



Using Total Quality Management as A Strategy to Improve the Performance of the Filling Plants Drinking Water in Khanaqin City

Assist. Lect. Farah Abdulkadir Habeeb
College of Computer & IT
Garmian University- Khanaqin, Iraq
Email: Farah.abdulkadir@garmian.edu.krd

ABSTRACT

The plastic water bottles industry in Khanaqin faced challenges that undermined the success and performance of the filling plants. Therefore, this study sought to evaluate total quality management (TQM) as an effective and appropriate quality management strategy to address these quality challenges. Thus, improving the performance and work of those local laboratories and to achieve this goal, a case study approach was adopted where quality management systems and Four (4) water filling plants strategies were evaluated and reviewed in Khanaqin, where they were selected on the basis of their presence within the geographical area of the city of Khanaqin and the people's purchase of plastic water bottles from those factories (Al Barka company, Qater Al Nada Co., Kalat Water Factory).

Three (3) different sets of questionnaires were conducted in addition to the structured open interviews. Used as the main data collection tools, the stratified random approach was used in collecting the data which was processed using SPSS and Excel programs and the tables and graphs in the data analysis. The results of the study proved that the quality of water in plastic bottles is relatively better with more quality than plastic cup water, and finally, there is a positive relationship between the quality management and performance of water filling plants and in light of these results. The study concluded that total quality management was the most appropriate strategy for quality management in the water industry and bottling in Khanaqin city-Iraq.

Keywords: Quality Management, Filling Plants, Drinking Water, Khanaqin City.



Introduction:

In khanaqin particularly, the district has come a long way from the days of getting access to Drinking water in public by purchasing water sold in plastic cups, to water sold in plastic bottles.

And do not forget that whoever buys a water bottle often pays the costs of plastic, and the question remains: What is the cost of plastic to the environment? It costs production, packaging, information labels, transportation and storage, It is known that the manufacture of plastic bottles is made of polyethylene, which is extracted from crude oil. This not only leads to the release of greenhouse gases released by oil wells, but also leads to the excretion of many toxic gases during the process of petroleum refining and filtering, and thus its direct impact on the health of the consumer, These plastic bottles contain carcinogenic substances called "deha" , According to a study - published in the “ journal Chemosphere” , which measured the average plastic particles that can leak into the body when drinking with a single-use plastic cup - the amount is not insignificant, reaching about (3 milligrams) per cup.

The bottled water trade is profitable as well as a source of employment for the thousands of local residents of Khanaqin.

Unfortunately, some water filling plants suffer from poor performance due to problems in the quality of bottled water and their direct impact on human health. Therefore, government and concerned agencies must rely on the application of the water quality system to solve the problems of the water industry.

Problem statement:

The increasing spread of water bottling companies throughout the city of Khanaqin It led to the emergence of all kinds of bottled water products in the local market; most of it not registered and not approved by regulatory agencies. There is also widespread ignorance and sometimes a blatant disregard for water quality standards by producers. a lot of Companies not only lack qualified personnel to oversee quality issues but also appropriate personnel Technology to achieve quality output. Quality management systems are often sabotaged in favor of higher profits.

Some producers even fill (untreated) water in plastic bottles that have been used to fill water more than once, And sell it as pure water. Consumer confidence in the water industry and bottling was great in the past It is high, but it has gradually decreased due to these specific errors, Perhaps of most concern is consumer health risks associated with quality problems.

Because of these problems, this study seeks to suggest TQM as a strategy To address the quality problems facing the manufacture of plastic water bottles.

Objectives of Study:

The current research aims to achieve the following:

A- Describe and diagnose the requirements for total quality management and product design.

B- Building a model that represents the influencing relationship of total quality



management requirements in product design.

C- Increasing awareness of the importance of TQM requirements in product design.

D- Reaching a conclusion that increases the strengths of the partnerships, a sample search for role Comprehensive quality management requirements in product design and work to address deficiencies from By creating a set of appropriate recommendations.

Significance of Study:

The importance of the research lies in the fact that it represents a contribution to providing a theoretical study on the requirements of total quality management and product design, as well as the importance of the field to enhance the role of water filling plants to enhance their performance, continuity and growth in the labor market, The findings of this research would assist Khanaqin city local administration policy on regulation of quality Management in plastic bottle water industry. It would enable monitoring agencies and other Stakeholders to realize the need for Total Quality Management as a strategy to improve Performance of the water producers in order to achieve the envisaged objective of ensuring safe and acceptable drinking water for the populace.

Search limits:

A- Objective limits: which include total quality management (TQM) and product design.

B- Time limits: - which extends from the month of January until the month of July 2021

C- Location limits: This research was prepared by selecting a sample of industrial companies Khanaqin city- In Diyala –iraq Governorate.

Research Design:

The study adopted a Case Study and Survey approach. For the case study, the following four (3) Bottle water companies represented the case companies for the research:

No.	water filling plants (factory name)	Inception Date	products
1	Al Barka company	1995	Water
2	Qater Al Nada Co.	2001	Water
3	Kalat Water Factory	2014	mineral water

Table (1): A simplified definition of the research sample Factories

Brief overview of the research sample:

Description of the research sample Drinking water filling plants Choosing the mineral water companies operating in Khanaqin city as a study target for research



Scientific studies on the grounds that these factory are considered profitable Factories or remaining in the market In addition, it occupies great importance, as it covers the markets of Khanaqin city, and it depends on A lot of product and variety in the design of their products (mineral water plastic bottles), A sample was selected as It is made up of three water filling plants Plastic bottles and plastic cups, as shown in Table (1):

No.	Product
1	large bottle water (17 Liters/L)
2	bottle water (0.33 Milliliter/ML)
3	Bottle water (0.5 Milliliter/ML)
4	cup of water (200 Milliliter/ML)

As the main activity of the establishment is bottling, as well as distributing mineral water in five different volumes according to:

The desires of the flies are as follows: 2 liters, 5.1 liters, 1 liter, 5.0 liters, 33.0 cl.

The production process goes through the following stages:

- inflating and forming bottles
- Product packaging stage
- packing stage
- The stage of collecting the bottles.

The company's products consist of the following components, in the quantities indicated in the table:

Table No. (2): components of mineral water

Ingredients	Ingredients mg/L
calcium	78
Magnesium	37
Sodium	29
Potassium	2
Sulfate	95
chloride	40
nitrate	4,5
Nitrite	0.01
bicarbonates	1445,8
Carbon dioxide	2500

Here you could have a rough idea of mineral water compositions.

Calcium plays a major role in our bodies, strengthening bones and teeth, but this bone-building mineral is also significant in other areas of our health, including weight



management and warding off PMS.

Magnesium and other minerals absorbed into the body are utilized as “ions” and circulated throughout the body via the blood. There, magnesium is used by our cells in order to perform routine functions such as creating energy, building hormones, maintaining cells, and bodily movement.

Sodium helps muscles and nerves work properly by assisting muscular contraction and transmission of nerve signals. It also helps regulate blood pressure and volume. The proper amount of sodium in the body maintains an appropriate overall balance of bodily fluids.

The health benefits of **potassium** include relief from stroke, blood pressure, heart and kidney disorders, anxiety and stress, as well as enhanced muscle strength, metabolism, water balance, electrolytic functions, and nervous system.

Bicarbonate is a major element in our body. Secreted by the stomach, it is necessary for digestion.

Table No.(3): Number of packets in one container

The number of containers	size	The volume of the package	The number of bottles
1	1,5	112	6
1	2	86	6
1	1	108	6
1	0,5	150	12

Materials and Methods:

Schematic representation of water bottling and sampling locations: (I) raw water, (II) deferrized filtered water, (IIIa) cleaned glass bottles, (IIIb) filled glass bottles, (IVa) caustic cleaning solution, (IVb) caustic concentrate, (V) filled and capped glass bottles.

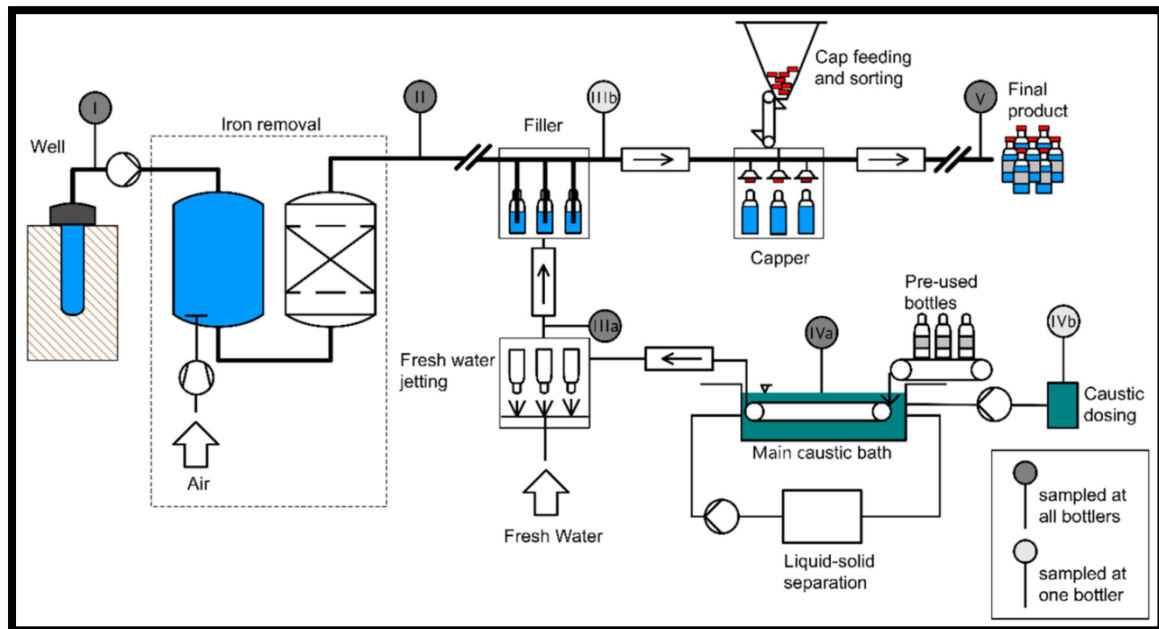


Fig. (01): Schematic representation of water bottling

Presentation of the results of the applied study:

For the second topic: presenting the results of the applied study

To find out the reality of the implementation of total quality management in an old mineral water establishment, we distributed a questionnaire It is made up of (35) representative samples of the organization's workers, distributed in various administrative levels, and two channels

By downloading them to reach the desired. The first requirement: the results of the study We distributed a questionnaire to collect information related to the subject of our study, which included information related to the data. Personality (gender, age, educational level, years of experience) about the workers, as well as a part that contains the (TQM) and the second part of the dimensions of competitive advantage.

Statistical loading method:

After collecting the information and the answers of the sample members, we analyzed them using the statistical package for the statistical information (SPSS) in order to address the hypotheses of the study and this is in a simplified form, using illustrative means (tables) from To deny or prove hypotheses.

❖ Measurement of the stability of the resolution

Checking the stability of the resolution (the questionnaire) based on the calculation of Cronbach's alpha coefficient de (Alpha Cronbach) for all the items of the questionnaire together and for each specific field.



One of the basic elements of the questionnaire is testing it before its practical application, where we measure the stability and validity of the vocabulary (phrases), The questionnaire (where we learn about the parameters of validity and reliability, by using one of the stability coefficients such as the coefficient of alpha Cronbach, where it takes a value ranging from zero to one, so that there is not enough stability in the data, so there is no value The coefficient is equal to yellow, and on the contrary, if it is completely constant, the value of the coefficient is equal to the integer one.

And as the value of the stability coefficient approached from one, the stability was high, and as it approached zero, the stability was low, Table No. (04): Stability Coefficient (Alpha-Cronbach Method).

Case Processing Summary

		N	%
Cases	Valid	30	81.1
	Excluded ^a	7	18.9
	Total	37	100.0

Table No. (4) (a. Listwise deletion based on all variables in the procedure)

Reliability Statistics

Cronbach's Alpha	N of Items
.090	16

Measuring the reliability of the questionnaire with its various items Number of phrases Cronbach's alpha value ,090.

From the table, we conclude that Cronbach's alpha coefficient is high and it is positive, and this indicates that the stability coefficients High for resolution areas.

The results of the final field study

First: Describe the sample vocabulary according to its sociodemographic characteristics

1. Distribution of the sample's vocabulary according to the gender variable

Table No. (05): Distribution of the sample's vocabulary by gender variable

Male or Female

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	26	70.3	86.7
	female	4	10.8	13.3
	Total	30	81.1	100.0
MissingSystem	7	18.9		
Total	37	100.0		



It is clear from the table that the majority of the institution's workers are male, with a percentage of (70.3%), which is a category Men are concentrated in the administration and the informant due to the simplicity of the work and its compatibility with their specializations. As for the female gender, it was formed singular (10.8%), see the fig. (02).

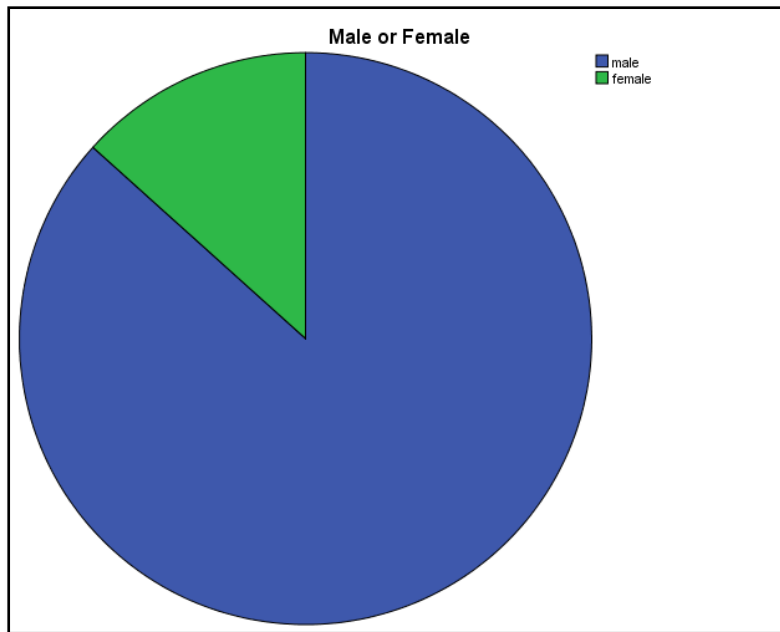


Figure No. (02): Distribution of sample items by gender variable

2 -Distribution of sample vocabulary according to the age group variable Table No. (06):

Distribution of sample vocabulary according to the (age group) variable ,Special Age Group Percentage with respondents.

age

Standard Attributes	Value
Measurement	Scale
Role	Input
N	30
Valid	7
Missing	27.60
Central Tendency and Dispersion	Mean
	Standard Deviation
	8.818
	Percentile 25%
	15-21 Year
	Percentile 50%
	22-26.Year
	Percentile 75%
	32-48 Year

It is clear from the data in the table that the majority of the age group is from (15-21) years, with a percentage of (25%), and the category The age group is from (22-26) years, at a rate of (50%), because the temporary workers in the establishment are



integrated immediately after stuttering, and finally the category (32-48) years old with a percentage of (75%), and we explain this difference between the different categories, including this case study of an old mineral water establishment. The institution does not establish fair and objective methods in the hiring process, as well as expanding the gap between new and old workers.

The deal is also an important element in the course of the institution's activity.

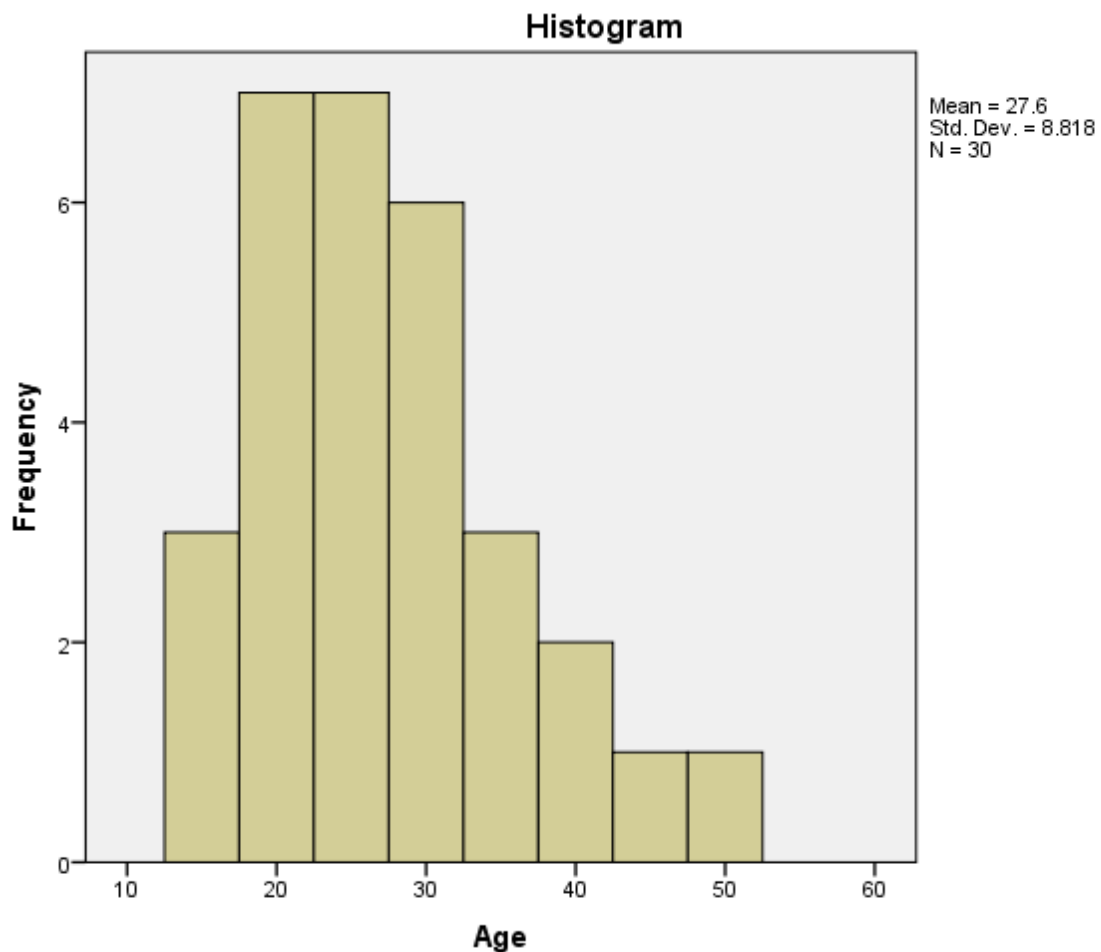


Figure No. (03) Distribution of sample vocabulary according to the age group variable

3. Distribution of the sample items according to their educational level

Table No. (07): (Distribution of sample items according to educational level

The respondents' generalization level Frequency percentage

**Educational level**

Information		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Don't (read & write)	5	13.5	16.7	16.7
	primary	8	21.6	26.7	43.3
	secondary	9	24.3	30.0	73.3
	undergraduate	8	21.6	26.7	100.0
	Total	30	81.1	100.0	
Missing	System	7	18.9		
Total		37	100.0		

We note from the table that the members of the research sample with a education level (Primary, Secondary, Undergraduate) represent a percentage of (66%), and this Refer to the importance of the educational level that occupies administrative positions, or the (Don't read & write) level has constituted a percentage of (13.5%), and this is for their ability to acquire and employ experiences that help them perform.

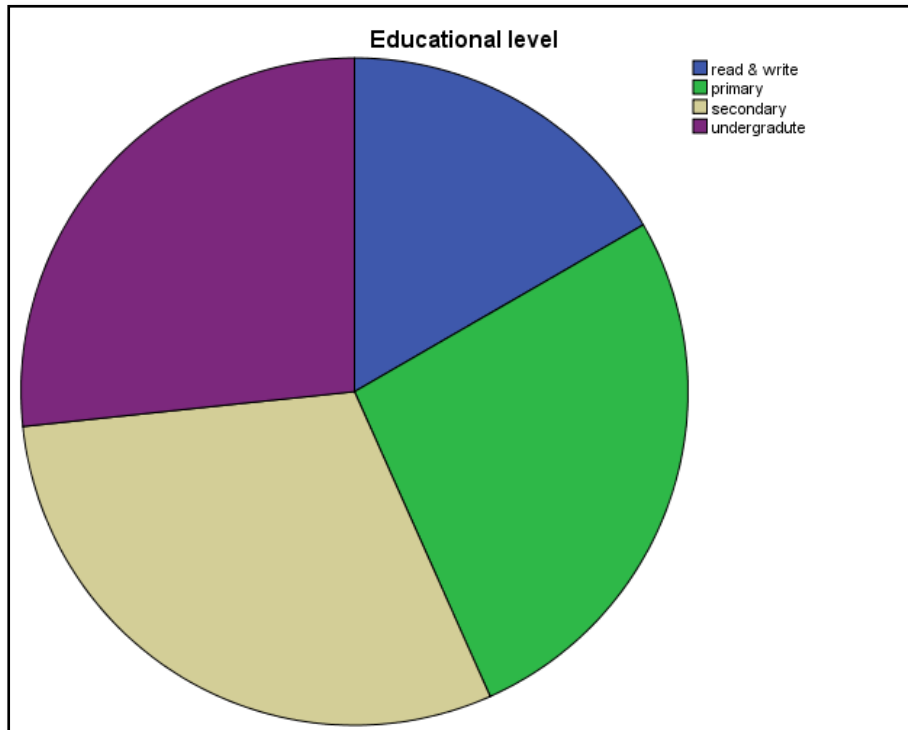


Figure No. (04): Distribution of the sample items according to the educational level



4-Brand Choice of Water Sales:

Although over 75% of the company respondents disclosed that they sell more than one brand large bottle water (17 liters) products they also indicated their preferred choice of packaged water which they often sell. These choices, they explained are as result of the high market demand for these brands by their customers. It is illustrated (in percentages) in Fig. (8) the various brands often sold by retailers and distributors, table No. (08) Brand Choice of Water Sales of the June 2021.

Size	Percent of sale of June
large bottle water (17 L)	75%
bottle water (0.33 ML)	20%
Bottle water (0.5 ML)	47.5%
cup of water (200 cc x 60 cups)	35.8%

Here again bottle water (0.33 Meters) tops with 20% of the distributors/retailers citing it as the brand they prefer and usually sell. Bottle water (0.5 Meters) is followed with 47.5%, the last (35.8%) “the Others peoples” as used cup of water (200 cc x 60 cups) in the study represents brands of the markets in this case study.

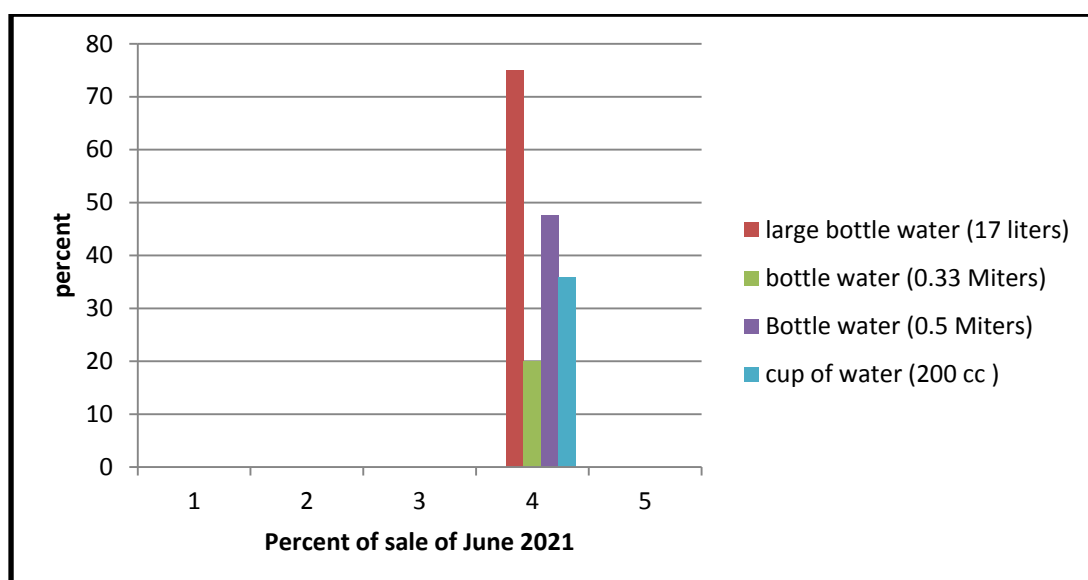


Fig. no (05) Source: Field Survey, June, 2021

❖ Analysis the paragraphs of the second part

Principles of comprehensive quality management

Design of Questionnaires All questionnaires were designed to be answered using a



five-level Likert Scale type with responses ranging from “1” to “5”. The definitions for the responses are:

- 1 = Strongly agree = SA
- 2 = Agree = A
- 3 = Natural = N
- 4 = Not agree = NA
- 5 = Strongly not agree = SN

1. Paragraphs of the field of “Overall Management Commitment”

Statistical loading

Table No. (09)

No.	Paragraphs	mean	median modal	Arithmetic mode	skew normative
1	management works on setting policies Quality as well as future goals	4,182 8	4	4	0,95047
2	The management supports all quality programs Which helps to distinguish the organization	4,150 5	4	4	0,97216
3	The senior management of the General Foundation participates in order to improve levels the quality	3,847 5	4	4	1,06422
4	Senior management supports all initiatives to improve Enterprise product	4,032 3	4	4	1,01503

- The arithmetic mean of the paragraph “the management is working on setting quality policies within its future goals” is equal to 4,182 8 and a standard deviation of 0,95047, which confirms that the upper management is working on setting Quality policies are very high.

- The arithmetic average of a paragraph that supports the higher management of all the quality programs that help to distinguish the institution "is equal to 4,150 5 and a standard deviation of 0,97216 , which confirms that the upper management supports all quality programs Which helps to distinguish the institution to a very high degree.

- The arithmetic average of the paragraph “The upper management of your organization participates in efforts to improve the levels of The quality "is equal to 3,847 5 and the standard deviation is estimated at 1,06422 with a high degree of agreement, which indicates that The institution in the study is responsible for supervising workers in efforts to improve quality levels.

- The arithmetic mean of the paragraph “The senior management supports all initiatives to improve the image of the company’s products” is equal to 4,032 3 and a standard deviation of 1,01503 with a very high degree of agreement, which confirms



that the administration The Supreme Council supports all initiatives to improve the image of the company's products.

Note: Arithmetic mean: It is the average value (mean) of this group of response alternative values from 1 to 5.

Median: It is the value that lies in the middle of the group values, for this table the value is 4, that is, the majority.

2-Statistical Analysis Customer focus:

No.	Paragraphs	mean	median modal	Arithmetic mode	skew normative
1	The manager conducts a periodic study of the market to identify the desires of customers	4,0303	4	4	0,76994
2	The company innovates and develops products and services to meet the needs of the market	4,0305	4	4	0,88335
3	The company is keen to win customers by paying attention to their suggestions	3,9697	4	4	0,95147
4	The company's products are characterized by characteristics favored by the customer and the labor market.	4,2121	4	4	0,92728

-The arithmetic average of the paragraph "The manager conducts a periodic study of the market to identify the desires of customers " equals (4,0303) with a very high approval degree and a standard deviation of (0,76994), which confirms that the director of The institution conducts a periodic study of the market to get to know the desires of customers.

-The arithmetic average of a paragraph that your organization innovates and develops products and services to meet needs and expectations equals (4,0305) with a very high approval degree and a standard deviation of (0,88335), showing that the institution is Innovating and developing products and services to meet the needs and expectations of customers.

- The arithmetic mean, paragraph "The company is keen to win customers by paying attention to their suggestions" Its implementation "is equal to (3,9697) with a high degree of approval and a standard deviation estimated at (0,95147), which indicates that

The institution is keen to win the loyalty of falsehoods by paying attention to my proposals and working on their implementation.



-The arithmetic mean of the paragraph “The company's products are characterized by characteristics favored by the customer and the labor market.”

The other “is equal to (4,2121) with a very high degree of agreement and a standard deviation of (0,92728), which shows that an institution characterized by characteristics that favor customers more than other institutions.

Conclusion:

Quality is one of the topics that have received wide attention by many researchers and thinkers, in order to keep pace with Intellectual developments in various social, economic and cultural fields, especially in light of these changes.

and the transformations witnessed by the world, and in order for the institution to be able to face these challenges and developments and achieve quality in its products and services, it must have the ability to compete, which qualifies it in facing its competitors.

Small and medium-sized enterprises are among the most important institutions that support the economic structure and the basic pillar of the national economy The implementation of total quality management by institutions helps them to improve their performance and achieve distinction in the level of quality its products and services and improve its competitive advantage, as it is an important way to attract customers and buyers.

And in the light of the field study in an Khanaqin mineral water institution, it is necessary to prove the validity of the following hypotheses:

There is a significant signification effect relationship between total quality management and competitive advantage in an Khanaqin mineral water establishment Whereas, the total quality management works on improving and developing the production and operational processes in the organization, which takes The company aims to improve its performance and achieve excellence in the quality levels of its products and services, with the aim of satisfying the customer.

In any way possible, as well as excellence in the market by owning an ISO certificate of quality for an old institution that contributes to Improving its reputation and increasing the volume of its transactions, thus increasing its sales and profits.

Results:

In light of the foregoing, we can conclude from the theoretical side as well as the practical side the following:

-Total quality management aims to achieve customer satisfaction and loyalty, by providing a level of quality that achieves your expectations and needs.

Quality is the responsibility of all employees of the institution.

- Collaboration and collective participation among the employees of the institution helps to provide an environment that encourages development and innovation.

- The establishment's possession of an effective marketing system leads to the provision of high quality products.

- The institution that works on supervising its employees in decision-making is what



helps it to perform its activities.

Quality contributes to improving the competitive advantage through its ability to achieve customer satisfaction and the continuity of its dealings with Enterprise. The technologies used in the organization help to achieve quality in products and services and improve their advantages competitiveness.

References:

- 1- Ma'ali Abbas (2018), The Directive Total Quality Management and its Impact on Institutional Performance , PhD thesis, Sudaf University of Information and Technology, Business Administration, 2018.
- 2-Rahmani Sana (2017), the role of economic intelligence in achieving the competitive advantage of economic institutions, the scientific forum International on: The digital transformation of institutions and predictive models on large data, Al-Mussima University.
- 3- Hussein Abdel Qader (2016), Intellectual Capital in Palestinian Universities and Enhancing Competitive Advantage, Compilation of Accounting Financial Studies and administration, Al-Istiklal University in Palestine, sixth issue, December 2016.
- 4- Arthur , Ackah (2011). Management Theory and Total Quality: Total Quality Management (Tqm) As A Strategy To Improve The Performance Of Sachet, Nkrumah University of Science and Technology, pp. 42–45.
- 5- Filippini, R., Forza, C. (1998). TQM Impact on Quality Conformance and Customer Satisfaction: A Causal Model. International Journal of Production Economics, Issue 55, pp 3- 6.
- 6-Taguchi, G. (1995). "Quality engineering (Taguchi methods) for the development of electronic circuit technology", IEEE Transactions on Reliability 44 (2): 225–227.



APPENDIX (A)

SURVEY QUESTIONNAIRE ABOUT EMPLOYEE EMPOWERMENT AND INVOLVEMENT IN QUALITY

This questionnaire is for investigating the involvement of employees in achieving quality. I would greatly appreciate if you would answer these questions which forms part of a graduate student thesis. Thank you very much for your help.

A. (Please tick (√) the correct answer as pertaining to you.)

❖ Part one: Personal Information

1. Age: [Under 20] _____, [20-29] _____, [30-39] _____, [40 and above] _____.
2. Gender: [Male] _____, [Female] _____.
3. Educational background: [No Education] _____, [Elementary] _____, [J.H.S], _____, [S.H.S] _____, [Diploma] _____, [Degree] _____.
4. Company Name: _____
5. Job position (please specify): _____.

❖ Part Two: Principles of Total Quality Management

1- The management's practical commitment

No.	Paragraphs	SA	A	N	NA	SN
1	management works on setting policies Quality as well as future goals					
2	The management supports all quality programs Which helps to distinguish the organization					
3	The senior management of the General Foundation participates in order to improve levels the quality					
4	Senior management supports all initiatives to improve Enterprise product					

Note:

- 1 = Strongly agree = SA
- 2 = Agree = A
- 3 = Natural = N
- 4 = Not agree = NA
- 5 = Strongly not agree = SN

2- Focus on the customer



No.	Paragraphs	SA	A	N	NA	SN
1	The manager conducts a periodic study of the market to identify the desires of customers					
2	The company innovates and develops products and services to meet the needs of the market					
3	The company is keen to win customers by paying attention to their suggestions					
4	The company's products are characterized by characteristics favored by the customer and the labor market.					

❖ **Supplement No. (02): the institutions of Bottled water production (pictures)**



Source: Field Survey (July, 2021)



Source: Field Survey (June, 2021)



Source: Field Survey (July, 2021)