 0.67, it is a high value. The effect size

(F2) when the value is less than 0.02 means there is no effect. However, if the value is limited to between 0.02 and 0.15 then the effect size is small. If it is between 0.15 and 0.35, it is a moderate effect. However, if the value is greater than 0.35, then The effect size is large (Cohen, 1988). And the variance inflation factors (VIF), which must have a value of less than 5 according to the rule (Hair et al., 2018). The value of (T), which must be greater than (1.96), at a significance level of 0.05 (Hair et al., 2017).

It is clear from Figure (3) and Table 5 that the results of testing the first main hypothesis that (CI) has achieved a moderate positive impact on sustainable competitive advantage, in addition to that (CI) can explain (65%) of the changes that occur in the competitive advantage variable. The remaining percentage (35%) is attributed to the contributions of other variables not included in the study model, which is a moderate explanatory value. It is also evident from Table (5) and Figure (3) that the value of the marginal slope coefficient (β) is (0.808). It shows that increasing levels of availability of (CI) by one standard deviation will lead to increasing levels of (SCA) by (80%) by one standard deviation.

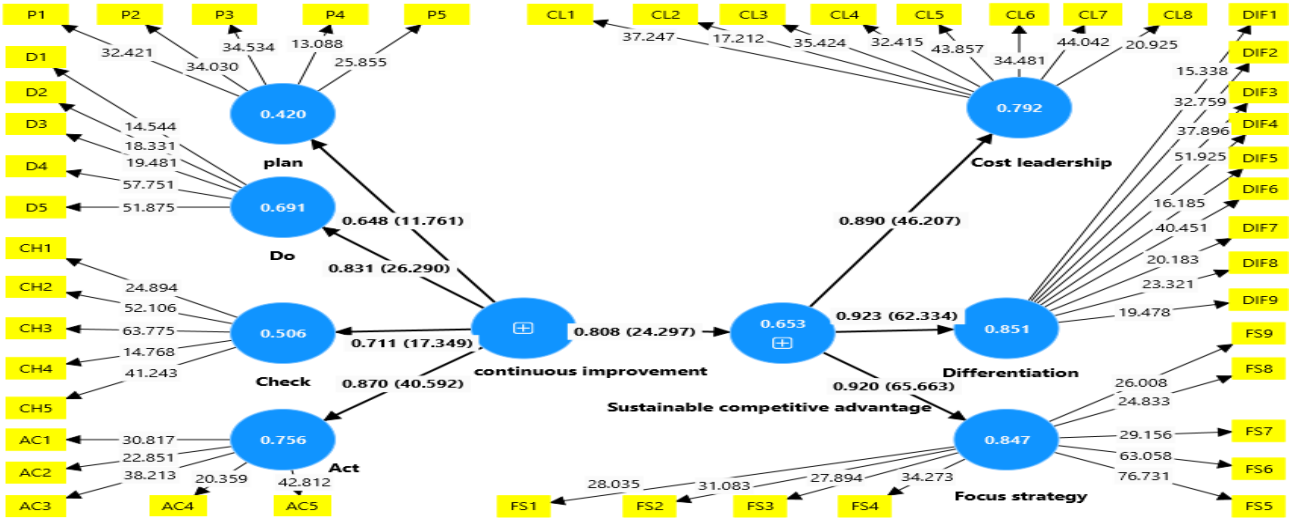
While the significance values of the test were (t=24.297,p<0.01), in addition to the amount of effect (F^2=1.885), which means the relationship is significant and thus accepting the first main hypothesis which states *(There is a significant influence relationship between elements of* (CI) *and the sustainable competitive advantage)* as well as the value (VIF=1.000) which appeared lower than the standard specified for acceptance.

Table 5. Estimates of the Influence Model between (CI) and (SCS**).**

H	path	β S.R.W	t-value	P-value	f-Square >0.02	VIF <5	Remark
H.1	continuous improvement -> Sustainable competitive advantage	0.808	24.297	0.000	1.885	1.000	Supported
R-Squared (>0.19): Main Hypothesis =0.653							

(Source: Authors)

Fig. 3. Structural model (Main Hypothesis)



It is clear from Figure (4) and Table 6 the results of testing the sub-hypotheses that (CI) has achieved a moderate positive impact on the dimensions of sustainable competitive advantage, in addition, that (CI) can explain (73%) of the changes that occur in the competitive advantage variable. The remaining percentage

(27%) is attributed to the contributions of other variables not included in the study model, which is a moderate explanatory value. In addition, all values of the variance inflation factor (VIF) in Table (6) were less than 5, which indicates that there is no problem with multicollinearity.

Table 6. Estimates of the Influence Model between the Dimensions of (CI) and Sustainable Competitive Advantage

H	path	β S.R.W	t-value	P-value	f-Square >0.02	VIF <5	Remark
H.1.1	Plan -> Sustainable competitive advantage	0.070	1.369	0.171	0.014	1.287	Not Supported
H.1.2	D0 -> Sustainable competitive advantage	0.356	5.291	0.000	0.256	1.858	Supported
H.1.3	Check -> Sustainable competitive advantage	0.020	0.383	0.701	0.001	1.486	Not Supported
H.1.4	Act -> Sustainable competitive advantage	0.531	8.402	0.000	0.501	2.108	Supported
R-Squared (>0.19): Sub-Hypotheses = 0.733							

(Source: Authors)

The results of testing the sub-hypotheses shown in Table (6) and Figure (4) confirmed that the plan had a significant positive effect on sustainable competitive advantage, as ($\beta = 0.356$, $t = 5.291$, $p < 0.001$) with a moderate effect size ($f2 = 0.256$). Thus confirming the second sub-hypothesis. The act also had a significant positive impact on (SCA) ($\beta = 0.531$, $t = 8.402$, $p < 0.001$) with a high effect size ($f2 = 0.501$), thus confirming the fourth sub-hypothesis. Finally, the other sub-hypotheses were not supported because the P-value was greater than 0.05.

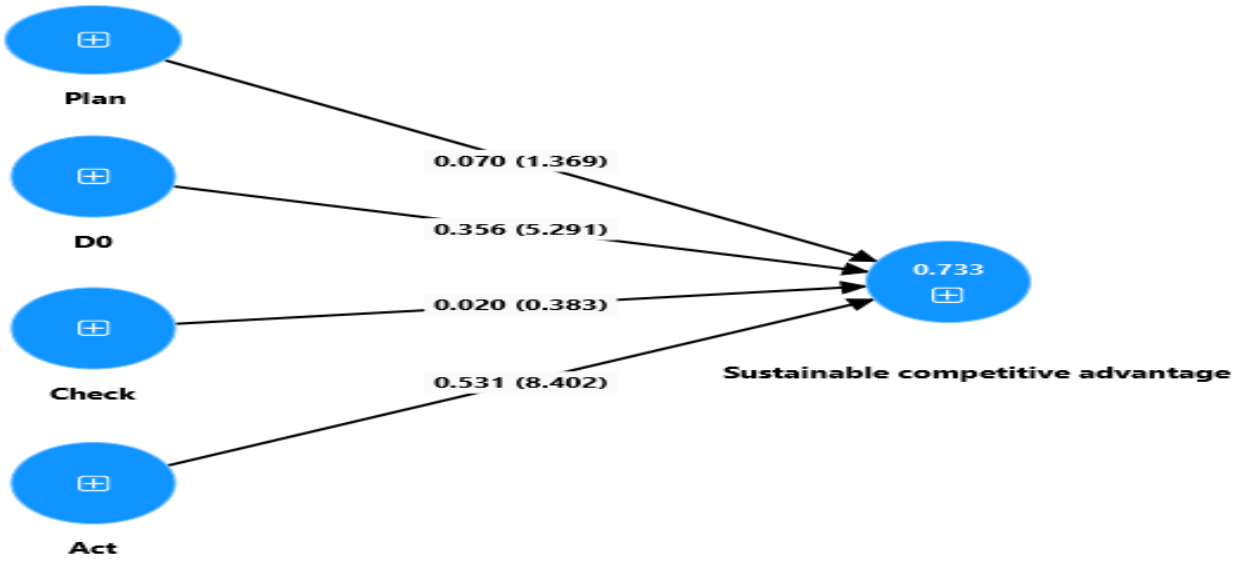


Fig. 4. Structural model (Sub-Hypothesis)

Discussion

Table (1) shows that the gender of the sample members was (175) males, which is equivalent to (100%) of the members of the study population. This indicates that the work that is done inside the factory requires high physical effort, and this is what you could not do before. For females, the age factor showed that participants in the category (31-40) ranked highest, and finally, the age group was (50 years and over). This indicates that the factory has good human energy that can enhance the factory's performance if used correctly. What is the academic qualification? As the table above shows, the number of participants who held a bachelor's degree came in first place at a rate of (55%), and lastly those with middle school

certificates at a rate of (5%). The reason for this is that the researcher targeted the segment of technicians who hold a bachelor's degree - engineering, because they are the closest and most knowledgeable about the variables. The study. As for years of service, we note that the highest percentage was for the category (2 years - 5 years), at a rate of (56%). This is clear evidence that the factory has recently begun production operations and that the factory is currently in the growth stage of the life cycle.

As shown in Table (2) and Figure (2), all Cronbach's alpha values were greater than 0.70. This means that the questionnaire would give the same results if it were distributed again to the same study sample. Also, the composite reliability (CR) values for all dimensions ((CI) and sustainable competitive advantage) were greater than 0.70. This means that all the questionnaire questions are correct and have a direct relationship with the variables. The (AVE) values were all greater than the criterion for acceptance, which was 0.50. All indicator stability values through calculating Outer Loadings (OL) for the items (indicators) of the scale were greater than the criterion specified for acceptance, which is 0.70, except for items (P4, D1, CH4), which were (0.59, 0.659, 0.61), respectively. After deleting these items, there were no values of (Cronbach's alpha, composite reliability, and (AVE) were improved, so they were retained.

Table (3) shows that the shaded numbers for all seven dimensions have achieved higher values with themselves than their values with the rest of the dimensions, which means that these dimensions are distinguished by the lack of overlap for each of them with the rest of the dimensions within the variables ((CI) and sustainable competitive advantage), which confirms the discriminatory validity of the dimensions.

The results of the statistical description in Table (4) of the variables of the current study showed that individuals have a high-level perception of the dimension (focus strategy) and the extent to which the management of the factory under study pays attention to this dimension to a large degree, as it ranked first in terms of its ordinal importance, is consistent with most studies such as (Abdali et al., 2018; Ali et al., 2018; Abd et al., 2020; Al-Humairi et al., 2024). And this indicates that the factory seeks to provide environmentally friendly products for a specific group of customers for the longest possible period. It focuses on managing risks and preventing environmental pollution from the waste of its production operations. It is keen to identify a specific sector in the market to compete in and maintain a clean and sustainable environment. Less important, however, in the degree of ordinal importance, was the share of (check), as it came Ranked ninth which is not consistent with studies (Abd et al., 2018; Ali et al., 2018; Abd et al., 2020), This is clear evidence of a weakness in examining products in a way that reduces waste, or there may be a weakness in the ability to remanufacture and design products during their life cycle.

The results of the study, according to Table (5), confirmed the existence of a strong relationship between the application of (CI) elements and achieving sustainable competitive advantage in the studied iron and steel factory. This was evident in improving productivity and accelerating the introduction of new products, which is consistent with the literature (Kim, 2019; Özkan & Haass, 2021; Azizi et al., 2023). However, a strong relationship did not appear between the elements of planning and verification and competitive advantage, which is consistent with the literature (Tanković, 2013; Helmold, 2020; Kushwaha et al., 2023). The second and fourth sub-hypotheses (planning, verification) were not achieved due to the presence of a very weak influence relationship between them, as the influence values reached (0.014, and 0.001), respectively. Moreover, the study considered only one factory as a study site, while future studies should focus on conducting parallel investigations in multiple iron production sites. These findings call for future studies on a larger scale that include other sectors such as the automotive industry as they also contribute significantly to environmental pollution issues in Iraq.

Conclusion

To increase environmental awareness among companies and society, recent decades have witnessed rapid changes in all fields, which has forced many organizations to develop their performance by adopting ways and methods to achieve the competitive advantage appropriate to their capabilities and capabilities and to constantly improve and develop these capabilities to maintain the desired excellence, based on that. The Iraqi Ministry of Health and Environment has placed many restrictions on industrial organizations (Furber & Johnstone, 2004:Al-Mosawi, 2020). These restrictions make companies take many measures to improve their workplaces and reduce pollution by applying elements of (CI). The application of these elements depends largely on the development of technology. In addition, applying (CI) elements increases the ability to achieve a sustainable competitive advantage.

The reason for rejecting the first sub-hypothesis, which states (the existence of a significant impact relationship between the plan and sustainable competitive advantage), this means that the factory may not choose the area to be improved according to specific rules, or the factory may set goals and plans for improvement that are not measurable. The reason for rejecting the third sub-scale (the existence of a significant impact relationship between inspection and sustainable competitive advantage), maybe that factory workers may not implement inspection steps, or workers may not continuously inspect the achieved goals. Therefore, factory management must develop long-term plans and strategies to implement the elements of (ci), but this does not indicate the factory's failure to adhere to environmental standards, as the main hypothesis has proven (the existence of a significant impact relationship). Moral impact between the elements of (ci) and sustainable competitive advantage) proved the existence of a moral influence relationship at a good level. Since factory management aspires to enter the global field, it must establish some mechanisms to implement, achieve, and sustain performance.

Several Recommendations are Proposed as listed below to Implement (CI)

1. In line with the directions of the study and the effective role of both the elements of (CI) and (SCA) strategies in the success of contemporary organizations and their superiority in the business world, this calls on the factory management to pay more attention to the elements of (CI) for the effective role in achieving a (SCA) and ensuring survival, growth, and development.
2. Given that the elements of (CI) obtain high agreement rates and good mathematical averages, and more so for both elements (Do, Act), and despite their role in providing the best, the elements (plan, check) are considered pivotal elements for the integrated (CI) cycle, which must be given the same attention is considered the complete half of the (CI) cycle.
3. Although the strategy of focus, differentiation, and cost leadership obtained good and close agreement rates, cost leadership adopted by many organizations requires greater attention from the factory under study as a tool to attract a wide segment of customers.
4. Emphasis on opening a scientific communication nucleus with advanced (Polish) universities and concluding agreements to provide scientific advice to the factory in its field of activity and developing its capabilities by adopting the latest findings of international organizations in the field of iron and steel manufacturing.
5. Attention should be paid to the two dimensions (plan, check) because their effect is insignificant in bringing about a tangible improvement in (SCA) through:

- Keeping up with the latest methods for planning and inspecting products.
- Involving factory workers in practical workshops to improve their planning skills.
- Making changes in the product structure and formulations.
- Adding the product to a family of products that have a unified design style.

6. The Iraqi state, and especially the Ministry of Finance, should look at this factory and provide it with the necessary financial support because it is one of the factories that has proven its worth and success in the

field of producing rebar, which is used in construction, especially since the Iraqi state began the stage of developing and building infrastructure after... It was destroyed by terrorist gangs.

Future Studies

In the future, researchers should focus on developing, implementing, and validating (CI) components for multiple types of steel plants with different processes. Moreover, the current study suggests adding smart maintenance as an intermediary variable between elements of (CI) and (SCA) strategies, or green manufacturing in future research studies. Iraqi society needs a strong educational campaign in the areas of green manufacturing, environmental care, and pollution reduction as part of achieving sustainable competitive advantage. These topics require more in-depth study, specifically in the Iraqi environment.

Thanks and Gratitude

The researchers extend their thanks and gratitude to the management of the iron and steel factory, which worked hard to provide us with all the data we needed. I extend my thanks and gratitude to Professor Dr. Mahmoud Fahd Al-Dulaimi for reading this study and taking notes regarding the production aspect, and to Professor Dr. Awad Al-Khalidi for his discreet statistical amendments.

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