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The Evaluation of Quality Engineering for Supply Chain Operations in Khan Dhari Silo / Case Study

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Abstract:

The study aims to search for mechanisms to improve the supply chain operations in the silo of Khan Dhari by applying the requirements of quality engineering and focusing on the axes of design, human engineering and value engineering, which are among the most important axes concerned with quality engineering in the silo.

The case study approach was relied upon as an approach that helps in the comprehensive and in-depth analysis of the research problem, and the researcher relied on checklists in collecting and analyzing data. The research problem is summarized in the main question (there are failures and stops in the process of receiving the wheat crop, and there is no analysis of the processes of transporting the wheat crop from the processing sources to the storage stage, through circulation. From transportation, weighing and storage tools, and there is no keeping up with the management of supply chains in the silos departments in Baghdad, Including the silo of Khan Dhari with modern technologies), the importance of the research lies in showing how to employ quality engineering and rearrange the technical activities related to receiving grain. The most important results reached are the adoption of advanced strategies related to the processes of receiving the wheat crop and the reliance on an advanced electronic system in the work.

Key Words : Quality Engineering, Value Engineering, Supply Chains, Khan Dhari Silo.

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1.Introduction:

It has become clear that the issue of quality is no longer an intellectual luxury, but has become a practical reality that must be applied in various business organizations. Therefore, the issue of quality is considered one of the most important topics that business organizations focus on in their different businesses and activities. The word quality expresses the presence of certain and characteristics in the product, especially since quality is considered one of the administrative philosophies because of its impact on the reputation of the organization and its position among business organizations. Its loss means the organization's loss of its identity, as it is considered the key to success for the gateway to development, and for this reason organizations, seek to constantly pay attention to the priority of quality to keep changes and developments in the external environment and keep pace with technological progress.

Today industrial and service organizations tend to adopt new methods and methods that enable them to continue in the market due to the increase in competition, the introduction of advanced technology, and the adoption of modern production methods and techniques to achieve higher levels of performance, such as spreading and developing a culture of quality, and there is no need to convince anyone of the multiplicity of crises facing organizations as a result of rapid changes in political, economic, social and technological conditions (Al Faihan and Abd ulbaqi, 2016). Where reflect changes in the world in which we live reflect their effects on many areas of life and their effects are reflected on many businesses. Because of the global economic crisis on the wheat crop and the changes resulting from the repercussions of the war between Ukraine and Russia, and because the wheat crop is at the forefront of strategic crops in the world due to its nutritional importance, which constitutes a food source for more than 35% of the world's population. It is also considered one of the most important grain crops, covers the largest cultivated area on the surface of the earth, and is the first crop in Iraq in terms of cultivated area, production and consumption, as it is The basis of the daily sustenance of the individual. the importance of this crop, the General Company for Grain Trade, was required to secure strategic storage, whether from local production or imports, to meet the local need.

One of the company’s priorities is the organization and development of its work related to the process of handling the wheat crop, whether local or imported, in its silos, especially the Khan Dhari Silo, the case study sample, and engineering the quality of supply chain operations, as it was designed to store the strategic wheat crop. One of the priorities of the operating industrial organizations is to adopt strategies to enhance their position, and therefore their management must rely on entrances capable of adapting to these changes, to raise production rates and improve the quality of products through the application of modern scientific theories and methods, and that all organizations and companies at present seek to improve the quality of their products to continue and remain in the work environment. There are several methods that all employees learn to improve quality in their organizations, and the main purpose of these methods is to work towards goals that focus on getting rid of errors (Jawad and Hussein, 2019). Adopting the quality engineering approach can contribute to addressing the problems of industrial organizations.

1.1 Literature review:

Quality engineering works on the basis of good inputs and processes and turns them into good and distinct outputs that satisfy customers. There are many studies that discussed the possibility of applying quality engineering requirements in industrial and service organizations, including. Box and Woodall (2016) Where explained that there is a significant role for quality engineering and statistical methods in achieving creativity in organizations. While Ahmed (2016) explained that the application of the principles of quality engineering in all productive organizations contributes to achieving all the goals they seek, especially in the field of quality improvement, cost reduction, work procedures and speed in their completion. Al-Murabit (2019) indicated that teaching the quality engineering curriculum and training quality engineering is part of the educational products that are supposed to be provided in the faculties of economics

P-ISSN 2518-5764
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and administrative sciences. Youssef (2021) also explained that adopting the concept of quality engineering is an important method in the rationalization and engineering analysis of the causes of damage that affects the quality of the commodity and the high costs And he also described the engineering research that led to that.

In addition, there are many studies that discussed the supply chain activities adopted by industrial organizations, including. The study of Ambe (2014) which showed that the indicators of improving supply chain performance of European manufacturers compared to Asian and American manufacturers indicate that European manufacturers have a number of important characteristics of the supply chain that respond to customer requirements. Hafez (2020) also explained the impact of quality dimensions and product development in enhancing the basic capabilities of the organization through the mediating role of supply chain practices. Kazem study (2022) also showed that supply chain activities are among the important intellectual topics in production and operations management. In addition, Karim (2022) showed that there is a waste of space and energy due to the use of pneumatic conveyors to transport bottles, and there is a waste of water for washing bottles, and this is a result of weakness in supply chains.

2. Material and Methods:

The researche relied on several methods to collect data, which are as follows:

1- Field cohabitation in the silo.
2- Personal interviews with specialists.
3- Personal notes.
4- Data and records of marketing operations.
5- Check – List

The researcher made checklists for the scales of the considerations related to the variables of the study. The checklists included questionnaire, where the two researchers worked on developing (6) questions to cover the considerations related to the application of quality engineering requirements, and (4) questions to cover the scale of the components of the supply chains.

2.1 Research population and sample:

The research community is represented by the State company for Grain Trade, which is an Iraqi government company established in 1939 By-Law No (32) of 1939 and was performing duties that did not exceed the price bulletin and available information about grains. And according to Law No (199) of 1969, it became one of the formations of the General Grain Corporation, and the name of the company was previously the General Grain Authority, and it was also divided to become the General Company for Grain Trade and the Bakeries Authority. The tasks of this company were to import grain, grind it and distribute it to bakeries. The tasks and duties of the company developed after the issuance of Trade Regulatory Council resolution No (4190202) of the year 1973 pertaining the marketing of grains (wheat, barley and rapeseed) which will be carried out exclusively by the company to this company, to become the to became the sole authority of importing, handling and procuring the wheat crop from farmers to secure strategic storage. The silo of Khan Dhari Silo in Baghdad governorate, was chosen as a sample for the research, and it is one of the sites affiliated to the General Company for Grain Trade as a field of application for the following reasons:

a) One of the most important reasons for choosing the field of research is that the reason for establishing the silo is to be a place for strategic storage of the wheat crop, and this crop is very important for people's daily sustenance.
b) The Khan Dhari silo is considered one of the largest silos in Iraq, both in area and capacity.
c)It is distinguished by its geographical location close to the local wheat cultivation and marketing areas, and is linked by railway lines with the imported storage and handling facilities in the port of Umm Qasr.

P-ISSN 2518-5764
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2.2 Procedural chart:

The Systematic processing of the study problem requires building a procedural scheme for the study to reach the goals and clarify the scope of the problem, and as shown in Figure 1, a simplified expression that reflects the sequence of the study path.

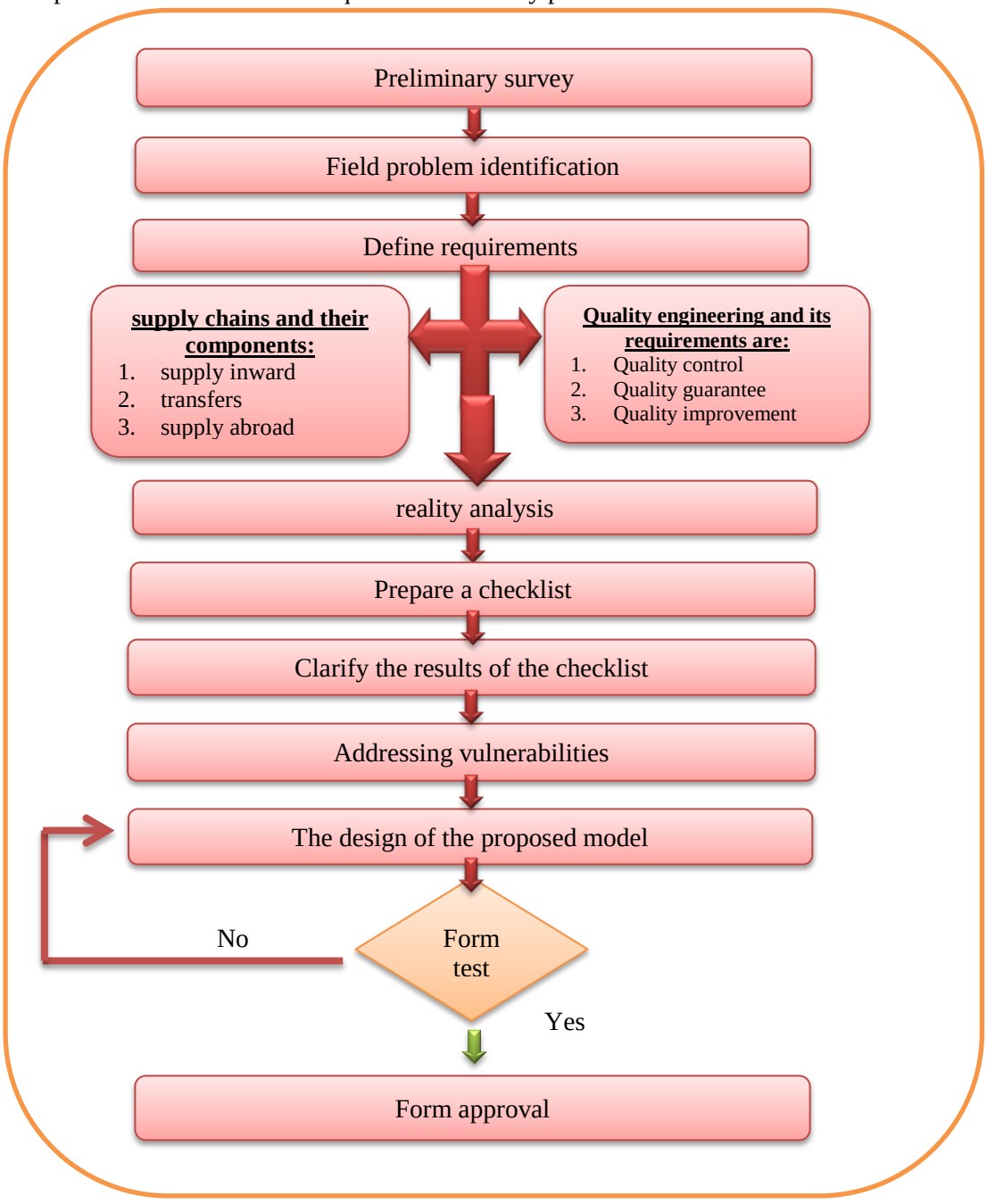

Figure (1) Scheme of the research

*Source: Prepared By The Researcher.

P-ISSN 2518-5764
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2.3 Measurement Tool:

This topic dealt with a presentation of the check lists, where the researcher made check lists for the measures of the considerations related to the variables of the study. The checklists included a set of questions, where the researcher worked on developing (6) questions to cover the considerations related to the application of quality engineering requirements, and (4) questions to cover the scale of the components of supply chains. Seven Likert scales were applied (fully implemented, fully documented, fully implemented, partially documented, fully implemented, not documented, partially implemented, fully documented, partially implemented, partially documented, partially implemented, not documented, not applied, not documented). To analyze the answers to the questions that were included in the check lists by the silo manager, his assistant, engineers and technicians with specialization.

The Specification And Identifying The Gaps Through The Use Of Weights For The Seven-Point Likert Scale. As Shown In Table 1:-

Table 1: Seven-Segment Likert Scale

T	Paragraphs Of The Heptatonic Scale	The Weight
1-	Fully Implemented, Fully Documented	6
2-	Fully Applied Partially Documented	5
3-	Completely Undocumented	4
4-	Partially Implemented, Fully Documented	3
5-	Partially Implemented Partially Documented	2
6-	Partially Implemented, Not Documented	1
7-	Not Implemented Not Documented	0

Taha, Q. Q.(2017), The Possibility Of Applying The Quality Management System And Iso Iso 9001:2008at Al-Rustamiya Station (Case Study) Journal Of Economic And Administrative, Vol.(23), No.(76).

2.4 Concept and Definition Of Quality Engineering:

Quality Engineering: It is a method created by Dr. Genichi Taguchi and abbreviated by the symbol (QE), where he developed an approach to improving quality at the lowest cost, as it focuses on designing products and reducing performance deviations from specific and targeted standards. This method depends on the management culture that is committed to total quality management. This method has been developed in Japan and the United States of America (Bennett, et al, 2002). Most business organizations have a quality engineering system. This system develops radical solutions to the standard requirements of the process of designing and improving production processes. Quality engineering primarily focuses on quality, starting from design and manufacturing processes, as well as reducing variation in product performance, according to Takeuchi (Su, 2013). Taguchi described quality engineering as a technique used to improve performance and reduce functional deviations caused by internal noise, outer noise, and manufacturing defects. This technology aims to produce products with sufficient durability against noise factors (Hassan and others, 2000).

2.4.1 Importance Of Quality Engineering:

The importance of quality engineering is summarized in the following points (Foster, 2010) and (Youssef, 2021)

1- It is considered one of the important ways to adjust the production process by means of the perfect control variables.

2- Provide the necessary foundations for defining the functional relationships between the design factors in product control and the outputs of the production process.

P-ISSN 2518-5764
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3- Availability of appropriate procedures for examining the relationship between the random noise variables in the production process and the changes that occurred in the product.
4- Evaluation and analysis of quality using tools and techniques used to find means and methods to reduce the costs of manufacturing the product.
5- It expresses the aspirations of customers by translating their needs and desires into product design.

2.4.2 Quality control tools :

Quality control tools (the seven tools) are simple statistical tools used in monitoring operations and continuous improvement. These tools were developed by (Deming and Juran), and Ishikawa also mentioned that these tools can be used to solve 95% of all problems. These tools are very useful in detecting errors related to quality. These tools are used after collecting data, and this data is of great importance in understanding the actual reality, and this must be clear and related to the main topic to identify it. Traditional quality control tools include:(Majoud and Nimrawy , 2017)

a) Check Lists
b) Histograms
c)Graphics
d) Pareto Diagram
e)Cause-effect chart
f) Scatter diagram
g) Control charts

2.4.3 Requirements Of Quality Engineering :

Relying on the concept of quality engineering and its historical development, the most important basic requirements for quality engineering emerge, which are represented by the following (Taguchi, et al, 2005) and (Al-Sisi, 2011)

a) Quality Control.
b) Quality Assurance.
c)Quality improvement.

2.5 Supply chains:

The supply chain in most business organizations is considered as an umbrella that overshadows the decisions of the design and operation processes, and it is also the cornerstone of the success of the organization, as the use of supply chain indicators in the industrial environment contributes to improving the logistical performance of the organization and the customer by providing information that helps the organization to meet the needs and desires customers.

Supply chain management provides forward thinking by using new technologies with different functions to analyze data and identify new trends, potential problems, and promising opportunities across many systems simultaneously. This integrative approach aims to bridge the gaps between different applications and technologies to obtain a broader view of internal and external data and transform it into information that helps in making appropriate decisions at the strategic and operational levels. These chains benefit from the huge amounts of data generated from the chain's operations and are coordinated and analyzed by analytical experts and scientists specialized in extracting data from various sources and achieving optimal use in record time (Youssef et al., 2020).

P-ISSN 2518-5764
E-ISSN 2227-703X

2.5.1 Concept and definitions of supply chain:

The concept of the supply chain went through several stages, but it maintained its context in general. It is an integrated system that synchronizes a series of interrelated operations to create demand for the product, obtain raw materials and spare parts and convert them into finished products, and distribute and promote these products. As well as facilitating the exchange of information between various commercial entities such as suppliers, manufacturers, distributors, and retailers the main objective of this is to enhance operational efficiency and increase profitability as well as enhance the competitive position of the organization and its supply chain. In today's global markets, individual organizations no longer compete as an independent entity with a unique brand name, but rather as an integral part of the links of the supply chain. Thus, the ultimate success of any organization will depend on its managerial ability to integrate and coordinate the complex web of business relationships between supply chain partners (Min, 2015). "The concept of the supply chain is of great importance, especially for those involved in the measures, To implement process and system improvements, the definition of the supply chain can vary greatly and depends on the perspective from which the definition is developed. The current trend tends more to adopt the definition developed by the Supply Chain Management Staff Council (CSCMP); Describing the supply chain as all the activities and processes that are applied to a product from start to finish, In this sense, the supply chain roughly begins with the extraction of raw minerals and the cultivation of seeds, that is, the obtaining of raw materials from the earth" (Kazem, 2022).

2.5.2 supply chain components:

There is a discrepancy in identifying the components of the supply chain for many researchers; presented a several components of the supply chain, which are purchasing, materials management, and distribution, deals with the components of the supply chain as follows (Russell and Taylor, 2000):

a) The first component: It is the chain structure that includes the interactive organizational units within the supply chain, such as the organization, suppliers, customers, distribution channels, and design and engineering centers.

b) The second component: It is the processes that include demand planning, forecasting, supply, manufacturing operations, demand fulfillment, materials management, and new product or service development.

c) The third component: is the interdependence between the structure of the chain and operations, where this interdependence is achieved through sharing information and communications within the chain or the members of the chain, who are the suppliers, the organization, and customers, which facilitates joint planning for chain operations, including forecasting, supply, and processing.

3. Discussion of Results:

3.1 Checklist analysis:

For the analysis of the checklist, the seven-point Likert scale was used, as a specific weight was adopted for each of the items on the scale; (Fully applied, fully documented, weighing 6),(fully applied, partially documented, taking weight 5), (fully applied, not documented, taking weight 4),(partially implemented, fully documented, taking weight 3),(Partly implemented, Partially documented, weighed 2),(Partly implemented, not documented, weighed 1),(Not implemented, not documented, weighed 0). A mathematical analysis was performed using mathematical equations to extract (frequencies, arithmetic mean, extent of concordance, and gap size) as shown below (Saleh, 2023).

P-ISSN 2518-5764
E-ISSN 2227-703X

a)Weighted arithmetic mean = $\frac{\text{Total (repetitions x weight)}}{\text{The sum of iterations}}$ ation No (1)

b) Matching extent = $\frac{\text{weighted arithmetic mean The}}{\text{highest score on the scale}}$ uation No (2)

c)The size of the gap = 1 – extent (ation No (3)

3.2 Checklists:

The main tool for collecting the data needed by the researcher, was prepared in a way that is compatible with the nature of the silo's work, by referring to some studies related to the research variables, and it was presented to the specialized experts to benefit from their observations.

1- The measure of considerations related to the application of quality engineering requirements:

a. Design axis: It is the action plan that was developed by the design authority, in this axis designing supply chains, and Table 2 shows the checklist for the design axis.

Table 2: Design Axis Checklist

No	items	Fully implemented fully documented	Partially documented and fully implemented	fully applied Undocumented	Partially implemented, fully documented	Partially implemented, partially documented	Partially implemented, not documented	Not implemented Not documented
1.	The design process is the main step in the wheat crop transportation activities			★				
2.	Silo people contribute to the innovation and improvement of value engineering							★
3.	Designers have the necessary experience and skill in the field of design			★				
4.	The working site of the silo is designed to reduce waste in transportation operations					★		
5.	Work is being done to keep the latest developments in design							★
6.	There is a continuous evaluation by the silo management of the design process with the aim of improvement					★		
weights		6	5	4	3	2	1	0
iterations		0	0	2	0	2	0	2
Weights × iterations		0	0	8	0	4	0	0
mean		2						
extent of conformity		% 33						
gap size		% 67						

Clarification of the results of the checklist related to the theme of design:

- Failure to document the design process for the activities of transporting the wheat crop, leads to the inability to address errors in the future.
- Non-contribution of workers and their involvement in the process of innovation and improvement.
- There is no keeping up with recent developments in the design process, and there is no evaluation of the design process.

P-ISSN 2518-5764
E-ISSN 2227-703X

b.Human engineering: It is the engineering relationship between the working individual and the work environment and the conditions in which he lives. In this axis, it is intended to create suitable conditions for working in the silo; Table 3 shows the checklist for the axis of human engineering.

Table 3: Human engineering checklist

No	items	Fully implemented fully documented	Partially documented and fully implemented	fully applied Undocumented	Partially implemented, fully documented	Partially implemented, partially documented	Partially implemented, not documented	Not implemented Not documented
1.	The management of the silo is concerned with the principles of human engineering by working to reduce excessive movements in the wheat crop handling operations					★		
2.	The work equipment is redistributed to ensure saving time and effort					★		
3.	The silo management employs modern handling tools in an effort to improve the crop handling operations				★			
4.	The design of the workplace is evaluated for its continuous improvement						★	
5.	The equipment is placed and arranged in a way that is convenient for the movement of workers					★		
6.	Occupational safety requirements are available in terms of devices and equipment			★				
weights		6	5	4	3	2	1	0
iterations		0	0	1	1	3	1	0
Weights × iterations		0	0	4	3	6	1	0
mean		2.33						
extent of conformity		% 38						
gap size		% 62						

Clarification of the results of the checklist related to the themeof Human engineering.

P-ISSN 2518-5764
E-ISSN 2227-703X

• Lack of interest on the part of those in charge of artwork and workplace design with the principles of human engineering.
• Reducing human engineering requirements and working mechanisms by providing occupational safety requirements only.

c. Value Engineering: It is a structured technique used to improve the total value of a business by reaching the optimum level in terms of costs, time, and quality. In this axis the focus is on activities related to the supply chain process in the silo; Table 4 shows the checklist for the axis of value engineering.

Table 4: Value Engineering Axis Checklist

No	items	Fully implemented fully documented	Partially documented and fully implemented	fully applied Undocumented	Partially implemented, fully documented	Partially implemented, partially documented	Partially implemented, not documented	Not implemented Not documented
1.	Silo management eliminates unnecessary, non-value-adding supply chain operations activities							★
2.	The management of the silo works to reduce the costs of keeping the stock to the lowest possible level to achieve the value							★
3.	Silo management emphasizes pointing out lost times for supply chain operations that do not add value to the customer						★	
4.	The workers have the ability to disassemble the parts of the machines to see how they work and implement the production processes through them at a lower cost						★	
5.	Supply chain operations are analysed with the aim of implementing them in the shortest possible time							★
6.	Activities are reduced with the aim of reducing time							★
weights		6	5	4	3	2	1	0
iterations		0	0	0	0	0	2	4
Weights × iterations		0	0	0	0	0	2	0
mean		0.33						
extent of conformity		% 5						
gap size		% 95						

Clarify checklist results related to value engineering:
• Lack of interest in reducing the time of receiving the wheat crop.
• Engineers' failure to pay attention to the importance of dismantling machines and to analyse processes to reduce maintenance costs.
• Lack of specialists in planning the supply chain in the silo.

d. Failure analysis: What is meant here is the inability to analyze the causes of failure. Table 5 shows the checklist for the failure analysis axis.

P-ISSN 2518-5764
E-ISSN 2227-703X

Table 5: Failure analysis axis checklist

No	items	Fully implemented fully documented	Partially documented and fully implemented	fully applied Undocumented	Partially implemented, fully documented	Partially implemented, partially documented	Partially implemented, not documented	Not implemented Not documented
1.	The management of the silo is keen to reduce the holidays of the crop handling media belonging to it to the lowest possible level						★	
2.	Supply chain design systems are analyzed to identify possible types of failure and the possibility of avoiding them						★	
3.	Transfers of wheat crop are analysed before starting the storage process to identify possible types of failure and the possibility of avoiding them						★	
4.	The silo management monitors the storage levels continuously to avoid possible failure in the cases of running out and surplus	★						
5.	The crop is inspected before the processing process for the mills to determine the possible types of failure and the possibility of avoiding them	★						
6.	Risks are identified for each possible type of failure to avoid high-risk failures					★		
weights		6	5	4	3	2	1	0
iterations		2	0	0	0	1	3	0
Weights × iterations		12	0	0	0	2	3	0
mean		2.83						
extent of conformity		%47						
gap size		% 53						

Clarify checklist results related to Analyzing failures:

The lack of focus of the engineers in the silo on the analysis processes related to each of the operations related to the transportation and storage of the wheat crop, leads to an increase in the risk of failure and thus an increase in the production costs resulting from the repeated work**.**

e. Quality loss function: It is a statistical function used by the scientist Takeuchi to estimate the value of the loss resulting from the deviation from the quality specification. Table 6 shows the checklist for the quality loss function axis.

P-ISSN 2518-5764
E-ISSN 2227-703X

Table 6: Quality Loss Function Axis Checklist

No	items	Fully implemented fully documented	Partially documented and fully implemented	fully applied Undocumented	Partially implemented, fully documented	Partially implemented, partially documented	Partially implemented, not documented	Not implemented Not documented
1.	It is confirmed by the silo management to reduce deviations in the activities of receiving the crop to reduce the percentage of loss					★		
2.	The management of the silo emphasizes the removal of defects from the crop sent to the mills	★						
3.	The quality of the wheat crop is measured to ensure that it does not deviate from the target specifications	★						
4.	The management of the silo is concerned with reducing the order cycle time for the delivery of wheat to the mills					★		
5.	The deviations that cause the loss are precisely identified in order to avoid them at the product receiving stages							★
6.	Specific techniques and methods are used to prevent or reduce the percentage of deviations and thus reduce the percentage of loss							★
weights		6	5	4	3	2	1	0
iterations		2	0	0	0	2	0	2
Weights × iterations		12	0	0	0	4	0	0
mean		2.62						
extent of conformity		% 44						
gap size		% 56						

Clarify checklist results related to Quality loss function:

- Lack of emphasis by the specialized engineers to prevent or reduce deviations in the activities associated with the processes of receiving the wheat crop.
- Not using modern technologies to identify or reduce deviations from the activities associated with the supply chain.
- There is no experience among the specialists, whether engineers or technicians, in identifying and analyzing all deviations.
- Lack of financial allocations needed to replace old machinery and equipment.

f. Continuous Improvement: This standard aims for the organization to design, manage and improve its operations to fully support and fulfill its policy and strategy and create added value for its customers and stakeholders, (Abdul Reda, 2019). Table 7 shows the checklist for the continuous improvement standard.

P-ISSN 2518-5764
E-ISSN 2227-703X

Table 7: Continuous Improvement Checklist

No	items	Fully implemented fully documented	Partially documented and fully implemented	fully applied Undocumented	Partially implemented, fully documented	Partially implemented, partially documented	Partially implemented, not documented	Not implemented Not documented
1.	The silo management seeks to identify the causes of problems in order to carry out continuous improvement					★		
2.	The continuous improvement process is emphasized by the senior management		★					
3.	Continuous improvement methods are fully applied					★		
4.	Silo management relies on developing the skills and knowledge of workers in order to improve operations.					★		
5.	Focusing on improving quality internally by eliminating the root causes of quality problems					★		
6.	Employees are motivated and encouraged to contribute to quality improvement						★	
weights		6	5	4	3	2	1	0
iterations		0	1	0	0	4	1	0
Weights × iterations		0	5	0	0	8	1	0
mean		2.33						
extent of conformity		% 38						
gap size		% 62						

Clarify checklist results related to Continuous improvement:

- Lack of significant interest in the importance of continuous improvement.
- There is no stimulation by the senior management of the employees to contribute to the quality improvement process.
- Lack of financial resources required to develop the machines and mechanisms used in the supply chain.

g. Risk Management: It is the process of measuring and evaluating risks and developing strategies to manage them. Table 8 shows the checklist for the risk management standard.

P-ISSN 2518-5764
E-ISSN 2227-703X

Table 8: Risk management checklist

No	items	Fully implemented fully documented	Partially documented and fully implemented	fully applied Undocumented	Partially implemented, fully documented	Partially implemented, partially documented	Partially implemented, not documented	Not implemented Not documented
1.	Emphasis is placed on managing the risks of poor storage and strategic storage shortages by the silo management		★					
2.	Having the ability to diagnose and analyze all types of risks such as poor storage and lack of strategic storage		★					
3.	Risks are evaluated and ranked according to the probability and the losses resulting from them					★		
4.	There is the ability of the silo management to maintain the strategic storage of stored wheat from the risk of spoilage		★					
5.	Work to find the necessary solutions to face all kinds of risks and reduce their negative effects					★		
6.	Maintain reports of risks encountered or potential risks		★					
weights		6	5	4	3	2	1	0
iterations		0	4	0	0	2	0	0
Weights × iterations		0	20	0	0	4	0	0
mean		4						
extent of conformity		% 66						
gap size		% 34						

Clarify checklist results related to Risk Management:

- The attention of senior management to the importance of risk management in improving work procedures and reducing losses.
- The absence of a special risk management unit in the silo.
- The absence of workers specialized in the field of risk management in the silo.

P-ISSN 2518-5764
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h.Information management: It is the process of collecting, processing, and preserving data to produce and retrieve information and develop it to serve the objectives of the organization. Table 9 shows the checklist for the information management standard.

Table 9: Information management checklist

No	items	Fully implemented fully documented	Partially documented and fully implemented	fully applied Undocumented	Partially implemented, fully documented	Partially implemented, partially documented	Partially implemented, not documented	Not implemented Not documented
1.	The communications adopted by the silo management are characterized by accuracy in transferring data and information to and from customers					★		
2.	The management of the silo reduces the procedures for accumulating information regarding the certification of crops for marketing wheat and the flow of information between the laboratory and the stores in the silo.			★				
3.	The management of the silo is concerned with avoiding duplicating the information of farmers who market the wheat crop					★		
4.	The information and communication system adopted by the silo management contributes to directing trucks according to priority		★					
5.	Electronic copies of reports and documents for the work are kept		★					
6.	Work related information is constantly updated					★		
weights		6	5	4	3	2	1	0
iterations		0	3	0	0	3	0	0
Weights × iterations		0	15	0	0	6	0	0
mean		3.5						
extent of conformity		% 58						
gap size		% 42						

Clarify checklist results related to Information management :

- Lack of interest in modern technologies and information technology by the management of the silo.
- The work of the electronic calculator unit is limited to routine information, due to the lack of advanced technologies and programs in the silo, in addition to the lack of specialists in this field.
- Inadequate financial resources required to rely on modern information technology.

2- The scale of supply chain components :

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a. Inbound supply: It is the process of planning, executing, and controlling the effectiveness and efficiency of the cost flow and storage of materials. Table 10 shows the checklist for inbound supply.

Table 10: Inbound supply checklist

No	items	Fully implemented fully documented	Partially documented and fully implemented	fully applied Undocumented	Partially implemented, fully documented	Partially implemented, partially documented	Partially implemented, not documented	Not implemented Not documented
1.	Modern mechanisms are used to unload incoming shipments of wheat crop, which contribute to reducing time and effort				★			
2.	The management of the silo is interested in selecting nearby supply sources to reduce processing time.	★						
3.	The management of the silo seeks to reduce the types of waste in the crop during the processing operations.				★			
4.	The silo management prepares continuous improvement programs for its suppliers.				★			
weights		6	5	4	3	2	**1**	**0**
iterations		1	0	0	3	0	**0**	**0**
Weights × iterations		6	0	0	9	0	**0**	**0**
mean		3.75						
extent of conformity		% 62.5						
gap size		% 37.5						

Clarify checklist related to inbound supply:

Failure to keep pace with modern technologies in the wheat crop manufacturing processes, due to the lack of studies and proposals by those in charge of the General Company for Grain Trade to develop work mechanisms in all silos of the company.

b. Transport operations: This axis, it means the operations related to storing the wheat crop, starting with the transfer of wheat from the unloading places with belts to the sifting devices and then to the storage silos; Pesticides are added to the wheat to protect it from insects, in addition to the operations of ventilation and movement, and Table 11 shows the checklist of transportation operations.

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Table 11: Transfer checklist

No	items	Fully implemented fully documented	Partially documented and fully implemented	fully applied Undocumented	Partially implemented, fully documented	Partially implemented, partially documented	Partially implemented, not documented	Not implemented Not documented
1.	The silo management uses modern means and equipment for transportation and handling inside the warehouses to save time and effort.					★		
2.	Employing modern technologies in inspection, inventory and inventory control.					★		
3.	Provide accurate data on storage levels at any time to secure the needs of the requesting authorities (the General Company for Grain Trade).		★					
4.	The management of the silo relies on computer and information systems in the warehouse entry and exit operations to ensure the accuracy of the information.					★		
weights		6	5	4	3	2	1	0
iterations		0	1	0	0	3	0	0
Weights × iterations		0	5	0	0	6	0	0
mean		2.75						
extent of conformity		% 45.8						
gap size		% 54.2						

The checklist related to transfers states the following:

The management of the silo did not develop or suggest the development of laboratory equipment, due to the lack of access to modern technologies in storage operations and keeping pace with them.

c. Supply abroad: What is meant by this axis is the flow of the wheat crop from the warehouses in the silo to the parties that request the crop. Table 12 shows the checklist for importing abroad.

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Table 12: Overseas Supply Checklist

No	items	Fully implemented fully documented	Partially documented and fully implemented	fully applied Undocumented	Partially implemented, fully documented	Partially implemented, partially documented	Partially implemented, not documented	Not implemented Not
1.	Providing channels of communication between the silo management and the parties requesting the wheat crop		★					
2.	There is a possibility for the management of the silo to provide the wheat crop to the requesting party with specifications that suit their needs		★					
3.	The management of the silo uses high coordination and joint work with the authorities requesting the wheat crop.		★					
4.	The silo management is keen to send the wheat crop to the mills by adopting a specific schedule and at the appropriate time.	★						
5.	Silo management focuses on preventing unintended errors to ensure continued delivery of the wheat crop in a timely manner					★		
weights		6	5	4	3	2	1	0
iterations		1	3	0	0	1	0	0
Weights × iterations		6	15	0	0	2	0	0
mean		4.6						
extent of conformity		% 76						
gap size		% 24						

The checklist related to supplies abroad shows the following:

The silo management's lack of interest in documenting the unintended errors that occur during the process of preparing and processing the wheat crop request operations so that they do not recur in the future, In addition to its weakness in the use of modern technologies, and the reason for this is due to the old work mechanisms followed by the General Company for Grain Trade and its affiliated silos, which do not keep pace with the technological developments in the world and its adoption as new and advanced work mechanisms.

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4. Conclusions :

Through what was previously presented, The research reached a set of conclusions, The most important of which are:

1- There is a significant weakness in the design axis resulting from the lack of focus on the design function and the simple use of the design system through the computer, and the lack of specialized workers in the field of design who have experience and skill.

2- The silo is based on an old system of work that is mostly routine work and paperwork.

3- There is a significant weakness in value engineering through the existence of unnecessary activities that do not add value to the process of receiving the wheat crop, leads to an increase in time and cost.

4- The inability of the Khan Dhari silo administration to reduce the waiting time for farmers under the current system to receive the wheat crop.

5- Supply chains are considered one of the most important human resource management strategies, which focus on the need for workers to have multiple skills to perform various tasks, which contributes to the speedy completion of business.

Authors Declaration:

Conflicts of Interest: None

-We Hereby Confirm That All The Figures and Tables In The Manuscript Are Mine and Ours. Besides, The Figures and Images, Which are Not Mine, Have Been Permitted Republication and Attached to The Manuscript.

- Ethical Clearance: The Research Was Approved By The Local Ethical Committee in The University.

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تطبيق هندسة الجودة في تطوير سلسلة تجهيز سايلو خان ضاري / دراسة حالة

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مستخلص البحث

تهدف الدراسة إلى البحث عن آليات لتحسين عمليات سلسلة التوريد في صومعة خان ضاري من خلال تطبيق متطلبات هندسة الجودة والتركيز على محاور التصميم والهندسة البشرية وهندسة القيمة والتي تعد من أهم المحاور المعنية بالجودة. الهندسة في الصومعة.

تم الاعتماد على منهج دراسة الحالة كنهج يساعد في التحليل الشامل والمتعمق لمشكلة البحث ، واعتمد الباحث على قوائم المراجعة في جمع البيانات وتحليلها. تتلخص مشكلة البحث في التساؤل الرئيسي (هناك إخفاقات وتوقفات في عملية استلام محصول القمح ، ولا يوجد تحليل لعمليات نقل محصول القمح من مصادر التجهيز إلى مرحلة التخزين ، من خلال التداول. أدوات النقل والوزن والتخزين ، ولا مواكبة لإدارة سلاسل التوريد في أقسام الصوامع في بغداد ، بما في ذلك صومعة خان ضاري بالتقنيات الحديثة) ، تكمن أهمية البحث في إظهار كيفية توظيف هندسة الجودة وإعادة ترتيب الأنشطة الفنية المتعلقة باستلام الحبوب. ومن اهم النتائج التي تم التوصل اليها تبني استراتيجيات متقدمة تتعلق بعمليات استلام محصول القمح والاعتماد على نظام الكتروني متقدم في العمل.

نوع البحث: ورقة بحثية

المصطلحات الرئيسة للبحث: هندسة الجودة ، هندسة القيمة ، سلاسل التوريد ، صومعة خان ضاري.

*البحث مستل من رسالة ماجستير