Journal of Innovative Construction and Petrochemical Technologies, Vol.3, No.2 (December, 2026), 519-536

E-ISSN: 3007-9861 | DOI: https://doi.org/10.71285/icpt.v3i2.78

Journal of Innovative Construction and Petrochemical Technologies
https://icpt.ouk.kz/index.php/icpt/index



Research Article

Check for updates

The Role of Process Innovation in Achieving Competitive Advantages

Melad Gazal Saao
College of Administration and Economics, Tikrit University
Email: Melad@tu.edu.iq

Abstract: This research aims to find out whether the process innovation gives competitive advantage to the Kronji Soft Drinks Company. The research is directed towards new methods of production and improvement of the currently used ones. Descriptive Analytical technique was used and data was gathered from 60 respondents through questionnaires. Descriptive statistics, Pearson correlation coefficient and simple linear regression were used to analyse the data. Process Innovation was very well appreciated by participants (mean score 4.339) as well as competitive advantage (mean score 4.311). These two variables were positively correlated (r = 0.452) and statistically significant. The regression results showed that process innovation explains 20.4% of the variance in competitive advantage scores, and that process improvement is a more important factor in the variance in competitive advantage scores than is the design of an entirely new process. Cost reduction was the least scored out of all the dimensions of competitive advantage. Creativity and innovations were seen favourably, however, they were ranked last. The study suggests greater process refinement, investments in new processes, and the use of employee ideas and process-related measures for development. The results are constrained in size of the sample and some inconsistencies found within the dimensions of the competitive advantage.

Keywords: Process innovation, competitive advantage, process design, process improvement, Kronji Company.



Copyright © Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY).

INTRODUCTION

In the past ten years, radical and fast-paced change has occurred in all areas of the world, especially in manufacturing. As a result, management and industrial researchers have been increasingly at the center of interest in this new phenomenon, heralding a new industrial era. This change has forced companies to adapt to these dramatic changes in their business context in order to keep being competitive in this new industrial era or to keep their business alive, a requirement brought about by this new industrial age. Process innovation is one of the mechanisms to solve these challenges [1]. It is an essential tool and helps the company to create new products that cater to the target customer's needs and preferences. This is an important aspect of maintaining the company's market position. Also, companies may be trying to implement various competitive strategies at the same time: cost leadership, quality, flexibility, innovation, or fast delivery in order to outperform competitors and successfully respond to

customer needs. In this section the relationship between process innovation and competitive advantage is discussed and the influence of process innovation on achieving competitive advantage in the Kronji Soft Drinks Company is explored.

Research Problem

For enterprises of the twenty-first century, globalization -- as facilitated by technological progress -- has been one of the most important challenges, turning the world into a 'global village'. That's why these organisations have experienced many changes in their working contexts. Due to these speedy internal and external changes, businesses have been compelled to find answers to boost their output, enhance efficiency and formulate serious plans to survive the market.

Process innovation is a key element to overcoming these challenges, improving a company's ability to survive and thrive. Developing new processes or refining existing ones has become a strategy adopted by most firms—one they leverage to drive product innovation, thereby satisfying customer needs and desires while meeting their diverse and evolving requirements.

In the light of this background, the following conceptual question is used as the starting point for the present study: To what extent can process innovation help to create competitive advantages? This is a foundational question that leads to the following sub-questions:

1. To what extent does the management of the company under study recognize the importance of adopting a process innovation strategy?
2. How much does the management of the company studied have an awareness of the importance of process innovation in order to gain competitive advantages?
3. How are the components of process innovation related to the dimensions of competitive advantage?
4. What kind of relationship exists between the parts of process innovation and the parts of the competitive advantages?

Significance of the Study

1- Scientific Significance: The study deals with the relationship between two current concepts in the business of production and operations: Process Innovation and Competitive advantage.

2. The study helps the production and operations management of Kronji Soft Drinks Company to understand how scientific evidence about the importance of process innovation in achieving competitive advantage can help the company find strengths and weaknesses in its production operations.

3- Improvement of Production Practices: The Study provides scientific results and recommendations, which could be a guide to the company to draw up its production plans and strategies, in order to better understand the needs of consumers, offer more relevant services and offerings, and improve response to consumers' needs.

4- Enhancing the Company's Competitiveness: The company can gain its competitive advantage by optimizing its production process, offering better products and services and by understanding the needs of its customers better to keep them in the market and draw new customers to the market.

Research Objectives

The study aims to achieve the following objectives:

1- To determine the extent to which the surveyed individuals perceive the importance of process innovation within their company and how it distinguishes the firm from its competitors.

2- To determine the extent to which the surveyed individuals perceive the importance of conducting production activities in alignment with the principles and values that underpin competitive advantage.

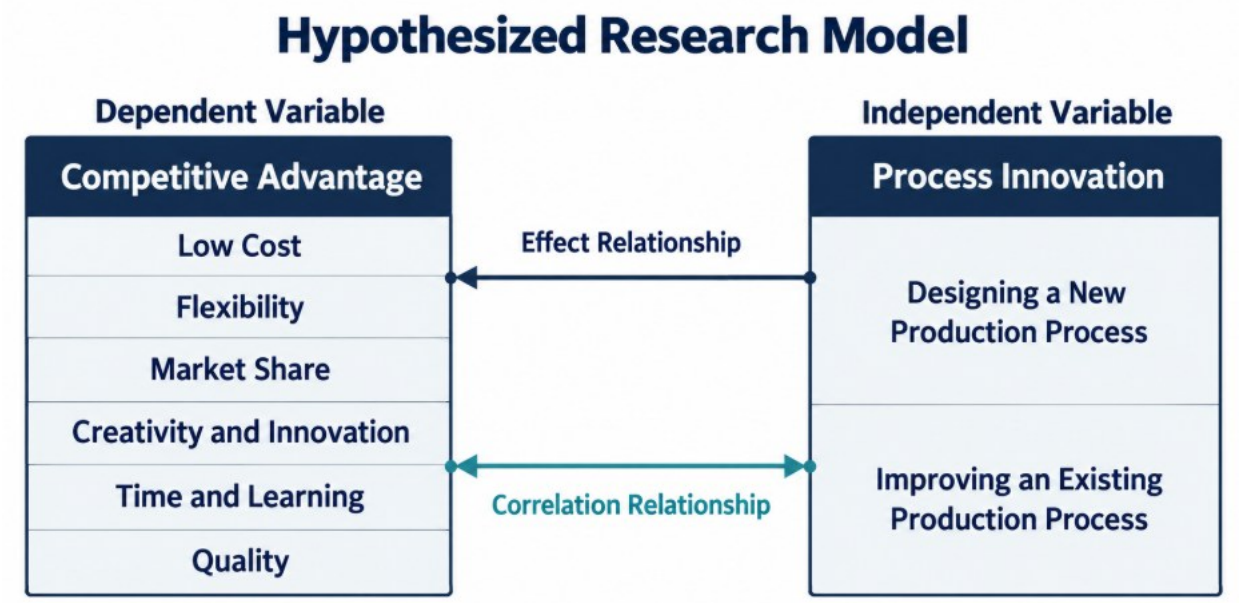
3- To identify the correlation between process innovation and competitive advantage.

4- To examine the impact of the components of process innovation on competitive advantage within the company under study. Fourth: The Study's Hypothetical Model:

In light of the study's problem and its significance, and in order to achieve its objectives, address its practical implications, and facilitate the research analysis, a hypothetical model has been designed to illustrate the relationship between the study's variables and their dimensions. The model includes the following:

1. Independent Variable: Process Innovation, which consists of two dimensions: designing a new

production process and improving an existing production process.
2. Dependent Variable: Competitive Advantage, which consists of six dimensions: low cost, flexibility, time and delivery, quality, and market share.



Fifth: Study Hypotheses: In order to find solutions to the problems addressed by this research, a set of hypotheses has been formulated as follows:
1. First Main Hypothesis: The components of process innovation are present within the company under study, according to the perceptions of the study sample.
2. Second Main Hypothesis: The dimensions of competitive advantage are present within the company under study, according to the perceptions of the study sample.
3. Third Main Hypothesis: There is a statistically significant correlation between process innovation and competitive advantage (in terms of its dimensions).
4. Fourth Main Hypothesis: There is a statistically significant effect of process innovation on competitive advantage (in terms of its dimensions).

Theoretical Background

Process Innovation

Excellence is the most important factor in the survival of business, and in the sustainability of businesses in the business world. Thus, companies now make an effort to add novelty, and innovation is increasingly a focus. Process innovation is one of the key components of adaptation to rapid changes; it needs to be nurtured in a management environment which is conducive to innovation and is an ongoing and continuous process. The dynamic nature of the business environment necessitates process innovation, highlighting the importance for companies to recognize the need for improvement and change within their production processes. This includes providing the right environment for workers to unleash their creative gifts and to use them to their maximum capacity [2]. [3], progressive companies, which use advanced levels of innovation, need to incorporate an innovation methodology into their production processes. This assures high quality design of operational processes and control systems. In addition to being high-quality and affordable, modern consumers want to see businesses produce environmentally friendly products and be environmentally-conscious. This is not only for the products themselves, but also for the manufacturing process, which must take certain design factors into account. The table below provides the most important definitions of process innovation that have been proposed by various researchers.

The Author and the Year	The Concept
Tagudeen et al, 2019: 2	It refers to a company's ability to continuously transform knowledge and ideas into new products and processes for the benefit of stakeholders.

The Author and the Year	The Concept
Al-Jamal et al. 2024: 1579	This refers to addressing the production methods for a good with the aim of improving performance—both technically and economically—thereby positively influencing the relationship between inputs.
Lampal et al , 2014: 467	It is a company's ability to devise creative solutions within the context of structural constraints, by leveraging available resources and employing lean problem-solving methods, thereby enabling the creation of products that meet customers' needs and desires.
Al-Musawi, 2009: 62	A company's ability to generate novel ideas for solving specific problems—or to reconfigure existing components into new forms that meet customer needs—constitutes process innovation. This innovation is not limited to tactical aspects alone; it extends further to encompass machinery, equipment, manufacturing methods, and job satisfaction, ultimately leading to increased productivity.
[21]	A set of behaviors practiced by employees at various levels within a company, which drive changes in organizational structures and production patterns. This is achieved by implementing new methods for manufacturing products, solving problems, and making decisions in a more innovative manner—ultimately meeting customer desires and satisfying their needs through the creation of innovative products.

Importance of Process Innovation

1- It helps organizations adapt to challenges and quick changes in external environment, and helps them be flexible.

2- It helps in the development and improvement of individual's capability and potential through opportunities to use creative approach to keep pace with the modern advancement.

3- It provides job opportunities for people in different sectors through new and unique projects.

4- It enables the maximum use of materials and reduces waste and defects to a "zero" level.

Innovation has tremendous importance, particularly in the context of the significant challenges that companies encounter these days. It is the perfect answer because companies are no longer able to compete on the world stage just on the basis of their efficiency and cost. IBM surveyed more than 1500 CEOs from different industries and countries in 2010 and researchers discovered that most of the CEOs considered innovation as a major quality – more important than integrity or analytical thinking.

[4]

Dimensions of Process Innovation

1- This dimension is one of the basic concepts of production and operations management, which is designing a new production process. [7], it is the mainstay of an organization's operations management, plays a significant role in the company's growth, stability of market share, product quality and customer satisfaction. Process design, therefore, is a set of decisions that are used by the management of an organization to drive performance improvements and meet customer needs. The significance of this dimension is related to the development and advances in modern production processes, including the "just-in-time" manufacturing system (JIT) [5]. Therefore, the design of a new production process can be said to be planning and development for a new production system, which involves a sequence of activities, selection of technology and equipment. 2 – Improving Production Processes: The design of production processes is not always aimed at creating entirely new products using cutting-edge technologies. It is often the case that these existing products are improved and developed to add new market-oriented value, ranging from improved functionality and performance to aesthetic value, streamlining of steps and operations, reduction of waste and integration of recycling. As a result, the company enjoys a

competitive edge and a bigger market share as it provides products according to customer needs and desires [6]. At the same time, [8] proposes that this dimension also involves the dismantling of legacy products for the recovery of raw materials, which is a type of sustainable design. This helps to lower energy use, waste, pollution, and stimulates producers to invent and innovate new, creative, and different uses for their products.

Competitive Advantage

The Author and the Year	The Concept
[11]	An organization's ability to meet customer needs contributes to maintaining its market stability and achieving a competitive advantage, which in turn increases its market share and maximizes its profits.
[22]	The data and strategies adopted by an organization that contribute to the provision of high-quality goods and services, enabling it to outperform its competitors through the optimal utilization of all its resources.
Njoroge&Kingye, 2025:37	A set of unique characteristics and capabilities possessed by an organization, which enable it to achieve superior performance compared to competing firms operating in the same field.
[23]	It refers to a company's capacity to possess financial resources that enable it to offer solutions meeting customer needs and desires; in other words, valuable and rare resources allow a company to gain a competitive advantage and increase its productivity.
Zouarquis&Mouaoui ,2024,:9	A set of characteristics and attributes possessed by a company that enable it to offer products meeting customer needs and desires—whether through low costs, rapid response to customer requests, high product quality, or other unique features—which competitors are unable to replicate.
Rashid et al, 2020: 137	These encompass the efforts, measures, innovations, and all productive activities undertaken by a company to secure a larger customer base and a greater market share within its target markets—ultimately enabling it to outperform its competitors by leveraging assets, attributes, or capabilities that are difficult to replicate or emulate. Consequently, there is a growing focus on the pursuit of competitive advantage among companies, all of which now aspire to attain a competitive standing on the global stage.
Al-Mana‘, 2026: 472	A company's ability to achieve sustained distinction or superiority—one that is difficult to imitate or replace—by providing added value that meets the needs and desires of the customer.

Importance of Competitive Advantage

The significance a company gains by achieving a competitive advantage over its rivals in the same field is as follows [9]:

1- The ability to keep existing customers and acquire new ones by meeting their needs and desires better than the competitors.

2- Customer satisfaction: the company is able to produce products that meet the expectations of customers.

3- Gaining the firm's market share by its ability to manufacture products and/or services that create customer satisfaction.

4- Making profits for the company – a key goal of any company on its path to being competitive

– to bring profits and net profit at the end of the year, thanks to the ability to satisfy the needs of their customers.

5- It is an important and basic element in the activities of different organizations. [10]

Dimensions of Competitive Advantage

These consist of a set of characteristics that a company selects and focuses on when offering products and fulfilling market demands. By leveraging one or more of these attributes, the company can secure a competitive advantage that allows it to outperform its rivals. [11], [12], [13], [14], [10], and Al-Obaidi et al. (2026: 4), these dimensions are categorized as follows:

1. Low Cost: Many companies strive to attract customers by offering products at low costs, thereby increasing their customer base. A competitive advantage is achieved by adopting this dimension and by creating unique, distinctive product attributes that cannot be easily imitated by competitors. This approach is also effective for responding to dynamic changes [15]. A company can secure a competitive advantage through a low-cost strategy while maintaining product quality by leveraging economies of scale, reducing human resource costs, increasing productivity, and minimizing waste, spoilage, errors, and defects in production processes. Furthermore, securing highly efficient suppliers who offer competitive pricing contributes to cost reduction, ultimately allowing the company to outperform its competitors [9].

2. Flexibility: This refers to a company's capacity to implement production systems that can adapt to a wide and diverse range of evolving customer needs. Consequently, the system must be flexible and capable of change to continuously navigate different environments. This enables the company to provide a diverse array of products—in terms of both quantity and variety—thereby increasing... ...its competitive capability [16].

3 – Creativity and Innovation: These are two fundamental pillars in the business world. Creativity is defined as the thought process that gives birth to a new idea, whereas innovation refers to the implementation of ideas and their transformation into tangible products and services.

Thus, creativity is understood as the development of new products, processes, or markets, as well as a company's ability to penetrate challenging markets [17].

4 – Time and Delivery: These are significant competitive dimensions because customers care about having their needs met in the right quantity and at the right time. This goes beyond merely delivering orders to customers; it also encompasses the time—which producers strive to minimize—required to innovate and introduce a new product or service, or to shorten production time and ensure delivery by the agreed-upon deadline. Furthermore, it includes meeting the specific timeframes set by customers, all of which contributes to achieving a competitive advantage [18].

5 – Quality: This refers to the set of comprehensive characteristics and attributes of a product that satisfy customer needs (Rashid et al., 2019: 54). Meanwhile, [19] view quality as the provision of products at a low cost yet with high quality, which enables a company to distinguish itself in the market from its competitors. By meeting customer needs, this helps achieve a competitive advantage. Adopting a focus on quality performance contributes to a company's success, and this dimension serves as an effective pillar for attaining a high level of production excellence (Hassan, 2017: ... 81) Quality refers to a company's ability to provide products that exceed customer expectations.

6- Market share: This is the total of a company's sales within the sector in which it operates. It is measured either by the number of customers to whom the company provides products, or by the monetary value of the sales the company generates for a specific product or service, relative to the total sales value within the entire market [20].

METHOD

Research Design and Procedures

Research Methodology and Analytical Techniques

The method used in this study was descriptive-analytical type and examined process innovation and related to competitive advantages of the Kronji Soft Drinks Company. The data were obtained from the questionnaires. Arithmetic means, standard deviations and relative importance scores

were computed, internal consistency was assessed by Cronbach's alpha, one-sample t-tests were used for mean scores, Pearson correlation coefficients and simple linear regression were used for the analysis. All analyses were done with SPSS software and the significance level (0.05) was used to determine the statistical significance of the results. Sensitivity analyses were also included to test the overall robustness of relationship.

Research Setting and Sample

The study was carried out with (60) subjects at the soft drinks company of Kronji in Kirkuk city. The context of the industrial setting is suitable for the study of the renewal and improvement of production processes in terms of operational and/or competitive considerations.

There were no missing values or answers outside the specified scale options for the (60) valid responses obtained for each of the 24 items on the questionnaire. The distribution of the items of the instrument is shown in Figure (1), both related to process innovation items (6 items) and competitive advantages items (18 items), indicating the overall structure of the questionnaire.

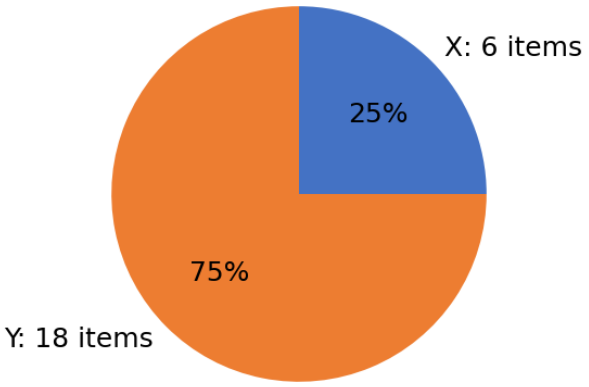


Figure 1. Distribution of the questionnaire items across the research variables
Source: Prepared by the researchers using SPSS.

Research Instrument and Measurement of Variables

The questionnaire included two main variables: process innovation as the independent variable, and competitive advantages as the dependent variable. Process innovation was measured through the design of a new production process and the improvement of an existing one, with three items for each dimension. Competitive advantages were measured across six dimensions—low cost, quality, time and delivery, market share, creativity and innovation, and flexibility—with three items for each dimension. Table (1) presents the codes for the variables and dimensions, as well as the sequence of their corresponding items.

Table 1. Coding of questionnaire items

Sequence	Count	Symbol	Dimensions	Axes
X1–X3	3	XX1	Designing a new production process	Independent
X4–X6	3	XX2	Optimizing an existing process	Independent
Y1–Y3	3	YY1	Low cost	Dependent
Y4–Y6	3	YY2	Quality	Dependent
Y7–Y9	3	YY3	Time and delivery	Dependent
Y10–Y12	3	YY4	Market share	Dependent

Sequence	Count	Symbol	Dimensions	Axes
Y13–Y15	3	YY5	Creativity and innovation	Dependent
Y16–Y18	3	YY6	Flexibility	Dependent
X1–X6	6	X	Process innovation	Independent
Y1–Y18	18	Y	Competitive advantages	Dependent

Source: Prepared by the researchers using SPSS

A five-point Likert scale was used with ascending coding starting from strongly disagree (1), then disagree (2), neutral (3), agree (4), and ending with strongly agree (5). The score for each dimension was calculated by the average of its three items, and the score of each variable was calculated by the average of all of its items. The relative importance was calculated by dividing the average by (5) and multiplying the result by (100). This percentage expresses the average position on the scale, and does not represent the percentage of participants who agree.

RESULT AND DISCUSSION

Internal Consistency of the Research Instrument

The Cronbach's alpha coefficient for the process innovation, competitive advantages, and the questionnaire is 0.702, 0.663, and 0.753, respectively (as presented in table 2). Some of the dimensions are weak, while others are strong; the overall reliability of the instrument does not make up for the weakness in some dimensions. Specifically, the alpha values were 0.025 for the market share dimension, 0.262 for the flexibility dimension, and 0.293 for the time and delivery dimension, which does not allow one to present strong conclusions based on the scores of these dimensions. These values require that the coding need to be reviewed and the aligning of the items with the content of each dimension. In addition, the square root of the alpha coefficient is a value from the reliability coefficient and is not independent of construct validity. The following results are reported with this limitation in mind, and are not adjusted for reliability or the removal of items to enhance reliability values.

Table 2. Internal consistency test for the questionnaire

Dimensions	Symbol	Alpha root	Cronbach's alpha	Number of items
Process Innovation	X	0.838	0.702	6
Competitive Advantages	Y	0.814	0.663	18
The Questionnaire as a Whole	—	0.868	0.753	24

Source: Prepared by the researcher using SPSS

Analysis of Respondents' Answers to the Questionnaire Items

Table (3) presents the arithmetic means, standard deviations, and relative importance of the questionnaire items. Within each dimension, the items are ranked according to their means to identify the practices rated highest and lowest by the participants, serving as descriptive indicators

that precede the hypothesis testing.

Table 3. Description of the questionnaire items

ت	Designing New Production Processes	Arithmetic Mean	Standard Deviation	Relative Importance	Rank
	The company pursues a clear strategic vision to design innovative production and packaging processes that have never been used before.				
X1	We possess the technical and operational capability to plan and implement new, independent production lines for manufacturing new beverage flavors or packaging sizes.	4.683	0.504	93.7%	1
X2	The setup and operation of machinery and equipment for new production processes are executed seamlessly, supported by expert training and supervision.	4.233	0.465	84.7%	3
X3	Optimizing Existing Processes	4.283	0.585	85.7%	2
	The company continuously re-engineers and improves current operational processes to enhance productivity.				
X4	We leverage insights and suggestions from frontline staff and technicians to address bottlenecks and minimize waste on existing filling lines.	4.467	0.536	89.3%	1
X5	Ongoing refinements to daily work methods make the production process faster, safer, and more efficient.	4.250	0.600	85.0%	2
X6	Low Cost	4.117	0.761	82.3%	3
	The company employs effective strategies to reduce total production and packaging costs without compromising the quality of the beverages. Operational efficiency and the reduction of raw material waste contribute to lowering the production cost per unit.				
Y1	We are all committed to optimizing the use of materials and inputs to minimize operational waste as	4.783	0.415	95.7%	1

ت	Designing New Production Processes	Arithmetic Mean	Standard Deviation	Relative Importance	Rank
	much as possible.				
Y2	Quality	4.733	0.446	94.7%	3
Y3	The company adheres to rigorous quality control standards throughout every stage of the manufacturing and packaging of carbonated beverages.	4.767	0.427	95.3%	2
	Our production lines are characterized by high precision in meeting product specifications (such as flavor, carbonation levels, and water purity).				
Y4	We place great emphasis on inspecting and detecting any potential product defects during the final packaging stages.	4.533	0.503	90.7%	1
Y5	Time and Delivery	4.317	0.469	86.3%	2
Y6	The company excels in fulfilling market and distribution network orders precisely within agreed-upon timeframes.	4.300	0.462	86.0%	3
	Our loading and packing operations are highly efficient, minimizing wait times and accelerating the distribution process.				
Y7	We work as a unified team to ensure that production and operational tasks are completed promptly and according to schedule.	4.483	0.624	89.7%	2
Y8	Market Share	4.067	0.634	81.3%	3
Y9	The company is dedicated to expanding its market share and increasing sales volume relative to competitors in the beverage sector.	4.533	0.623	90.7%	1
	Continuous improvement in product quality and variety helps attract a larger customer base and drives market demand.				
Y10	We take pride in the fact that our products are the preferred and most widely chosen option among a broad segment of consumers.	4.683	0.469	93.7%	1
Y11	Creativity and Innovation	4.383	0.613	87.7%	2

ت	Designing New Production Processes	Arithmetic Mean	Standard Deviation	Relative Importance	Rank
Y12	The company regularly introduces innovative and distinctive flavors or packaging designs to the market.	3.483	0.873	69.7%	3
	Management encourages creative ideas from employees to enhance the characteristics and features of our beverages.				
Y13	We actively incorporate development proposals aimed at innovating new work methods or... Improving Packaging Design	4.267	0.634	85.3%	1
Y14	Flexibility	4.050	0.622	81.0%	2
Y15	The company possesses a high degree of flexibility, allowing it to rapidly adjust production plans to keep pace with seasonal shifts or sudden market demand.	3.800	0.755	76.0%	3
	Our operational lines are sufficiently flexible to enable quick transitions between different flavors or packaging sizes, with minimal downtime.				
Y16	We adapt easily and swiftly to any urgent modifications required for operational schedules or work processes.	4.350	0.606	87.0%	1
Y17	Designing New Production Processes	4.000	0.582	80.0%	3
Y18	The company pursues a clear strategic vision to design innovative production and packaging processes that have never been used before.	4.067	0.821	81.3%	2

Source: Prepared by the researcher using SPSS

The mean scores of the items in the process innovation area were above the neutral (3). In terms of the design of new production processes, the item "strategic vision for innovation" (X1) had the highest mean value of 4.683 and the lowest mean value of 4.233 was the item "technical and functional capacity to introduce new production lines". This is an indication that the sense of direction for innovation was given a higher priority level than some implementation requirements. For the particular item related to process re-engineering and optimization (X4), the mean was 4.467 while the mean for the item related to operational speed, safety, and ease (X6) was 4.117. In practice, it is recommended that more attention be paid to the real-life performance of these improvement efforts and that the differences described should not be defined as statistically significant.

In terms of competitive advantages, Y1 (low cost) had the highest mean of 4.783, while in the quality-related items, Y4 (high quality) had the highest mean at 4.533, and at the same time, in

the time and delivery-related items Y9 (fast delivery) had the highest mean at 4.533. The item that reflected commitment to expansion (Y10) had a mean of 4.683 compared with a mean of 3.483 for the item which concerned perceived preference for and market penetration of the products (Y12) in terms of market share. The difference reflects the lack of clarity about the firm's share of the market since there are no independent sales figures available; a clear picture of a firm's market share can only be formed when the independent sales figures become available. Concerning creativity and innovation, item (Y13) had the highest rate of mean at 4.267, and item (Y15) had the lowest rate of mean at 3.800. Item (Y16) had the highest mean of 4.350 on flexibility and item (Y17) had a mean of 4.000.

The standard deviations represent the amount of variability from the means among the participants' responses. The dispersion itself is not enough to validate the scale and to determine the representativeness of the sample compared to the company population; in addition, high mean scores do not offset the lack of internal consistency of the scores for some dimensions.

Description of Variables and Dimensions and Testing of Hypotheses

Table (4) summarizes the levels of the two variables and their respective dimensions, presenting the mean, standard deviation, range, relative importance, ranking, and skewness. These indicators are used to describe the availability of practices as perceived by the participants, while the overall means are tested against the neutral value (3).

Table 4. Description of research variables and dimensions

Variable	Mean	Standard Deviation	Minimum Value	Maximum Value	Relative Importance	Rank	Skewness
XX1	4.400	0.372	3.667	5.000	88.0%	1	0.042
XX2	4.278	0.499	3.000	5.000	85.6%	2	-0.175
X	4.339	0.369	3.333	5.000	86.8%	—	-0.063
YY1	4.761	0.325	4.000	5.000	95.2%	1	-1.172
YY2	4.383	0.367	4.000	5.000	87.7%	2	0.479
YY3	4.361	0.404	3.333	5.000	87.2%	3	-0.520
YY4	4.183	0.385	3.333	5.000	83.7%	4	-0.126
YY5	4.039	0.506	3.000	5.000	80.8%	6	0.216
YY6	4.139	0.431	3.000	5.000	82.8%	5	0.239
Y	4.311	0.232	3.778	4.944	86.2%	—	0.501

Source: Prepared by the researcher using SPSS

The mean score for process innovation was 4.339, representing a relative importance of 86.8%. The design of a new production process (mean = 4.400) ranked higher than the improvement of an existing process (mean = 4.278), with a descriptive difference of 0.122 points, as illustrated in Figure (2). The one-sample t-test value (against a test value of 3) was 28.070, with 59 degrees of freedom and a p-value of less than 0.001. This result supports the first hypothesis regarding the presence of process innovation based on the sample's assessments; however, it does not test the statistical significance of the difference between the two sub-dimensions.

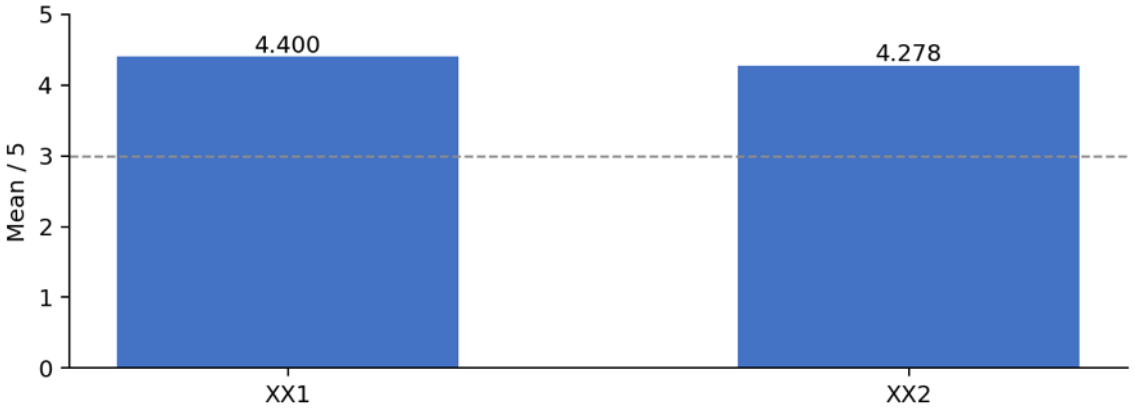


Figure 2. Level of agreement for the process innovation variable, with its two dimensions
Source: Prepared by the researchers using SPSS.

The mean score for competitive advantages was 4.311, representing a relative importance of 86.2%. Low cost ranked first with a mean of 4.761, followed by quality (4.383), time and delivery (4.361), market share (4.183), flexibility (4.139), and finally, creativity and innovation (4.039), as illustrated in Figure (3). The t-test value (against a test value of 3) was 43.786, with 59 degrees of freedom and a p-value of less than 0.001. This result supports the second hypothesis at the level of overall estimates, while noting the limited reliability of the dependent variable and some of its dimensions.

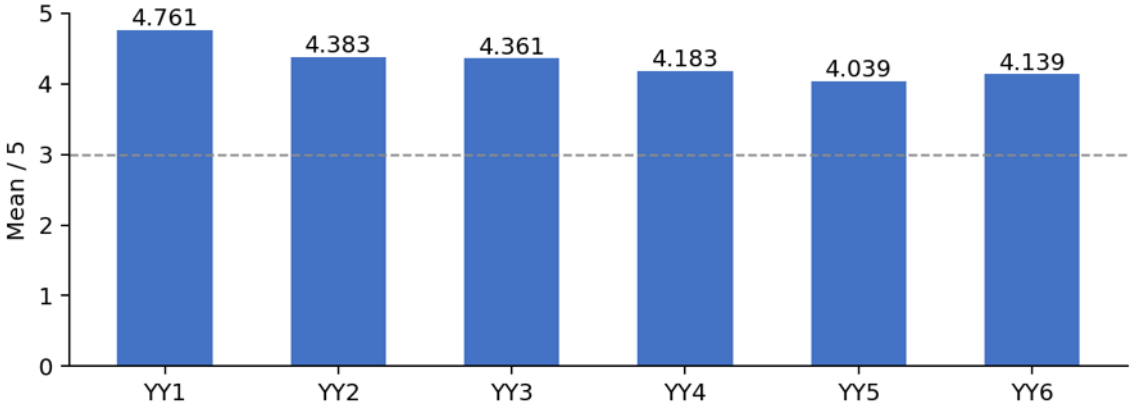


Figure 3. Level of agreement for the competitive advantages variable, across its six dimensions
Source: Prepared by the researchers using SPSS.

The dimensions of the practices are ranked, indicating that the practices related to cost, quality and delivery are more prevalent in the participants than the practices that involve creativity and innovation. The results do not, however, constitute evidence of true cost and/or market share compared to other competitors, but only the perceptions of the sample.

Normality and Sensitivity Analysis

The skewness figures shown in Table (4) show that the scores when compared to the level of symmetry are very different especially for the item "low cost" with a skewness of -1.172 and a mean score close to the top of the scale. Shapiro-Wilk test for the overall regression residuals gave 0.953 ($p = 0.023$) indicating that residuals are not normally distributed at the 0.05 significance level. Overall, the direction and significance of correlation sensitivity analysis (Spearman's rank correlation coefficient, 0.483, $p < 0.001$) are consistent with the direction and significance of the Pearson correlation. This uniformity contributes to the stability of the overall

relationship, but doesn't remove the necessity of looking at the other regression assumptions.

Correlation Hypothesis Testing

The third main hypothesis states the following:

H3: There is a statistically significant correlation between process creativity and competitive advantages (as defined by their respective dimensions) within the company under study.

Pearson's correlation coefficient was used to determine the direction, strength, and statistical significance of the linear relationship, based on 60 observations for each correlation. Table (5) presents the correlation coefficients at both the aggregate and dimensional levels; the columns are interpreted according to the coding scheme provided in Table (1).

Table 5. The relationship between process innovation and competitive advantages, at both the dimensional and overall levels

Variable	Description	YY1	YY2	YY3	YY4	YY5	YY6	Y
XX1	Pearson	0.258*	0.154	0.238	0.255*	0.076	0.070	0.290*
XX1	Sig.	0.046	0.239	0.067	0.050	0.564	0.593	0.025
XX2	Pearson	-0.014	0.354**	0.344**	0.377**	0.217	0.255*	0.453**
XX2	Sig.	0.918	0.005	0.007	0.003	0.095	0.049	<0.001
X	Pearson	0.121	0.317*	0.352**	0.383**	0.185	0.208	0.452**
X	Sig.	0.357	0.014	0.006	0.003	0.157	0.111	<0.001

Statistically significant at the 1% significance level; (*). Statistically significant at the 5% significance level.

Source: Prepared by the researchers using SPSS.

Key to symbols: YY1 – Low cost; YY2 – Quality; YY3 – Time and delivery; YY4 – Market share; YY5 – Creativity and innovation; YY6 – Flexibility. The reported probability value of (0.050) should be interpreted with caution, as it has been rounded to three decimal places.

At the aggregate level, the hypothesis is supported by the correlation coefficient between 'process creativity' and 'competitive advantages' which was (0.452) and p value was < (0.001). The individual dimensions of competitive advantage were also found to be correlated with quality (0.317) (p = 0.014); with time and delivery (0.352) (p = 0.006); and with market share (0.383) (p = 0.003). Its correlations with low cost (0.121; p = 0.357), creativity and innovation (0.185; p = 0.157), and flexibility (0.208; p = 0.111) were not statistically significant at the (0.05) level. The results show that an overall positive relationship does not mean there is a significant relationship with all the individual dimensions. Furthermore, the correlation between the improvement of existing processes and competitive advantages was (0.453), compared to (0.290) for the design of new processes; this numerical difference does not represent a statistically significant distinction between the two coefficients. These sub-relationships should be interpreted as exploratory findings, given the large number of tests conducted and the low reliability of certain dimensions. 6 Statistical Hypothesis Testing

The fourth main hypothesis states the following:

H4: There is a statistically significant effect of process innovation—as represented by its dimensions—on competitive advantages within the company under study.

Three simple linear regression models were employed to test the predictive relationship between each dimension of process innovation (and process innovation as a whole) and competitive advantages. In this context, "effect" refers to the statistical significance of the regression coefficient; a cross-sectional design based on a single measurement source does not allow for the establishment of causality. The symbol (Y) represents the score for competitive advantages, (a) represents the constant, (b) represents the unstandardized regression coefficient, and (e)

represents the residual. Meanwhile, (XX1), (XX2), and (X) represent the design of new processes, the improvement of existing processes, and process innovation as a whole, respectively.

Designing a New Production Process and Competitive Advantages

The first model examines the relationship between the design of a new production process and competitive advantages, according to the following formula:

$Y = a + b(XX1) + e$

Table (6) presents the estimates for the first model, their statistical significance, and the coefficient of determination.

Table 6. The impact of designing a new production process on competitive advantages

Authoritative	Interpretive	The constant a	Slope b	T	Sig.	F	Sig.	R^2
XX1	Y	3.516	0.181	2.308	0.025	5.328	0.025	0.084

Source: Prepared by the researchers using SPSS.

The F value of the model was 5.328, the degrees of freedom (1, 58), and the t value for the regression coefficient was 2.308, p value 0.025. A 1-point rise in the design of a new process is expected to result in a 0.181-point rise in the competitive advantage score, on average, within the range of the data. The standardized beta coefficient was 0.290 and the coefficient of determination (R^2), which is the proportion of the total variance accounted for by the model, was equal to 0.084 (8.4%). The outcome suggests a moderate yet positive correlation, so introducing new processes should be connected with an evaluation of what the processes do in practice, rather than just managerial preferences for innovation.

Improving an Existing Production Process and Competitive Advantage

The second model examines the relationship between improving an existing production process and competitive advantage, according to the following formula:

$Y = a + b(XX2) + e$

Table (7) presents the estimates for the second model, their statistical significance, and the coefficient of determination.

Table 7. The impact of re-optimizing an existing process on competitive advantages

Explanatory	Authorized	Constant A	Mile B	T	Sig.	F	Sig.	R^2
XX2	Y	3.411	0.210	3.866	<0.001	14.949	<0.001	0.205

Source: Prepared by the researchers using SPSS.

The F value of the model was (14.949) with two degrees of freedom (1, 58), and the t value of the regression coefficient was (3.866), with a probability value of less than (0.001). The slope was (0.210), meaning that an increase in the degree of improvement of the existing process by one point is associated with an expected increase of (0.210) points in competitive advantages. The standard beta was (0.453) and the coefficient of determination was (0.205), equivalent to explaining (20.5%) of the variance in the scores of the dependent variable. This result directs attention to improving existing work methods and monitoring bottlenecks and waste, without proving that these mechanisms produced the observed relationship. Also, the numerically higher coefficient of determination than the new process design model is not enough to confirm the statistical superiority of the existing improvement without a direct comparison test.

Overall Process Innovation and Competitive Advantages

The third model examines the overall relationship between process innovation and competitive

advantages, according to the following formula:
$Y = a + b(X) + e$

Table (8) presents the overall model estimates, their statistical significance, and the coefficient of determination.

Table 8. The overall impact of process innovation on competitive advantages

Explanatory	Authorized	Constant A	Mile B	t	Sig.	F	Sig.	R^2
X	Y	3.080	0.284	3.859	<0.001	14.890	<0.001	0.204

Source: Prepared by the researchers using SPSS.

The F-statistic value was recorded to be 14.890, having degrees of freedom (1, 58), while the calculated t-statistic of the regression coefficient was noted to be 3.859 with a p-value lower than 0.001. The slope had a value of 0.284, the standardized beta value was 0.452, while the coefficient of determination (R^2) was stated to be 0.204. This means that the model is valid and reliable enough to explain 20.4% variance of competitive advantage scores in the studied sample, hence supporting the fourth hypothesis in its statistical meaning. The analysis was enhanced by conducting the sensitivity analysis, based on heteroskedasticity consistent standard errors (HC3), which confirmed that the slope was still statistically significant having its p-value close to 0.003. This means that the model is able to provide a positive predictive relationship, indicated by the fact that considerable part of the variance is not explained by the model. Additionally, the interpretation of the results is complicated by the fact that additional explanation of the model does not mean that this information would be used for generating profits and sales; moreover, limited internal consistency of some measures of dependent variable is another strong reason, preventing from drawing strong general conclusions regarding the obtained outcomes.

CONCLUSION

1. Respondents showed a strong interest in creating new methods of production as compared to using the current ones. Their evaluation of management's vision of innovation was very high, while the assessment of technical skills necessary to the creation of new production lines was low. Apparently, requirements of implementation phase should be paid attention to while developing.
2. Creativity and innovation are at the bottom among competitive advantage dimensions, however, they are above zero point. The category titled "suggestions" got the lowest score which demonstrates that employees are not highly involved in the creation of projects and methods.
3. The data demonstrate the presence of a statistically significant positive relationship between process creativity and competitive advantage as a whole: we see its great influence on such aspects as quality, time, delivery, and market share. As for cost reduction, creativity, innovation, and flexibility, our findings did not reach the statistical significance level required, hence, they should be taken with caution.

Recommendations

1. Ensure that the necessary technical requirements and training are provided when designing new production processes. Furthermore, link each development project to specific objectives—such as increasing production capacity, reducing defects, or shortening operational lead times—to evaluate the extent to which the expected benefits are realized.
2. Formalize the participation of workers and technical staff in development efforts by establishing a clear mechanism for receiving, reviewing, and testing their suggestions. Additionally, ensure that employees are informed about the outcomes of implemented ideas and that their contributions are duly recognized. 3. Enhancing the dimension of

creativity and innovation as a competitive advantage by focusing on the development of flavors, packaging sizes, and designs, while leveraging feedback from customers and distributors before rolling out improved products on a larger scale.

REFERENCES

[1] Toufan and Al-Awadi, 2023. *Bibliographic details unavailable.*
[2] Marawi and Al-Shanafi, 2018. *Bibliographic details unavailable.*
[3] Shakun *et al.*, 2021. *Bibliographic details unavailable.*
[4] Sayiner, 2015. *Bibliographic details unavailable.*
[5] Al-Musawi and Al-Dabbas, 2026. *Bibliographic details unavailable.*
[6] Radwan, 2018. *Bibliographic details unavailable.*
[7] Ponsignon, 2017. *Bibliographic details unavailable.*
[8] Ali, 2023. *Bibliographic details unavailable.*
[9] B. A. L. Al-Rashidi, A. I. Ahmed, and A. H. A. F. Shaalan, "The competitive advantage approach and its strategies: An analytical study and integrative perspective," *Journal of the Faculty of Education at Benha*, no. 120, pt. 1, 2019.
[10] H. S. R. Al-Gharbawi and R. Tishoun, "Adopting a green value chain to achieve sustainable competitive advantage: An exploratory study of the perspectives of a sample of employees at the UR General Company for Engineering Industries in Dhi Qar," *Journal of Accounting and Financial Studies*, vol. 4, no. 2, 2021.
[11] A. I. Hassan, "The impact of total quality management practices on achieving competitive advantage: A field study in Jordanian pharmaceutical companies, categorized by company size," Master's thesis, 2017.
[12] A. R. Abdel Hamid and S. Al-Jabali, "The impact of marketing mix elements on competitive advantage: A field study in industrial plastics factories in Amman," unpublished Master's thesis, Middle East University, Amman, Jordan, 2018.
[13] R. A. M. Abdel Aziz, "Marketing culture and its impact on competitive advantage, mediated by e-service quality: A field study on employees in information technology companies in Egypt," *Scientific Journal of Financial and Commercial Studies and Research*, vol. 5, no. 1, pt. 3, pp. 1045–1074, 2024.
[14] H. Bin Hafiz and M. A. Al-Ashwal, "The role of strategic vigilance in achieving competitive advantage in the Yemeni telecommunications sector," *An-Najah University Journal for Research (Humanities)*, 2026.
[15] E. A. S. Sijabat, U. Nimran, H. N. Utami, and A. Prasetya, "The effects of dynamic capabilities, entrepreneurial creativity and ambidextrous innovation on firm's competitiveness," *Journal of Asian Finance, Economics and Business*, vol. 8, no. 1, pp. 711–721, 2021.
[16] J. Priyadarshini and A. Gupta, "Mapping and visualizing flexible manufacturing system in business and management: A systematic review and future agenda," *Journal of Modelling in Management*, vol. 19, no. 1, pp. 19–45, 2024.
[17] M. I. S. B. Mazla, M. K. B. Jabor, K. Tufail, A. F. N. Yakim, and H. Zainal, "The roles of creativity and innovation in entrepreneurship," *Advances in Social Science, Education and Humanities Research*, vol. 470, pp. 213–218, 2020.
[18] M. H. Waheed and N. U. Khan, "The impact of service recovery strategies and justice theory upon customer satisfaction in airline industry of Pakistan," *NICE Research Journal*, vol. 11, no. 1, pp. 25–38, 2019.
[19] V. Gupta, D. Garg, and R. Kumar, "Depiction of total quality management during a span of 2003–2013," *Journal of Engineering and Technology*, vol. 4, no. 2, pp. 81–87, 2014.
[20] M. R. Hammoud, "The role of product innovation in increasing market share: A field study," *Scientific Journal of Commercial and Environmental Studies*, vol. 8, no. 1, pp. 725–747, 2017.
[21] Al-Musawi and Al-Dabbas, 2024. *Bibliographic details unavailable.*
[22] O. R. Mahdi and I. A. Nassar, "The business model of sustainable competitive advantage through strategic leadership capabilities and knowledge management processes to overcome COVID-19 pandemic," *Sustainability*, vol. 13, no. 16, 2021.
[23] B. J. Ali and G. Anwar, "Strategic leadership effectiveness and its influence on organizational effectiveness," *International Journal of Electrical, Electronics and Computers*, vol. 6, no. 2, pp.

11–24, 2021.
[24] N. A. A. Al-Obaidi, M. M. M. Al-Halawaji, and M. R. A. Al-Tayyar, "Electronic human resource management and its role in sustainable competitive advantage: An analytical study of the perspectives of a sample of employees at the University of Mosul," *Tikrit Journal of Administration and Economics*, vol. 22, special issue, pt. 2, pp. 1–22, 2024.
[25] J. Al-Mana', "The impact of strategic leadership on achieving sustainable competitive advantage," *Al-Asala Journal*, vol. 8, no. 13, pp. 469–489, 2026.
[26] R. Mishra, "Configuration of volume flexibility in Indian manufacturing firms: Evidence from case studies," *International Journal of Quality & Reliability Management*, vol. 35, no. 1, pp. 232–265, 2018.
[27] F. Rashid, C. A. Taib, R. Z. Yusoff, and M. A. H. Ahmad, "Human resources management practices and total quality management (TQM) is the precondition to gain the sustainable competitive advantage in the Bangladesh ready-made garments sector," *Journal of Economics and Business*, vol. 3, no. 1, pp. 131–141, 2020.
[28] K. T. S. Rashid, D. A. Ismael, B. Othman, and R. Ali, "Dimensions of service quality and their effects on achieving competitive advantage: An exploratory study of banking organizations in Sulaimaniyah City-Iraq," *International Journal of Psychosocial Rehabilitation*, vol. 23, no. 2, pp. 548–560, 2019.
[29] I. Zouarqui and A. Mouzaoui, "The role of strategic vigilance in achieving competitive advantage in the institution: Case study of El Sewedy Cables, Ain Defla," *International Journal of Professional Business Review*, vol. 9, no. 11, 2024.