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Impact of Employee Training and Development on the Quality Management System: A Case Study of Dukan Oil Refinery in Iraqi Kurdistan

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Abstract

The aim of T this study is to investigates the critical role of employee training and development (T&D) in enhancing Quality Management Systems (QMS) within the Dukan oil refinery, Iraqi Kurdistan Region. this research addresses a gap in understanding the direct impact of specialized training programs in this specific regional context. A quantitative descriptive analysis was conducted using a questionnaire administered to 80 employees at the Dukan oil refinery, representing a 71.4% valid response rate. Data were analyzed using SPSS 26, employing descriptive statistics, t-test, correlation, and regression analysis. The findings reveal a significant positive correlation (Pearson $r = 0.931$, $p < 0.01$) between employee (T&D) and QMS. Regression analysis further indicated that employee T&D positively influences QMS with an R^2 of 0.7225, demonstrating that 72.25% of the variance in QMS can be explained by T&D initiatives. The t-test confirmed a statistically significant impact ($t = 2.257$, $p = 0.002$) of training on QMS. Specifically, "Post-Training Evaluation" was identified as the dimension with the highest impact on QMS (Mean = 3.62). Managerial implications are substantial, Dukan oil refinery and similar industrial entities in the Kurdistan Region should prioritize and strategically invest in comprehensive employee T&D programs. This includes rigorous training needs assessments, effective program implementation, and robust post-training evaluations to cultivate a skilled workforce, enhance process efficiency, ensure compliance with standards, and foster a culture of continuous improvement, thereby strengthening their overall QMS performance and operational safety.

Keywords: Quality Management System, Training and Development, Dukan Oil Refinery.

JEL Classification: M53, L15, L65

1. Chapter One: Introduction

1.1. Introduction

The new perspective on industrial processes emphasizes the important role of human resources, as well as their effectiveness and efficiency in organizational systems, especially in industries such as oil refining, where safety and quality are paramount. With regard to the Dukan oil refinery in the Iraqi Kurdistan Region, understanding how employee training and development impacts the quality management system is crucial for improving operational outcomes. This study aims to investigate the interconnect of human resource development and quality management system enhancement, focusing on Dukan oil refinery as the case study of this study.

A quality management system is a series of organizational activities, which are mutually coordinated and aimed at directing and controlling the processes of a given organization to continuously improve the quality of the organization's products and services. In the oil and gas industry, a robust quality management system is one of the current requirements to ensure compliance with local standards on the one hand and international standards on the other, and this system is important to maintain operational efficiency and safety (Ali & Anwar, 2021). However, nowadays quality management systems are often associated with technological innovations and scientific procedures, but the overall part of this process emphasizes the role of employees in ensuring the effectiveness of these systems. Research has shown that employee training and development processes are very important for establishing a high quality culture in organizations (Wu & Liu, 2023). This process is particularly important in industries such as oil refining, which is a very complex process with many types of technical, chemical, physical, and so on hazards. (Zhang, 2021)

Programs dedicated to employee training and development can develop individual competencies within an organization, improve collaboration among team members, and further develop organizational commitment (Wright & Snell, 2022). All of these processes and activities can directly affect the operational capabilities of the organization. In the Dukan oil refinery, having specialized training programs for the workforce may bridge the gap between the procedures of the quality management system and the implementation of that system within the refinery (Hassan and Al-Hashmi, 2020). Moreover, initiatives specific to training programs can create a shared understanding of quality standards and create a culture of continuous improvement (Mohammed et al., 2021).

Several studies emphasize a positive relationship between employee training and quality management system implementation. It has been shown that the training process enhances employees' technical skills, increases problem-solving skills within institutions, and encourages them to be more committed to quality standards (Xu et al., 2022). In their study, Bashir and colleagues (2021) found that employee participation in professional development on an ongoing basis directly contributes to greater compliance with quality regulations and improved quality control systems. Similarly, in another study on manufacturing plants, Shukri and colleagues (2020) concluded that intensive training led to the effective application of quality management system principles, resulting in significant improvements in production quality and employee performance.

The characteristics of the Kurdistan Region are influenced by political, economic and cultural factors. In this culture, training and development affect the quality management system. This region has emerged as an oil producing region, and has faced labor-related

challenges (Amin & Mhamad, 2023). These challenges create both opportunities and obstacles for Dukan Oil Refinery, making it an important case for examining how training and development programs can be used to overcome and overcome quality management deficiencies.

This paper attempts to contribute to present all the knowledge that exists in reality on the relationship between employee training, development, and quality management system performance by focusing on Dukan oil refinery as a case in this study. Another objective of this study is to evaluate the effectiveness of employee training and development in strengthening the quality management system in Dukan oil refinery. Another goal of this study is to improve overall performance and operational safety. Through this study, the researchers intend to provide practical insights to other organizations operating in similar industries facing comparable challenges in workforce development and quality management.

1.2. **Research importance**

This research is important because it investigates the role and significance of employee training and development programs in enhancing the effectiveness of the quality management system in the oil refining industry, with a focus on the Dukan oil refinery in the Kurdistan Region. Oil refining as one of the processes of the oil industry is very complex, because in this process must be carefully implemented quality standards, this is to ensure efficiency, safety of workers and environmental protection. By examining the impact of training and development programs on the quality management system, this research aims to fill the existing gap in the relationship between workforce competence and the implementation of quality control processes, especially in newly emerging economic geographies such as the Kurdistan Region.

Moreover, the results of the study could play a role in showing valuable insights specific to oil refining processes, as the results highlight the various benefits of investment as a driver for following effective quality management practices. This research can also contribute to the development of refinery policies and strategies that improve employee skills, which will play a role in improving the performance of quality management systems, preventing operational risks, and growing productivity. These findings can be used as a model for other organizations in similar industries, especially for the Kurdistan Region, which is still in its infancy in terms of workforce development.

1.3. Research Problem

Of course, there is a current and widespread importance of strong quality management systems (QMS) dedicated to operational efficiency and compliance with international standards within the oil refining industry, and there is a significant gap in understanding the direct impact of specialist training programs. With the general literature addressing QMS implementation and training, there is also very little analytical evidence that specifically examines how deficiencies in ongoing training methodologies translate into demonstrable deficiencies in QMS performance at refineries in the Kurdistan Region.

The aim of this study is to address this gap through research on Dukan oil refinery. Previous studies, such as (Al-Shammari, & Al-Turki,, 2024), have identified widespread challenges in implementing QMS in Kurdish society as a developing economy, but none have comprehensively addressed the differences between current staff training program design, staff capacity development explained. Therefore, this study clearly identifies how current training programs at Dukan Oil Refinery fail to adequately prepare employees for complex QMS

demands, and how benefits from targeted employee upskilling can be translated into tangible improvements in QA practices and overall QMS effectiveness. This unique focus on the Dukan oil refinery provides a novel context for contributing to the existing body of knowledge by providing practical insights relevant to similar regional industrial environments.

1.4. Research Questions

1. What is the level of QMS in in the research area?
2. Do the programs related to the T&D processes of employees have an impact on the QMS in in the research area?
3. Is there a relationship between the programs related to the T&D of employees and the QMS in the research area?

1.5. Research Objectives

1. It is to understand the level of implementation of QMS in the research area.
2. To understand the effects of programs related to employee T&D processes on the QMS in the research area.
3. To understand the relationship between programs related to staff T&D processes and QMS in the research area.

1.6 Research Hypotheses

1. The quality management system is at a high level in the research area.
2. Employee T&D programs have an impact on the QMS in the research area.
3. There is a relationship between employee T&D programs and the QMS in the research area.

1.7. Research Model

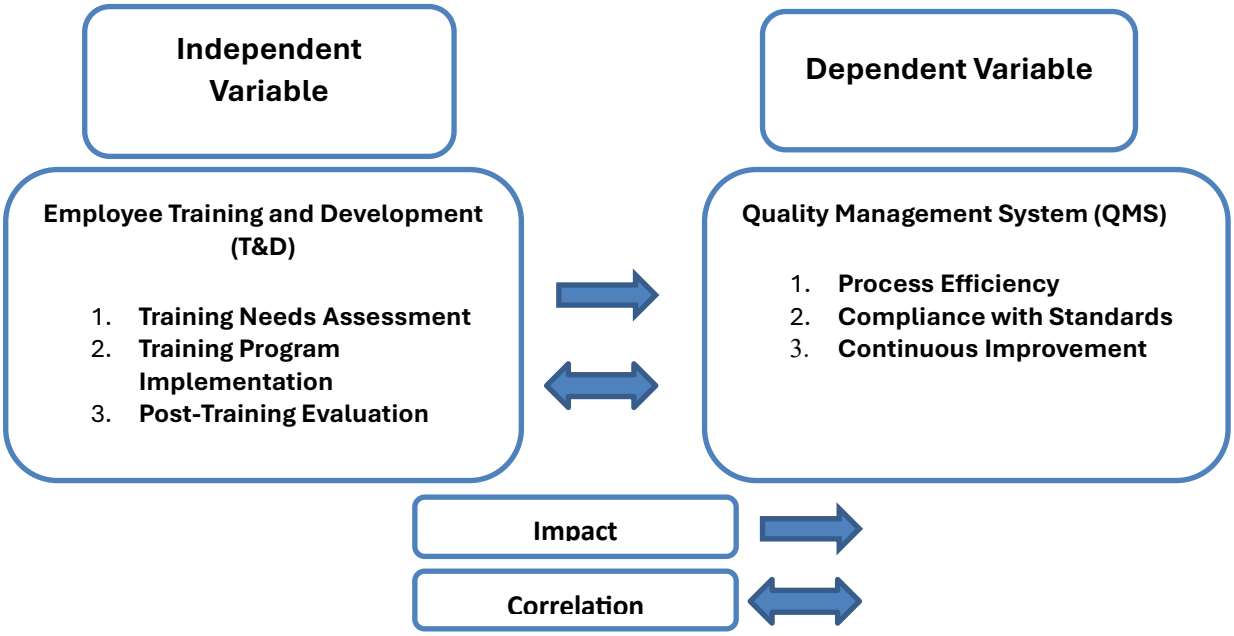

Figure 1. Research Hypothetical Diagram

2. Literature Review

Employee training and development programs are of particular importance in enhancing organizational performance and sustaining organizational competitiveness in management science (Haque, 2021). Organizations constantly strive to improve their processes and integrate research and development initiatives within the organizational framework, especially for industries with high organizational standards such as oil refining (Sharifi & Zarei, 2023). A case study such as the Dukan Oil Refinery in Iraqi Kurdistan is a noteworthy example, particularly as it focuses on employee training, the impact of that training on the quality management system, its effect on process efficiency, adherence to standards, and continuous process improvement. This review critically examines the relationship between employee training and development programs and the quality management system, analyzing their key dimensions.

2.1. Employee Training and Development

Employee training and development programs are crucial components for enhancing organizational performance, especially in a critical sector like oil and gas, which has strict adherence to high-quality standards (Moser & Yao, 2022). Implementing training and development programs ensures that employees acquire the necessary skills and knowledge to achieve organizational goals and consistently maintain the quality of their services and products. This R&D approach involves several stages, including needs assessment, program implementation, and post-training staff evaluation (Lee & Wong 2023).

2.1.1. Training Needs Assessment

This process is the first step in the sequence because it is defined by the assessment of training needs, which is very important in designing effective research and development programs. This process emphasizes the identification of skills gaps, to ensure that the training process is aligned with both organizational needs and staff development. Research has clearly shown that if an organization regularly assesses training needs, this will show higher levels of employee satisfaction and performance (Chavez & Anderson, 2023). Employee skills lead to high-level training programs, this idea is especially true for complex environments such as oil refineries, where these skills are key to implementing organizational standards (Miller et al., 2024).

2.1.2. Training Program Implementation

In the sequence, this stage begins after the identification of training needs, which includes the processes of designing and implementing training programs. Oil organizations and processes must understand that the outcomes of training and expertise are consistent with the objectives of the quality management system. Several studies have shown that effective training programs have used a variety of learning methods, for example on-the-job training, e-learning and simulation-based training (Chavez & Anderson, 2023). Integrating practical training methods in oil refining processes is important for enhancing employees' abilities to handle complex processes and equipment (Miller et al., 2024).

2.1.3. Post-Training Evaluation

Post-training evaluation refers to one of the most important processes within employee training and development programs. This process evaluates the outcomes of the training and development process, which determines whether employees have acquired the desired skills,

and to assess the level achieved by the quality management system (Chavez & Anderson, 2023). Kirkpatrick's four-level training evaluation model (2021) Reaction, Learning, Behavior, and Results is a significantly important framework for assessing training outcomes. In the context of production processes at the Dukan oil refinery, post-training evaluations can provide insights into the extent to which training programs have contributed to process efficiency, compliance, and continuous improvement.

2.2. Quality Management System

A Quality Management System (QMS) is composed of the policies, procedures, and resources that an organization utilizes to consistently meet customer requirements and to improve the quality of its operations (Hassan et al., 2023). If a QMS is implemented well within an organization, it ensures that the organization can provide products and services that are consistent with established quality standards. From this perspective, employee training programs in a practical format play a crucial role in enhancing the various dimensions of the quality management system (Pradhan & Jena, 2022).

2.2.1. Process Efficiency

Initiatives to implement training processes create a solid scientific understanding for employees, develop work processes, improve employees' ability to perform tasks efficiently, and reduce errors (Kaplan & Norton, 2022). Aligning employee skills with the requirements of work processes allows organizations to streamline their operations, reduce the waste of time and resources, and enhance overall performance (Alvarez & Rubio, 2024). In the working conditions of the Dukan oil refinery, training can improve process efficiency by ensuring that employees have the necessary tools to handle complex machinery and to optimize refining procedures.

2.2.2. Compliance with Standards

Giving importance and adhering to local and international standards are the cornerstones of the oil refining industry. For instance, ISO standards, such as ISO 9001, require organizations to follow a robust system for quality management (Zhao & Zhang, 2023). Employee training ensures that workers and staff understand these standards and can effectively implement them in their daily work. By investing in training and development, organizations can reduce the risk of their employees' non-compliance with the organization's programs (Harris et al., 2021).

2.2.3. Continuous Improvement

Continuous improvement is defined as one of the core principles of quality management, which can become a key foundation in organizational work. Processes on this principle constantly emphasize the need for organizations to review investment processes, understand the level of organizational work and work to improve the level of their organizations (Harris et al., 2021). Training is one of the most important pillars of organizations to foster a culture of continuous improvement, which is done by equipping organizations' employees by upgrading employee skills, identifying any inefficiency that exist, and addressing all inefficiencies by proposing appropriate solutions. Studies suggest that organizations that place a strong

emphasis on employee development tend to strengthen their practical experience of continuous improvement (Gao et al., 2024).

2.4. The Linkage between Employee Training and QMS Effectiveness

The relationship between employee training and the impact on QMS is a very important subject to educate and enhance overall organizational performance. If an organization prioritises employee development, it may be able to achieve a higher level of QMS effectiveness, since training processes provide employees with the necessary tools to prepare for the complex demands of quality assurance (Lee & Wong, 2023). Also, strong programs dedicated to R&D can lead to better outcomes for employee progression and long-term retention, contributing to a more stable and skilled workforce (Pradhan & Jena, 2022).

The relationship is symbiotic: effective training enhances QMS dimensions (process efficiency, compliance, continuous improvement), and a strong QMS provides a framework for identifying training needs and evaluating training effectiveness. For example, training in risk management directly contributes to the QMS's ability to anticipate and mitigate operational hazards, ensuring safer and more reliable processes (Smith & Jones, 2021). Conversely, QMS audit findings can pinpoint areas where additional training is required to close performance gaps, demonstrating the interconnectedness of these two critical organizational functions (Brown & Davis, 2022).

2.5. Research Gap

It is clear that extant literature has focused extensively on employee training, QMS as well as their overall relationships between the two concepts, but it has been noted that there is a significant gap in in-depth and contemporary case studies. Some contemporary studies such as (Haque, 2021; Moser & Yao, 2022; Chavez & Anderson, 2023) have a broad understanding, but often do not go into detail and explain how specific training interventions directly affect QMS criteria and performance outcomes within business and industrial processes.

This research aims to address these gaps by conducting a focused case study on the Dukan Oil Refinery, providing novel insights into how a targeted approach to employee training and development influences the various dimensions of its QMS, thereby contributing a contemporary and contextually relevant understanding to the existing body of knowledge.

3. methods and data collection

3.1. Research design

This study is designed in such a way that it can be divided into two parts; Theory section and practical section. Through the first part, the topic of the research and the main concepts related to the topic are discussed and analyzed, but within the framework of the practical part, the researchers have developed a form to collect information and then analyze the data collection to know the results. For this purpose, they prepared a questionnaire, in which some logical questions were asked to some of the research participants to answer. The content of the questionnaire is based on the Likert questioning method. There are five options that participants can tick for each question. The options are (strongly agree, agree, neutral, disagree, and strongly disagree).

3.2. Study population and sampling technique

The people selected for this survey are employees of Dukan oil refinery in Sulaimani province. Approximately 112 employees of both sexes were selected, 80 fully responded to the questionnaires, with varying levels of education, and aged between 20 and 50 years**.** The sampling technique of this study is convenience sampling. The reason for choosing this technique was due to practical limitations in accessing a comprehensive framework of sampling and the possibilities of reaching the target population within a given time frame and resources. This has provided valuable insight into the phenomena on which this study was conducted.

3.3. Questionnaire Distribution and Response Rate Clarification

The total number of questionnaires distributed was 112. However, only 80 responses were fully collected and included for analysis. However, 32 other questionnaires were excluded and not counted for the following reasons: Incomplete responses, these included 25 questionnaires, these had a significant number of unanswered questions or sections, so they were not suitable for comprehensive analysis. Incorrect answers, these included 7 questionnaires, these showed clear indications of non-serious participation, for example, their answers were similar throughout the questions. However, the actual response rate for the valid and standards questionnaire was 71.4% (80 valid responses / 112 questionnaires distributed). This figure is high and acceptable in surveys, especially for such studies.

Several justifications are given for the adequacy of the sample size of the study, which include:

The final sample size of the study is 80 participants; this number was carefully considered and is acceptable for statistical analysis. It mainly involves descriptive statistics, correlation and effect analysis, relative to descriptive statistics, the sample size of the study is 80 which is sufficient to provide reliable estimates of central tendency and scatter for the variables. Regarding association and effect analysis according to accepted research sample guidelines (e.g., Hair et al., 2010), a sample size of at least 50 is most often considered adequate to detect moderate associations and effects with adequate statistical power. So our sample size of 80 has a lot of power to detect meaningful relationships between variables.

3.4. Method of data collection

The method used for data collection in the study by the researchers is defined as quantitative method since the researchers obtained responses from the participants in a face-to-face manner. For this purpose, the researchers used a questionnaire design based on the Likert scale (five options), and the number of questions in the questionnaire was thirty.

3.5. Reliability

It refers to the consistency of the results of a measure or test when measuring the same variable or the same sample under different conditions. In other words, if the data are given multiple times to the same person or sample, it will produce consistent (i.e., similar) results.

Table 1. Cronbach's alpha test

Cronbach's Alpha	N of Items
.790	25

Source: Author development

The researchers (25) randomly distributed questionnaires to some of their study sample. After retrieving their results, we found that the Cronbach's alpha value was (79.0%), which means this is a very good result.

3.6. Method of data analysis

The researchers collected the data in the study described and defined within the questionnaires, and the data was collected based on the responses of the participants. All responses to each question have been collected, and then analyzed in order to find answers to the research questions discussed in the first chapter. Based on the responses of the participants, whether positive or negative, the researchers have tried to make an argument related to the topic concerning the impact of human resource management on employee performance evaluation in Dukan oil refinery.

For this purpose, the researcher relies on the statistical analysis program (SPSS) to find out the exact relationship between the variables which are (impact of employee training and development on quality).

4. Data Analysis and Results

In this chapter, the researcher focuses on the analysis of the data obtained in the data collection processes according to the standards of scientific research.

4.1. Demographic information

The demographics of the study population are explained in different ways, it shows the diversity of the population background. The following tables and figures show the methods and data, which include gender, academic level, age, responsibility, length of employment in the refinery of the study framework, length of employment in processes related to the oil industry for the study population :

Table 2. Demographic information

Variable	**Category**	**Frequency**	**Percent**
Gender	Male	72	90.0%
	Female	8	10.0%
Academic Level	Illiterate	2	2.5%
	Able to Read	8	10.0%
	Intermediate	12	15.0%
	Preparatory	16	20.0%
	Diploma	32	40.0%
	Bachelor's Degree	10	12.5%
Responsibility	Company Director	2	2.5%
	Department Manager	6	7.5%
	Employee	50	62.5%

	Worker	22	27.5%
Age Group	Under 20 Years	2	2.5%
	20–30 Years	54	67.5%
	31–40 Years	18	22.5%
	41–50 Years	4	5.0%
	Above 50 Years	2	2.5%
Duration of work in the oil refinery	Less than One Year	13	17%
	1-5 Years	56	72%
	6-10 Years	7	8%
	More than 10 Year	2	3%
Obtaining a special Courses about Oil and Gas Projects	Didn't Taken A special Courses	52	65%
	Did taken a special Course	28	35%

Source: Author development

Table 2 shows that the lowest number of female respondents (10% – N=8), while the number of males is the highest (90% – N=72) out of the total number of participants (80). Then, Most of the respondents are those who have diploma degree which is (40.0% - N=32) while the number of people who have high school degree is less and they are (20% – N=16). The number of people with secondary education is also lower (15.0% - N = 12). After that, Most of the respondents are employees who are (62.5% - N=50) while the number of workers are less and they are (27.5% – N=22). However, the number of people in charge of the company's departments is the lowest (7.5% - N = 6). As well as, the above table shows that most of the respondents are in the age group of (20-30) years, while they (67.5% – N=54), and the second number are (31 - 40) years old, while about (22.5% – N=18) years. In addition (5.0%-N=4) are between (41 - 50 years). Other like, most of the respondents who work in this refinery have been working in it for about (1-5) years, they constitute (72.5% – N=58), the second number are the group who have worked in this refinery for less than one year, while they are about (17.5% – N=14). Finally, Most of the respondents did not take any special course about oil and gas projects, namely (65.0% – N=52), and the second number are those who took a special course about oil and gas projects, namely (35.0% – N=28).

4.2. Descriptive Statistics of Questionnaire Items: Mean, Standard Deviation, and Strength/Weakness Ratio Analysis

In scientific research, Descriptive Statistics is used to summarize and organize data in a meaningful way. This helps the researcher to gain a general understanding on the questionnaire data before analyzing it more in-depth. The most important measures in this area are the mean and the standard deviation.

The mean, or arithmetic average, is a measure of the proximity to the trunk and is used to find the central value of a set of data. In questionnaire analysis, the median is calculated for each question (or theme) separately. This provides an overall picture on the direction of the participants' responses. Standard deviation is also a measure of how close or far apart responses. Other likes Strength /Weakness Analysis is types of analysis, often referred to as "finding strengths and weaknesses," are a way to interpret center results. The strengths are the questions or themes that scored the highest center. This refers to aspects in which participants evaluate it positively or in which performance is high. Otherwise the Weaknesses are questions or threads with the lowest center. This identifies areas that need further review, improvement, or research.

Using these three concepts together, helps the researcher not only to get an overall picture on the data, but also to identify important points of interest, which become the basis for the later stages of the study and making recommendations.

4.2.1. Descriptive Statistics for Employee Training and Development: Mean, SD, and Strength/Weakness Ratios.

Table 3. Descriptive Statistics for Employee Training and Development

Questionnaire	Std. Deviation	Mean	I disagree very much	I disagree	Neutral	I agree	I'm very satisfied
X1	1.244	3.30	8 (10.0%)	14 (17.5%)	18 (22.5%)	26 (32.5%)	14 (17.5%)
X2	1.091	3.30	4 (5.0%)	18 (22.5%)	16 (20.0%)	34 (42.5%)	8 (10.0%)
X3	1.057	3.40	2 (2.5%)	18 (22.5%)	16 (20.0%)	34 (42.5%)	10 (12.5%)
X4	1.128	3.40	4 (5.0%)	14 (17.5%)	22 (27.5%)	26 (32.5%)	14 (17.5%)
X5	1.172	3.40	4 (5.0%)	18 (22.5%)	14 (17.5%)	30 (37.5%)	14 (17.5%)
Average	1.138	3.36	10 (5.0%)	45 (22.5%)	43 (21.5%)	75 (37.5%)	30 (15.0%)
							52.5%

Source: Author development

The results of Table 3 reveals that most of the employees (52.5%) believe that, training needs assessment affects the quality management system. The Average Mean is also 3.36, indicating moderate agreement on the need for training. In addition, the results of the Standard Deviation (ranging from 1.057 to 1.244), also show moderate variation in the responses. Questions X2 and X3 achieved the highest percentage of agreement (42.5%). Overall the table suggests that employees recognize the importance of training but with some changes in perspectives.

4.2.2. Descriptive Statistics for Training Program Implementation: Mean, SD, and Strength/Weakness Ratios.

Table 4. Training Program Implementation

Questionnaire	Std. Deviation	Mean	I disagree very much	I disagree	Neutral	I agree	I'm very satisfied
X6	1.219	3.48	8 (10.0%)	8 (10.0%)	18 (22.5%)	30 (37.5%)	16 (20.0%)
X7	1.085	3.45	6 (7.5%)	8 (10.0%)	20 (25.0%)	36 (45.0%)	10 (12.5%)
X8	1.035	3.58	2 (2.5%)	14 (17.5%)	12 (15.0%)	40 (50.0%)	12 (15.0%)
X9	1.248	3.33	6 (7.5%)	20 (25.0%)	10 (12.5%)	30 (37.5%)	14 (17.5%)
X10	1.051	3.65	2 (2.5%)	12 (15.0%)	14 (17.5%)	36 (45.0%)	16 (20.0%)
Average	1.128	3.50	24 (7.5%)	62 (15.5%)	74 (18.5%)	172 (37.0%)	68 (21.5%)
							58.5%

Source: Author development

Table 4 shows that many respondents (58.5%) in their opinion believe that the implementation of the training program has an impact on the quality management system. The mean average is also 3.50, indicating a moderately positive perception of the implementation of the training program. This is despite the fact that the most positive item is X10 received the highest mean (3.65) and strong agreement (45%). The standard deviations (SD) also range from 1.035 to 1.248, indicating moderate variability in the responses. In summary, the implementation of the training program is generally viewed positively, with the majority of respondents satisfied or very satisfied.

4.2.3. Descriptive Statistics for Post-Training Evaluation: Mean, SD, and Strength/Weakness Ratios.

Table 5. Post-Training Evaluation

Question	Std. Deviation	Mean	I disagree very much	I disagree	Neutral	I agree	I'm very satisfied
X11	1.217	3.43	8 (10.0%)	12 (15.0%)	10 (12.5%)	38 (47.5%)	12 (15.0%)
X12	1.281	3.50	8 (10.0%)	12 (15.0%)	10 (12.5%)	32 (40.0%)	18 (22.5%)
X13	1.167	3.35	8 (10.0%)	8 (10.0%)	24 (30.0%)	28 (35.0%)	12 (15.0%)
X14	1.318	3.58	8 (10.0%)	10 (12.5%)	14 (17.5%)	24 (30.0%)	24 (30.0%)
X15	1.215	3.40	6 (7.5%)	16 (20.0%)	12 (15.0%)	32 (40.0%)	14 (17.5%)
Average	1.239	3.452	7.6 (9.5%)	11.6	14	30.8	16 (20.0%)

	(14.5%)	(17.5%)	(38.5%)	58.5%

Source: Author development

Table 5 shows that many respondents (58.5%) in their opinion believe that post-training evaluation also affects the quality management system. This is despite the mean average of 3.45, indicating an overall positive view of training evaluation. The strongest theme is X14 was the most satisfied (30% "very satisfied") and the mean was 3.58. The average standard deviation (SD) is also 1.239, indicating a moderate spread in the responses. Overall, post-training evaluation is perceived positively, with more than half of respondents satisfied with how training outcomes are evaluated.

4.3. Ranking the Dimensions by Their Influence on the Quality Management System (QMS)

The results of the study ranked the dimensions of the quality management system as a dependent variable.

Table 6. Ranking of dimensions according to their impact on quality management system

Dimensions	Mean	St. Deviation	Ranking
Training Needs Assessment	3.36	1.138	Third
Training Program Implementation	3.498	1.128	Second
Post-Training Evaluation	3.618	1.259	First

Source: Author development

Table 6 describes the order of the dimensions according to their impact on the dependent variable (quality management system). In this table, we see the mean value and the standard deviation. We observed that the arithmetic means value for the dimension (Post-Training Evaluation = 1.259), the arithmetic means value for the dimension (training programs implementation = 1.128), and the arithmetic mean value for the dimension (training needs assessment = 1.138). After adjusting each of the arithmetic means for all dimensions, we see that the third dimension (training needs assessment) has the most impact on the dependent variable (quality management system) compared to both the second dimension and the first dimension. Post-Training Evaluation ranked first with the highest mean score of 3.62, indicating that it has the strongest influence on the Quality Management System (QMS).

Therefore, in the context of Kurdistan refineries, post-training evaluation was the strongest factor because its high mean score of 3.62 demonstrates that effectively evaluating training after it has occurred has the most significant positive impact on the overall quality management system. This suggests that understanding the outcomes and effectiveness of training is crucial for improving and maintaining quality standards within these refineries.

4.4. Descriptive Statistics for Quality Management System: Mean, SD, and Strength/Weakness Ratios:

4.4.1. Descriptive Statistics for Process Efficiency : Mean, SD, and Strength/Weakness Ratios:

Table 7. Process Efficiency

Question	Std. Deviation	Mean	I disagree very much	I disagree	Neutral	I agree	I'm very satisfied
X16	1.265	3.80	6 (7.5%)	10 (12.5%)	6 (7.5%)	30 (37.5%)	28 (35.0%)
X17	1.074	3.78	4 (5.0%)	8 (10.0%)	8 (10.0%)	42 (52.5%)	18 (22.5%)
X18	1.118	3.68	6 (7.5%)	4 (5.0%)	18 (22.5%)	34 (42.5%)	18 (22.5%)
X19	1.375	3.58	8 (10.0%)	14 (17.5%)	8 (10.0%)	24 (30.0%)	26 (32.5%)
X20	1.463	3.25	16 (20.0%)	8 (10.0%)	16 (20.0%)	20 (25.0%)	20 (25.0%)
Average	1.259	3.618	10 (12.5%)	11 (13.75%)	14 (17.5%)	37.5 (46.875%)	27.5 (34.375%)
			21			65	

Source: Author development

Table 7 shows that many respondents including (65%) believe that process efficiency affect the quality management system. The average mean score is 3.62, reflecting an overall positive view of process efficiency. The exceptions are positive responses are a strong majority (65%) of respondents chose "satisfied" or "very satisfied", indicating satisfaction with the level of functionality. About 14% remained neutral, indicating moderate uncertainty or mixed opinion. Overall, 21% expressed disagreement, showing that some areas still need improvement.X16 also had the highest mean (3.80) and the highest pooled positive responses (72.5%). X20, on the other hand, had the lowest mean (3.25) and highest strong disagreement (20%), indicating a possible area of improvement.

4.4.2. Descriptive Statistics for Compliance with Standards : Mean, SD, and Strength/Weakness Ratios:

Table 8: Compliance with Standards

Question	Std. Deviation	Mean	I disagree very much	I disagree	Neutral	I agree	I'm very satisfied
X21	1.291	3.78	8 (10.0%)	6 (7.5%)	10 (12.5%)	28 (35.0%)	28 (35.0%)
X22	1.207	3.68	4 (5.0%)	14 (17.5%)	8 (10.0%)	32 (40.0%)	22 (27.5%)
X23	1.127	3.53	4 (5.0%)	6 (7.5%)	20 (25.0%)	26 (32.5%)	24 (30.0%)
X24	1.132	3.53	6 (7.5%)	8 (10.0%)	18 (22.5%)	34 (42.5%)	14 (17.5%)
X25	1.239	3.55	6 (7.5%)	12 (15.0%)	14 (17.5%)	28 (35.0%)	20 (25.0%)
Average	1.199	3.614	7.6 (9.5%)	11.2	14	29.6	21.6

				(14.0%)	(17.5%)	(37.0%)	(27.0%)
			19			64	

Source: Author development

Table 8 shows that many respondents (64%) believe that compliance with standards affect the quality management system. The mean average is also 3.61, indicating an overall positive perception of standards compliance. Positive responses, formed a strong majority (64%) of respondents chose "agree" (37%) or "very agree" (27%), reflecting a solid commitment .However, neutral responses are about 17.5%, indicating some uncertainty or balanced opinion. X21 also had the highest mean (3.78) and strongest satisfaction (70% positive). The least ranked items are X23 and X24, which had lower mean (3.53), although still positive mean. In summary compliance with standards is largely viewed positively, with most respondents agreeing. Smaller areas (such as X23 and X24) show room for improvement.

4.4.3. Descriptive Statistics for Continuous Improvement: Mean, SD, and Strength/Weakness Ratios:

Table 9. Continuous Improvement

Question	Std. Deviation	Mean	I disagree very much	I disagree	Neutral	I agree	I'm very satisfied
X26	1.317	3.60	8 (10.0%)	12 (15.0%)	6 (7.5%)	32 (40.0%)	22 (27.5%)
X27	1.170	3.38	8 (10.0%)	6 (7.5%)	28 (35.0%)	24 (30.0%)	14 (17.5%)
X28	1.299	3.58	8 (10.0%)	10 (12.5%)	12 (15.0%)	28 (35.0%)	22 (27.5%)
X29	1.213	3.63	8 (10.0%)	4 (5.0%)	18 (22.5%)	30 (37.5%)	20 (25.0%)
X30	1.281	3.53	10 (12.5%)	6 (7.5%)	14 (17.5%)	32 (40.0%)	18 (22.5%)
Average	1.256	3.544	8.4 (10.0%)	7.6 (9.5%)	15.6 (19.5%)	29.2 (36.5%)	19.2 (24.0%)
			20			60.5	

Source: Author development

Table 9 shows that many respondents (60.5%) believe that continuous improvement affect the quality management system. The mean average is also 3.54, indicating a favorable overall perception of continuous improvement practices. Positive responses made up the majority of responses, with 60.5% of respondents choosing "agree" (36.5%) or "very satisfied" (24%), indicating overall support for continuous improvement efforts. As for neutral responses about 19.5% remained neutral, suggesting that some respondents were undecided or felt that improvement was moderate. The highest evaluation items X29 had the highest mean (3.63) with 62.5% positive responses. X27 also had the lowest mean (3.38) and the highest neutral responses (35%), indicating mixed perspectives. Sustained improvement is generally viewed as favorable, although some responses (particularly to X27) suggest changes in experience or effectiveness across different areas.

4.5. Ranking the dimensions according to their impact on the Quality Management System (QMS)

The results of the study ranked the dimensions of the quality management system as a dependent variable.

Table 10. Ranking of dimensions according to their impact on quality management system

Dimensions	Mean	Standard Deviation	Ranking
Continues Improvement	3.544	1.256	First
Process Efficiency	3.618	1.259	Second
Compliance with Standards	3.614	1.199	Third

Source: Author development

Table 10 shows the order of the dimensions according to their impact on the dependent variable (quality management system). This table shows the distribution of the arithmetic mean value and standard deviation. It is observed that the mean value of arithmetic for dimension (continuous improvement = 3.544), the mean value of arithmetic for dimension (process efficiency = 3.618), and the mean value of arithmetic for dimension (compliance with standards = 3.614). After adjusting the arithmetic mean for all dimensions, we observe that the third dimension (continuous improvement) has a greater impact on the dependent variable (quality management system) than the second and first dimensions.

4.6. Impact of Employee Training and Development on the Quality" based on T-Test analysis

In this study, this type of test was used to determine the extent of the impact of employee training and development on the quality management system**.**

Table 11. Effect of Employee Training and Development on Quality management system based on T-Test analysis

N	Mean	St. Deviation	Df	T – Test	T – Table	Sig.
40	105.58	28.06	39	2.257	1.684	0.002

Source: Author development

In the above table, we see that the arithmetic mean (105.58,) and standard deviation (28.06) also note that the T-Test value is (2.257), which is more than (Table - T =1.684). Given the significance level value, which is smaller than the P-value, this means that the variable (training and development of employee) affects (quality management system).

4.7. Analyzing the Relationship Between Key Variables: A Correlational Study

This item is used in this study to determine the amount and quality of relationship between the variables in the study.

Table 12. Correlation among study variables

	Compliance with Standards	Quality Management System
Compliance with Standards	1	0.931**
Quality Management System	0.931**	1
Sig. (2-tailed)	0.000	0.000
N	80	80

** Correlation is significant at the 0.01 level (2-tailed).

According to Table 12 concerning the relationship between the study variables, the relationship between the independent (employee training and development) and dependent (quality management system) variables is found to be positive, which is one of the objectives of the study. The results or Pearson correlation (PC=0.931**), the results are positive and the relationship exists. Thus according to the results employee training and development (independent variable) has a positive effect on quality management system (dependent variable) which means that employee training and development is very important and has a role in quality management system.

4.8. Modeling the Relationship Between Variables Through Regression Techniques

This model has been used to determine the extent and level of correlation between variables through regression techniques.

Table 13. Regression between variables

Model summary			
Model	R	R Square	Adjust R Square
1	0.85	0.7225	0.7180

a. Predictors: (Constant): employee training and development

b. Dependent Variable: quality management system

Source: Author development

According to Table 13, the results are treated using computer programs such as SPSS. The result obtained shows that employee training and development can influence the quality management system with FF85% of the probabilities. That's while (the R-square of the correlation is (0.7225).

4.9. Analyzing the Influence of Independent Variables: A Study of Regression Coefficients

Table 14. Regression coefficients

Coefficients [a]

Model		Unstandardized Coefficients		standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	Constant	1.134	3.548		0.038	0.000
	employee training and development	0.86	0.07	0.931	5.769	0.001

a. Dependent Variable : quality management system

Source: Author development

Based on the regression analysis results procedure (coefficients), a significant and positive effect can be seen that employee training and development likely to influence employee quality management system to improve their activity quality and productivity rate for each successive activity is 86% and significance (.001).

4.10. Analyzing the Relationship Between Training and Quality Management via ANOVA

This type of test helped the researcher to evaluate whether the linear regression model significantly predicted the dependent variable—in this case, the quality management system—using the independent variables of employee training and development.

Table 14. ANOVAa

Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	178.284	1	178.284	33.28	0.001
Residual	48.529	9	5.392		
Total	226.813	10			

Source: Author development

a. Dependent Variable: quality management system
b. Predictors: (Constant), employee training and development

The ANOVA results show that the regression model is statistically significant **(**F = 33.28, p = 0.001**)**, meaning employee training and development has a strong and meaningful impact on **the** quality management system.

The results of this study are compared with another study, both of which have the same sample, their variables are very close to each other, and the results are close to each other, which indicates that the results of this study are on the right track. Important data are presented to illustrate the results of the study. In 2024, a study conducted by Al-Shammari, & Al-Turki, focused on oil refineries in northern Iraq, the title of the study is the impact of implementing total quality management on sustainable development. The results of the study were that the researchers found that the implementation of total quality management (TQM) supports sustainable development in refineries, and they have emphasized the importance of management awareness in TQM to meet quality requirements and development objectives. The study also recommended changes in traditional working methods and replacement of methods with new TQM approaches. They also emphasized in focusing on human resources - especially

training and development, the goal being the successful implementation of quality management systems in refineries. The study also recommended that attention be paid to further training and development to increase staff participation.

5. Conclusion and Recommendation

5.1. Conclusion

The results of the data analysis and the results presented in the analysis, based on the evaluations and comparison of evaluations with standard criteria, showed that employee training and development has an important and direct relationship with quality system management. Employee training and development can be the foundation of a quality management system in the workplace, motivating employees in positive directions and improving their skills and quality. Employee training and development focuses on establishing an appropriate workplace quality management system aligned with employee quality, providing training and development opportunities, and creating a positive work environment with a high quality management system. Employee training and development also addresses employee wellbeing, such as mental health support, work-life balance initiatives and training to improve employee performance in the workplace, contributing to rising standards of work. By investing in employee development and creating a work culture, organizations can positively impact the quality of their employees' performance.

One of the most obvious findings of this study in the context of Kurdistan refineries was post-training evaluation, which was the strongest factor because the high mean score of 3.62 indicates that effective post-training evaluation has the most significant positive impact on the overall quality management system. This indicates that understanding the outcome and effectiveness of training is crucial to improving and maintaining quality standards within this refinery. It should also be noted that future research should expand on such findings through multiple case studies, with the aim of validating the observed relationships across diverse organizational contexts. In addition, examining the impact of digital training approaches and their specific contributions to quality system management offers valuable insights for modern workforce development.

5.2. Recommendation

This section makes several recommendations that organizations should prioritize employee training and development, as this can be used as a strong foundation for developing a quality system that organizations can benefit from. Organizations should also focus on programs and processes that encourage their employees to participate in training courses that will improve the skills and quality of employees and organizations in their workplaces. In addition, organizations should establish relationships with other organizations and institutions for proper and appropriate training for employees. It is also recommended that organizations create qualified trainers and provide the necessary budget for such processes, continuously provide guidance and assistance to employees to improve the quality of their employees, it is important to work on rewards, punishments and promotions.

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