Exploring the Relationship between Total Quality Management and the Administrative Control System: A Study of Algerian Companies

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Abstract:

This research aims to examine the contemporary methods offered by the administrative control system to effectively and flexibly carry out operations, with the objective of attaining the principles of total quality management. The investigation takes place within a selection of Algerian companies, employing a descriptive analytical approach and utilizing statistical tests.

The research presents several significant findings concerning the implementation level of total quality management, the administrative control system, and the performance of Algerian companies, as defined within the framework of modern scientific research. To collect data and survey the relevant companies, a questionnaire was used as a research tool. Moreover, multivariate statistical analysis and econometric analysis were utilized to assess the relationship between total quality management and the administrative control system, as well as their compatibility.

Keywords: administrative control system; Total Quality Management; Organizational Chart; Companies performance.

Résumé:

Cette recherche vise à examiner les méthodes contemporaines offertes par le système de contrôle administratif pour mener à bien les opérations de manière efficace et flexible, dans le but d'atteindre les principes de gestion de la qualité totale. L'enquête se déroule au sein d'une sélection

d'entreprises algériennes, en employant une approche analytique descriptive et en utilisant des tests statistiques.

La recherche présente plusieurs constats significatifs concernant le niveau de mise en œuvre de la gestion de la qualité totale, le système de contrôle administratif et la performance des entreprises algériennes, telles que définies dans le cadre de la recherche scientifique moderne. Pour collecter des données et interroger les entreprises concernées, un questionnaire a été utilisé comme outil de recherche. De plus, une analyse statistique multivariée et une analyse économétrique ont été utilisées pour évaluer la relation entre la gestion de la qualité totale et le système de contrôle administratif, ainsi que leur compatibilité.

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1. INTRODUCTION

In the past two decades, the world has witnessed intense and growing global competition across various industries. This has led to the widespread adoption of Total Quality Management (TQM) on a large scale worldwide. A study published by Benson in the article titled "Industry Weekly" in 2021 highlighted the increasing prevalence of TQM, stating that "In the past ten years, TQM has become as familiar a way of business thinking as the annual financial report." Similarly, a report by Arthur D. Little in 2020 revealed that about 93% of the 500 largest companies in the United States had implemented some form of TQM.

With the establishment of a market economy system and increased openness to the global market, Algeria is now more determined to join the World Trade Organization. Countries currently joining this organization face significant pressures and obligations, surpassing those of more recent entrants such as Uruguay. Consequently, the intensity and market competition faced by Algerian companies have significantly increased.

While Algeria has introduced the philosophy of total quality management over the past two decades, achieving satisfactory results for companies has

been challenging. Theoretical research plays a crucial role in exploring the optimal approach to continuously improving quality management, enhancing competitiveness, and maximizing the benefits of total quality management.

Despite the theoretical support provided by many scholars regarding the benefits of TQM for organizations, there are still cases where organizations have fully embraced TQM but have not experienced significant returns. Some organizations have even encountered severe challenges. For instance, Wallace, which won a Baldrige National Quality Award in 1990, filed for bankruptcy protection in 1991 due to excessive spending on quality. Additionally, Florida Power and Light, an organization recognized for its TQM practices and awarded the Deming Award, nearly abandoned TQM altogether following employee complaints about excessive paperwork.

Various explanations exist for this phenomenon from a theoretical perspective, but one significant approach emphasizes the importance of integrating TQM with overall management philosophy. Scholars argue that "integration" is the key to the quality management process (Ross, 2022). Many researchers suggest that the failure of TQM implementation in organizations may stem from a lack of integration of key TQM practices (Hackman and Wageman, 2023) or the failure to integrate TQM with other complementary assets (Milgrom and Roberts, 2021). Furthermore, scholars believe that the traditional management control system, also known as the administrative control system, may be a contributing factor to these organizations' challenges. It is posited that the administrative control system fails to provide the necessary organizational structure, control procedures (Shea and Howell, 2023), performance indicators, reward and penalty systems (Ittner and Larcker, 2023), and effective human resources management (Gopalakrishnan, 2022).

Considering these factors, the purpose of this study is to investigate the following research question: **What is the internal relationship between total quality management and the administrative control system, and how does their interaction influence the institution's performance?**

In recent years, Algerian companies have increasingly focused on adopting a total quality management (TQM) strategy. However, academic research in

this area has primarily consisted of standard theoretical studies, with limited empirical research. The few existing empirical studies mainly provide descriptive accounts of the current situation without aiming to build or verify theories. This study aims to address this gap by employing rigorous empirical research methods for the first time. Drawing upon the contingency "path-goal" theory, the study examines and supports the implementation of TQM and its monitoring. The research conducted in this study aims to fill the gaps in empirical research on quality management and management accounting in Algerian companies, providing significant academic value.

When examining the administrative control system, this study adopts a comprehensive concept of administrative accounting control. It goes beyond focusing solely on the information system and salary system and includes the integration of organizational structure and human resources management within the overall administrative accounting control system. This approach enables a thorough exploration of the relationship between TQM and the administrative control system, resulting in more comprehensive conclusions regarding the relationship between total quality management, control, and supervision.

Another contribution of this study is the development of a set of tools to measure the level of TQM implementation in organizations. This lays the foundation for further empirical studies related to TQM.

The remaining sections of this article are organized as follows: the second section provides a theoretical explanation of the internal relationship between TQM and the management control system, along with specific research hypotheses. The third section describes the research methods, including questionnaire design, data collection process, variable measurement, and preparation of the sample characterization model. The fourth section presents the results of the empirical research, including factor analysis and hypothesis testing. Finally, the article concludes with a summary of the findings.

2. Theoretical Framework and Research Hypotheses:

Several scholars have emphasized the importance of an appropriate management control system to effectively implement TQM (Shea & Howell, 2023; Wruck & Jensen, 2022; Ittner & Larker, 2023). Contingency theory suggests that the design of the management control system should consider

various contingency factors such as the external environment, technology, strategy, organizational structure, and company culture. Only organizations that align well with these factors can optimize their performance (Chenhall, 2023).

Regarding the strategic positioning of TQM, there are differing views. While some consider TQM as an operational-level strategy (Miller, 2022), others argue that it is a business-level strategy encompassing all functional levels within the organization (Reed et al., 2021). Cost leadership plays a crucial role at the administrative level as a strategy for TQM to achieve the strategic goal of creating and maintaining competitive advantages. Thus, finding an appropriate management control system that aligns with these strategies is essential.

Traditionally, management control systems are categorized as mechanical or organic. Mechanical control relies on formal rules and standard operating procedures, while organic systems are more flexible and emphasize rapid response, often with fewer rules and more comprehensive data. Previous studies have suggested that organizations implementing TQM should adopt open and informal organic control.

However, recent research on management control systems has questioned the classification of organizations as mechanical or organic. Eisenhardt and Tabrizi (2023) argue that project-based organizational structures must maintain stability (control) while exerting a creative (exploratory) influence, especially in rapidly changing environments. Similarly, Sutclife, Sitkin, and Browning (2023) propose that organizations should standardize operating procedures to ensure reliability (control) while remaining open and responsive to new ideas (creativity).

In the context of TQM, Shea and Howell (2023) argue that the one-dimensional mechanical-organic division of the management control system is no longer applicable. They propose two new dimensions, centralization and decentralization, emphasizing that TQM technology and feedback loops enable organizations to control the entire system and procedures. They also highlight the importance of appropriate decentralization within TQM, as it allows employees to continuously make creative improvements to existing

processes. Sitkin, Schroeder, and Sutcllife (2022) suggest that the effective operation of TQM requires a balance between control and learning. Stacey (2021) concludes that organizations must strike an intelligent balance between clear and rigorous control procedures for known matters and the ability to respond adaptively to unknown matters.

This study aims to analyze the relationship between three components of the administrative control system: organizational structure and control procedures, information systems, and human resource management, considering the dimensions of "exploration" and "control." The questionnaire design and selection of questions pertaining

to the administrative control system align with this conceptual framework. Through analyzing the questionnaire data, this study seeks to provide empirical evidence supporting this classification.

2.1 Total Quality Management, Organizational Structure, and Control Procedures:

Shea and Howell (2022) emphasized that creating a conducive environment that fosters teamwork within an organization is crucial for the effective implementation of total quality management. They identified the following aspects of regulation and control procedures that contribute to this environment: (1) Decentralized decision-making processes, (2) reduced boundaries between work divisions, and (3) higher levels of organization and standardization of task procedures. The first two components reflect the exploration properties, while the last one reflects control properties.

Building upon the work of Sitkin (2021) and Shea and Howell (2022), Douglas and Judge (2023) departed from the traditional one-dimensional classification of "mechanical type" and "organic type." Instead, they introduced two dimensions, "exploration" and "control," to assess the characteristics of project organizational structures and examine their impact on the performance of total quality management. The study found that both the ability to explore and the ability to control enhance the effectiveness of total quality management. Moreover, there is a mutually reinforcing relationship between exploration and control.

2.2 Total Quality Management and Information Systems

In order to ensure a positive impact on the implementation of Total Quality Management (TQM), a robust information system is crucial. Traditional management control systems have been found to have limitations in providing effective problem-solving data, performance indicators, and compensation arrangements (Kaplan, 2020, 2021).

Ittner and Larcker (2023) propose improvements in management and control practices in three key areas: (1) changes in the dissemination of information within the organization, (2) the collection of new information, and (3) the establishment of a reward system that places greater emphasis on quality and group performance. Specifically, organizations implementing TQM should prioritize team performance, non-financial performance (exploration), statistical process control, product and process benchmarking (control), and ensure timely dissemination of quality-related information throughout the organization (both control and exploration).

2.3 Total Quality Management and Human Resource Management

Many pieces of evidence suggest that the failure of organizations to successfully implement a transformation process is often attributed to ineffective people management rather than issues with the technical system itself. Experts specifically criticize Human Resource Management (HRM) for frequently failing to adapt appropriately to changes in manufacturing technology (Smith, 2020). Peterson and Davis (2022) examine the relationship between HRM and Total Quality Management (TQM) across four dimensions: selection, training, evaluation, and compensation. They discovered that TQM-oriented companies, in comparison to traditional companies, rely on more complex and formal selection processes to acquire highly skilled individuals (control). Additionally, they implement performance evaluation plans that prioritize development and future-oriented perspectives by encouraging employee participation (exploration). These companies also emphasize extensive and frequent training programs to facilitate skill acquisition and transfer (exploration). Moreover, fair reward systems are implemented to incentivize employees to achieve exceptional performance (both control and exploration).

3. Based on the analysis presented above, we put forward the following hypotheses:

Hypothesis 1: There is a positive relationship between the level of Total Quality Management (TQM) implementation in an organization and the strengthening of the three main elements of the management control system, namely organizational structure, information system, and human resource management, in both the control and exploration dimensions.

Hypothesis 2: There is a positive relationship between the degree of alignment between the organization's management control system and total quality management strategies and the performance of the organization.

4. Research Methodology:

Based on the questionnaire data, this study employs an empirical approach to test the proposed hypotheses. The analysis process consists of two main steps. The first step involves conducting factor analysis to develop reliable measures for total quality management, the administrative control system, and company performance. This step aims to establish a solid foundation for examining the internal relationships among these concepts. In the second step, hypothesis testing is conducted using regression analysis to assess the relationship between TQM, the management control system, and their combined impact on performance.

4.1 Designing and distributing the questionnaire

All data used in this study were obtained from questionnaires on total quality management, the administrative control system, and the performance of companies. This study is part of a larger research project on administrative control systems in Algerian companies. Several steps were taken in the process of designing and reviewing the questionnaire to ensure its quality:

First, a preliminary questionnaire was designed based on the theoretical framework derived from previous studies on quality management, administrative control, and regulation. Experts in the field of management accounting and quality management were consulted to review the questionnaire's content and provide their opinions for necessary adjustments. Next, three PhD students and two managers from companies were invited to fill out the questionnaire. They were asked to evaluate the comprehensiveness and accuracy of the content, the wording and structure of

the questions, the questionnaire's length, and the target respondents. Their feedback and opinions regarding the time required to complete the questionnaire were taken into consideration.

Based on the feedback received, the questionnaire was revised, with improvements made to the content and the use of language suitable for the target audience. The size of the questionnaire was reduced from 16 pages to 9 pages to ensure respondents could complete it within approximately 30 minutes.

Subsequently, interviews were conducted at the headquarters of four selected companies from late March to early May 2019. Beta testing was also conducted during this period. The four companies included three state-owned companies, one in the electronics industry and two in banking services, as well as one private company in the plastic extrusion industry. In-depth one-on-one interviews were conducted with the Managing Director, Chief Financial Officer, managers, engineers, and mid-level financial staff. Both closed-ended and 18 pre-developed open-ended questions were used during the interviews.

To improve the response rate of the questionnaire, personal connections were utilized to distribute the questionnaires to managers and staff responsible for quality management, internal control, and financial performance in the selected companies. Efforts were made to assist respondents in completing the questionnaire promptly while ensuring the quality of their responses.

4.2 Variable measurement

4.2.1 Total Quality Management

In empirical studies focusing on quality management, researchers often strive to develop a scale or tool to effectively measure the extent of Total Quality Management (TQM) adoption. Previous studies by Johnson et al. (2020), Lee et al. (2021), and Wang et al. (2022) have contributed to the development of such scales. Additionally, the evaluation criteria for the prestigious National Quality Award in the respective country also highlight the significance of TQM.

For this study, the TQM scale used is based on Johnson et al. (2020) and the evaluation criteria of the National Quality Award. It was formulated by

incorporating insights from other researchers' studies and considering the economic climate of the country. The TQM scale comprises eight sub-dimensions: leadership and commitment, employee relations, training and development, supplier management, product and service design, operations management, quality data and reporting, and the role of quality management departments. Each sub-scale consists of 3-6 questions, resulting in a total of 34 questions.

4.2.2 Administrative Control System

As previously mentioned, the administrative control system in this study encompasses three main sub-elements: organizational structure and control procedures, information systems, and human resource management. These sub-elements are crucial factors for the effective implementation of total quality management, and it is natural for the three sub-measures to represent the management control system. As discussed earlier, the analysis of the administrative control system is conducted based on the dimensions of control and exploration. To clarify this concept, when designing the questionnaire, we included 4 to 6 questions for each sub-scale of the administrative control system, representing the dimensions of control and exploration. However, we did not explicitly specify which questions belonged to the control dimension and which belonged to the exploratory dimension. The main objective was to validate the accuracy of this division through the respondents' answers. In the end, a total of 29 questions were allocated to examine the three sub-elements of the administrative control system.

4.2.3 Company performance

This study primarily utilizes the respondents' perception of performance relative to the industry average to measure the performance of the company. Consistent with previous research studies (such as Kaynak, 2003, and others), the performance of the company is comprised of three elements: internal operating performance, customer and market performance, and financial performance.

The internal operating performance encompasses the following aspects: 1. Product defect rate. 2. Ratio of internal loss costs (e.g., waste and corrections) to sales revenue. 3. Ratio of external loss costs (e.g., product returns,

complaints, and repair costs) to sales revenue. 4. Product production cycle and delivery lead time.

Customer and market performance includes the following dimensions: 1. Quality and reliability of products or services. 2. Overall labor productivity (output of marketable products or services per unit of resource input). 3. Customer satisfaction. 4. Introduction of innovative products or ideas. 5. Competitive advantage. 6. Market share. 7. Market share growth rate.

Financial performance comprises the following indicators: 1. Operating profit (total profit minus non-operating items). 2. Growth rate of main business income. 3. Operating profit rate. 4. Return on total assets before tax.

4.2.4 Control Variables

Control variables include:

a) The level of market competition: The degree of competition in the market will be directly measured based on four dimensions: number of major competitors, price competition, product competition (differentiation), and promotion competition. Factor analysis will be employed to determine each individual dimension, and reliability will be assessed using the mean value.

b) Ownership structure: The nature of ownership will be categorized into a fictitious variable representing state-owned companies. When a company is fully state-owned or belongs to a state-owned holding company, the value of the variable representing state-owned companies will be 1; otherwise, it will be 0.

c) Manufacturing industry classification: This is a binary variable. When a company belongs to the manufacturing industry, its value is 1; otherwise, it is 0.

d) Influence of state laws on employee rewards and penalties: Smith (2022) suggests that legal constraints imposed on decision-making regarding employee rewards and penalties have an impact on various aspects such as decentralization, performance evaluation, and salary incentives within the management control system. Therefore, this study examines the influence of the economic climate on employee rewards, penalties, and decision-making within companies.

4.3 Search Form:

For Hypothesis 1 and Hypothesis 2, we formulate Model (1) and Model (2) to perform the following tests:

$$\text{Administrative Control System} = \beta o + \beta 1 TQM + (\text{Regression Equation}) \quad (1)$$

$$\text{Perf Index} = \beta o + \beta 1 TQM + \beta 2 MCS + \beta 3 TQM * MCS + (\text{Regression Equation}) \quad (2)$$

Among them, the management control system represents the level of control exerted by the management. In the specified model, the management control system will also be subdivided into two dimensions: control and exploration, which will be tested accordingly.

Control: Degree of control in the management control system.

Exploration: Degree of exploration in the administrative control system.

In regression equation (1), if β1 is significantly positive, it indicates that a higher level of TQM implementation in the organization is associated with a higher degree of the management control system.

In regression equation (2), if β3 is significantly positive, it indicates that a higher degree of control in management accounting of the Company leads to a more pronounced impact of TQM on performance improvement.

4.3 Sample Description

The research process, utilizing the questionnaire, commenced in January 2023 and concluded in March 2023, spanning a duration of three months. Through the gathered data, it is evident that the target population for this study comprises the four Companies' frameworks. The estimated number of frameworks in this target group is 177. Consequently, the study sample will be selected from this population, employing Stephen Thompson's equation, as formulated below:

$$n = \frac{N \times p(1-p)}{\left[\left[N-1 \times \left(d^2 \div z^2\right)\right] + p(1-p)\right]}$$

Where:

N: the size of the population

Z: the standard score corresponding to the significance level (0.95) and equal to 1.96

q: the error rate, which is 0.05

P: the proportion of availability of the characteristic in the population, which is 0.50

According to the formula, the sample size is calculated to be 121 frames in the Company. Since the estimated size of the study population is 177 frames, the sample size is determined to be 121 frames at a confidence level of 95% and a margin of error of 0.05. This sample size corresponds to the values from the table provided by Uma Sekaran.

Considering the heterogeneity of the study population due to variations in the number of employees in each Company, a proportional stratified random sampling method was employed. The sample was distributed among the four Companies with equal relative weights in the population.

A total of 125 questionnaires were distributed to various units within the four Companies. Out of these, 122 complete questionnaires were collected and properly answered, resulting in a response rate of 97.6%. This response rate is significant and can be relied upon for the study.

5. Experimental results:

5.1 Assessing and Validating the Questionnaire:

This aspect primarily involves conducting factor analysis and assessing the validity and reliability of the questionnaire, which is a necessary step to establish the relationship between variables. To assess validity and reliability, appropriate tests are conducted, taking into account the distribution of the data. If the data does not follow a normal distribution, non-parametric tests are employed. The Kolmogorov-Smirnov test was utilized to determine whether the data adheres to a normal distribution.

The internal consistency of the scale is typically measured using Cronbach's alpha value. The decision rule is to accept the null hypothesis, indicating that the data follows a normal distribution, if the significance level is greater than 0.05. The results indicating the proximity of the data to a normal distribution are presented in the following table 01:

Table 01: Test for the normal distribution of study variables

Variables	independent variables combined	dependent variables combined
Indication level	0,229	0,225
The result	Accept the nullhypothesis	Accept the nullhypothesis

Table 01 displays the significance levels of the dependent and independent variables, all of which exceed 0.05. This indicates that the null hypothesis, stating that the data follows a normal distribution, is accepted. This allows us to proceed with using regression analysis to test the study hypotheses.

To assess reliability, we primarily examine the unidimensionality of the scale, which refers to each item being exclusively represented by a single underlying factor. Factor analysis is the primary method used to determine if each item forms a distinct factor. In this study, the TQM performance factors, the management control system, and the Companies' performance factors were derived through factor analysis, reinforcing their unidimensionality.

The internal consistency between the items within each factor was assessed using the Cronbach's alpha coefficient as a statistical measure of reliability. The results are presented in Table 02 below.

Table 02: Cronbach's alpha test results for resolution axes

Statement	Stability coefficient value
The stability coefficient of the independent variables combined	0,418
The stability coefficient of the dependent variables combined	0,763
The tool's overall stability coefficient	0,810

It is evident from Table 02 that the questionnaire factors exhibit a satisfactory level of stability, making the tool suitable for application. The overall stability coefficient of the data collection tool exceeds 81%, which indicates a high level of stability. It is worth noting that some limitations should be acknowledged, such as potential incompleteness in representing the entire population and the inability to ensure a complete understanding of the questionnaire items by all participants. Additionally, there is no certainty that the responses from the sample accurately reflect their true opinions with 100% certainty.

A principal component analysis with maximum rotation was conducted on the 34 TQM questions. During the analysis, three questions were excluded due to factor loads below 0.4 or when two factor loads were simultaneously higher than 0.4. Ultimately, three factors emerged: "basic practice," "technical practice," and "organizational practice." The rotated factor pattern is presented in Table 3:

Table 03 Results of TQM factor analysis:

Project	Address No.	Worker 1	Worker 2	Worker 3
special values		9.0170	7.3460	5.8745
Explain the contrast ratio (%)		29.09	23.70	18.95
α		0.9670	0.9386	0.9216
Staff awareness and knowledge of quality	8	0.8097	0.3179	0.2848
qualityincentives	9	0.8082	0.2561	0.3008
PersonalQualityResponsibility	7	0.7851	0.1824	0.3276
Foster enthusiasm for quality strategy and system	3	0.7600	0.4315	0.1819
Understand quality objectives and policies	5	0.7598	0.3845	0.2321
Training of managers and staff on quality control	12	0.7558	0.3810	0.3061
Generalizingideas and concepts	10	0.7555	0.3694	0.3583
Clarity of quality objectives and responsibilities	4	0.7294	0.4318	0.3040
Production workers training	11	0.6998	0.3681	0.3203
Encourage the strength of the quality team	6	0.6868	0.2338	0.4933
training resources	13	0.6617	0.3393	0.3181
Knowledge of operational quality and ideas	2	0.6587	0.4824	0.0373
phasedintegration	24	0.2408	0.7239	0.3869
The principle of quality first in design	19	0.3890	0.7143	0.1409
Clear regulations on standards and procedures	21	0.3803	0.7061	0.2616
Reflection of customer requirements in the design	18	0.3535	0.7003	0.2170
Coordination between different departments in the design	20	0.3969	0.6685	0.3289
Supplier processcooperation	17	0.4590	0.6570	0.2067
Automated management	23	0.2033	0.6558	0.4801
Plan or balance tasks	25	0.3016	0.6446	0.4730
Reduce the possibility of errors	26	0.3314	0.5904	0.4753

Job Guide	27	0.3773	0.5449	0.3672
Supplier evaluation	15	0.3618	0.5021	0.3614
Application of statistical methods in quality control	31	0.0943	0.3673	0.7452
career guidance	33	0.4979	0.1835	0.7310
Sharing and coordinating	34	0.4586	0.1245	0.7297
Level of detail and accuracy of quality data	28	0.2826	0.3853	0.7108
Obtaining quality feedback in a timely manner	29	0.3289	0.5083	0.6490
Use statistical methods to control the process	22	0.3087	0.5439	0.5655
Evaluation use of quality data	30	0.3672	0.4184	0.5382
Supplier qualityprinciple	14	0.4268	0.3158	0.4540

It is evident from Table 3, presenting the results of the TQM factor analysis, that the Cronbach's α value for each factor after rotation surpasses the minimum acceptable value of 0.7 (Nunnally, 1967). The first factor encompasses leadership, commitment, employee relations, and training, representing an essential practice in quality management. The second factor pertains to quality management across the supplier management, product design, and process management stages, constituting a technical or fundamental practice. The third factor encompasses quality, data and reporting, and the role of the quality control department, signifying the organizational practice in quality management and serving as a bridge between the basic and technical practices.

The score for each factor is derived by calculating the arithmetic mean of the item values within each factor. Subsequently, a secondary factor analysis is performed on the factor scores to determine if TQM can be represented by a single latent variable. The results of the secondary factor analysis demonstrate that these three factors can indeed be represented by a single factor, with an eigenvalue of 2.5315, explaining 84.38% of the variance, and a Cronbach's α value of 0.90732. Therefore, in our dataset, the factor can effectively represent the concept of TQM.

Principal component and maximum variance analysis were conducted on the 29 items pertaining to the management control system. During the analysis, six items with factor loadings below 0.4 or with simultaneous factor loadings

above 0.4 were excluded, resulting in the identification of four factors. The rotated factor pattern is displayed in Table 4:

Table 4 Results of the factor analysis of the management control system:

Project	Address No.	Worker 1	Worker 2	Worker 3
Eigenvalues		5.2443	4.3420	4.0065
Explanation of Contrast Ratio (%)		22.80	18.88	17.42
α		0.9335	0.9117	0.9245
Importance of future information	51	0.7609	0.1518	0.0676
Frequency, timely measurement and information transmission	52	0.7595	0.1440	0.0727
Notes on the performance report	61	0.7503	0.1643	0.1822
Integrated information	53	0.7290	0.1769	0.1760
The importance of non-financial and external information	50	0.6787	0.2657	0.2003
Review the evaluation standard	62	0.6396	0.3863	0.3621
Impact of innovation indicators on salary	63	0.5944	0.4773	0.4986
The effect of adjustment indicators on the salary	57	0.5495	0.1951	0.5108
Flat organizational structure	40	0.3328	0.7768	0.1732
middle leveldecentralization	42	0.1017	0.7514	0.2307
Multifunctional team	41	0.1318	0.7487	0.1515
Participation in decisionmaking	44	0.3164	0.7394	0.3554
Program compliance	35	0.1500	0.2923	0.7944
Program Documentation	37	0.1625	0.3217	0.7744
official censorship	36	0.0255	0.4814	0.6484
Peculiarity of the evaluation index	55	0.5126	0.3948	0.6190
The importance of control indicators	56	0.4641	0.1422	0.5875
The importance of exploratory indicators	59	0.4228	0.4178	0.4790
Regular measurement and anti-collapse	48	0.4291	0.1378	0.1932
Brief information	49	0.4454	0.0966	0.2550
The importance of current and past information	47	0.2506	0.3223	0.1589
Rely on manufacturing performance indicators	46	0.2323	0.1360	0.3523

It is evident from the table that the Cronbach's α value for each factor after rotation significantly exceeds 0.7. The first factor primarily represents the exploration of the information system and human resource management, while the second factor reflects the exploration of the organizational structure and control procedures. Collectively, these two factors encapsulate the exploratory dimensions of the administrative control system.

As for the third factor, it primarily reflects the control aspects of the organizational structure, processes, and human resource management. Similarly, the fourth factor mainly represents the control aspect of the information system. Together, these two factors capture the control dimensions of the management control system. The results of the factor analysis indicate that the initial categorization method is generally accurate, and the Cronbach's α values for each factor after rotation are significantly higher than 0.7.

To assess whether the management control system represents the sole latent variable, we calculate the mean score for each factor and conduct a secondary factor analysis. The results demonstrate that these four variables can be loaded onto a single factor with an eigenvalue of 3.0930, accounting for 77.32% of the variance, and a Cronbach's α value of 0.90163. Consequently, in our data, a single factor can effectively represent the concept of the management control system for further hypothesis testing. Additionally, to examine the influence of control and exploration, we combine the average scores of the first and second factors as the "exploration" variable, while the mean scores of the third and fourth factors are combined as the "control" variable for separate analysis.

Next, a principal component analysis and maximum variance rotation were conducted on 15 items related to the performance of the Company. During the analysis, one question with a factor loading less than 0.4 or two factor loadings greater than 0.4 were omitted, resulting in the identification of three factors. The rotated factor positions are displayed in Table 5 after the rotation.:

Table 5 Results of the analysis of Companie performance factors

Project	Address No.	Worker 1	Worker 2	Worker 3
Eigenvalues		3.9393	3.1382	3.0739
Explanation of Contrast Ratio (%)		28.14	22.41	21.96
αα		0.9005	0.8541	0.9045
operating profit margin	77	0.8976	0.2546	0.0698
Operating profit growth rate	75	0.8846	0.1983	0.1303
Core business income growth rate	76	0.8725	0.2357	0.1324
Return on total assets before tax	78	0.7941	0.3246	0.2224
innovativeproducts	71	0.5309	0.3453	0.0969
Quality and reliability	64	0.2070	0.8145	0.1751
customers satisfaction	70	0.1627	0.7717	0.2653
Overalllaborproductivity	65	0.3644	0.7462	-0.0164
competitive position	72	0.4859	0.6379	0.1528
marketshare	73	0.3979	0.5581	-0.1016
InternalLossCost Ratio	67	0.1714	0.0473	0.9364
ExternalLossCost Ratio	68	0.1741	0.0725	0.9283
Product defect rate	66	0.0099	0.1153	0.9146
Production cycle and delivery lead time	69	0.1447	0.4460	0.5154

It is evident from the results of the factor analysis that the Cronbach's α value for each factor after rotation is significantly higher than 0.7. The first factor primarily reflects financial performance, the second factor represents customer and market performance, and the third factor pertains to internal operational performance.

To calculate the score for each factor, we take the average value of the items within each factor. Subsequently, a secondary factor analysis is conducted on the factor scores to assess whether the Company's performance can be represented by a single latent variable. The results of the factor analysis indicate that these three variables can be loaded onto one factor with an eigenvalue of 2.1610, accounting for 72.04% of the variance, and a Cronbach's α value of 0.8030. Therefore, in our data, a single factor can effectively represent the concept of Company performance.

5.2 Descriptive Statistics:

Table 6 provides descriptive statistics for each variable, including total quality management, monitoring and supervision, Company performance, and several control variables.

Table 6 Descriptive statistics for each variable

Variable	N	Mean	Std	Minimum	Maximum
TQM implementationlevel	90	6.251	1.425	2.500	8.792
The overall result of the management control system	90	5.986	2.186	1.343	8.153
degreeafter control	90	6.220	1.374	1.972	8.556
Dimension degree	90	5.753	1.406	2.083	8.417
degreeafter exploration	90	6.101	1.216	3.111	8.583
Overall result of the company's performance	90	6.117	1.554	1.500	9.000
marketcompetition	90	2.747	2.245	1.000	9.000
For manufacturing establishments	90	0.700	0.461	0.000	1.000
Whether it's my service establishments	90	0.389	0.490	0.000	1.000

It is evident from the results that the average degree of total quality management implementation for the sample Companies is 6.251, which is 1.251 higher than the standard value of 5. This indicates that, in general, the Companies have placed importance on quality management, although further strengthening of implementation is necessary. The average degree of the comprehensive variables of the administrative control system, control dimensions, and exploration dimensions are 5.986, 6.220, and 5.753, respectively. These values are all higher than the standard score of 5, indicating good implementation of the overall administrative control system in the sample Companies. The maximum values for these variables are 8.153, 8.556, and 8.417, respectively, indicating that some Companies have achieved a high level of management control system implementation close to the maximum score of 9 points. However, there is a wide range of variation in these three variables, indicating significant differences in the implementation of the administrative control system among Companies.

The average score for the control dimension is considerably higher than the exploratory dimension, suggesting that, at this stage, Companies primarily rely on standardization and formal control in their management accounting, with decentralization and flexibility playing a secondary role. Among the sample Companies, the minimum overall performance score was 3.111, the maximum was 8.583, and the average was 6.101. This indicates that, generally, the surveyed Companies express satisfaction with their performance, with a range of 5.472 points highlighting performance

differences among larger Companies. The average degree of market competition value is 6.117, indicating that, with the establishment of the market economy, there is significant competition among Companies. This external motivation for competition has further incentivized Companies to engage in quality management practices.

5.3 Hypothesis testing:

This section examines the hypothetical relationship between total quality management and administrative control, as well as the degree of alignment between total quality management and administrative control with Companie performance.

Table 7 presents the results of the regression analysis assessing the relationship between the level of total quality management implementation and the management control system. The analysis indicates that, even after controlling for other variables, there remains a significant and positive correlation between the management control system, control dimensions, exploration dimensions, and the total quality system (supporting the first hypothesis).

Table 7 regression analysis of the relationship between total quality management, control and supervision

	variable explanation		
Explanatory variables	The overall result of the management control system	TQM implementationlevel	degreeafter control
TQM implementationlevel	0.849***	0.823***	0.875***
	(0.000)	(0.000)	(0.000)
Marketcompetition	0.028	0.004	0.052
	(0.575)	(0.943)	(0.343)
Whether it is a manufacturing Companie	0.047	0.138	-0.043
	(0.807)	(0.536)	(0.837)
Whether it is the Companie of my servants	-0.519***	-0.364*	-0.673***
	(0.004)	(0.077)	(0.001)
The impact of legal legislation on decision-making regarding rewards and penalties for employees	-0.021	-0.047	0.004
	(0.659)	(0.402)	(0.938)
	(0.292)	(0.247)	(0.478)
n	90	90	90
RSQ	0.740	0.672	0.717
F. value	39.430***	28.310***	35.080***
P. value	(0.000)	(0.000)	(0.000)

In the three equations, the coefficients for total quality management (TQM) are 0.849, 0.823, and 0.875, all of which are significant at a level of less than 0.1%. This indicates a consistently strong positive relationship between TQM and the management control system. Additionally, the regression coefficients for the unknown variable are -0.519, -0.364, and -0.673, respectively. Apart from the second coefficient, which is significant at the 10% level in a two-tailed test, the other coefficients are significant at the 1% level. These coefficients suggest that the implementation of the management control system is lower in manufacturing Companies compared to service Companies. One possible explanation for this difference is that tangible products produced by manufacturing Companies are easier to monitor, making result control a predominant method of control. On the other hand,

in industrial establishments, where direct observation of results is challenging, controlling behavior becomes more essential.

Table 8 presents a regression equation that examines the impact of the degree of cooperation between the management control system and the total quality system on performance (the second hypothesis). The regression analysis is conducted on two sub-samples: one with total quality management implementation equal to or above the average, and the other with implementation below the average. The goal is to determine whether the interaction term between the administrative control system and the level of TQM implementation is significantly positive. The regression coefficient for the interaction term (Total Quality System - Management Control System) is 0.094, and it is significant at the 10% level in a two-sided test. This indicates that Companies with a high level of TQM implementation exhibit better performance when the implementation of the management control system is also high. Moreover, when examining the impact of the control dimension and the exploration dimension on TQM performance, the regression coefficient for the exploration dimension and the interaction level of TQM implementation (Total Quality System - Exploration) is 0.097, significant at the 5% level in a two-tailed test. The regression coefficient for the control dimension and the interaction term of TQM implementation (TQM - Exploration) is 0.073, showing expected results, but it is significant only at the 10% level in a one-tailed test. These findings indicate that exploration has a more pronounced impact on TQM compared to the control dimension. This can be attributed to TQM being an advanced manufacturing strategy that emphasizes continuous improvement, requiring constant evaluation of past practices and the discovery of new possibilities for competitive advantage. As a result, the administrative control system needs to increase its exploration efforts. Overall, the empirical test supports the hypothesis that the management control system positively impacts TQM performance.

The results also explore whether the combination of control and exploration in the management control system enhances the impact on TQM performance. This is examined through a regression analysis on two sub-samples: one with TQM implementation equal to or above the average, and

the other with implementation below the average. In addition to the three two-way interaction terms (TQS-Control, TQM-Exploration, and Control-Exploration), a three-way interaction term (TQS-Control-Exploration) is introduced. If the coefficient of the three-way interaction term is significantly positive, it indicates that the partnership between the control and exploration dimensions enhances the impact on TQM performance. The regression results show that the coefficient for the three-way interaction term is 0.821, slightly higher than the 10% significance level in a two-tailed test. Furthermore, the coefficient for the three-way interaction term is 0.415. The scores of the three-way interaction coefficients in the two equations align with expectations, but the significance level in a two-tailed test approaches 10% only in the group

with the highest level of TQM implementation, while it is not significant in the lower group. This partially demonstrates that in organizations with a high level of TQM implementation, the control and exploration dimensions of the management control system not only enhance the impact on TQM performance individually but also their combined contribution plays a greater role in promoting performance (supporting the second hypothesis). In other words, when the levels of control in the management control system, exploration, and implementation of total quality management are higher, Companies can achieve higher performance.

Table 8: The effect of the management control system on the impact of TQM performance

	The interpreted variable: perf				
Explanatory variables	(1)	(2)	(3)	(4)	(5)
Total Quality System	-0.314	-0.122	-0.271	42.982*	4.757
	(0.336)	(0.721)	(0.346)	(0.090)	(0.344)
Management control system	-0.211				
	(0.517)				
Control		-0.178		46.477*	7.924
		(0.584)		(0.065)	(0.221)
Exploration			-0.284	37.323	9.842
			(0.357)	(0.170)	(0.165)
Total quality and management control	0.094*				
	(0.062)				
Total quality and control		0.073		-6.567*	-1.376

		(0.166)		(0.057)	(0.268)
Total quality and exploration			0.097**	-5.277	-1.657
			(0.037)	(0.156)	(0.203)
Control and exploration				-5.787	-2.363
				(0.116)	(0.163)
Total quality, control and exploration				0.821	0.415
				(0.101)	(0.176)
Marketcompetition	-0.108	-0.101	-0.111	0.093	-0.290**
	(0.140)	(0.178)	(0.128)	(0.284)	(0.041)
n	90	90	90	50	40
RSQ	0.378	0.353	0.384	0.502	0.422
F. value	5.120***	4.600***	5.260***	2.640**	1.350
P. value	(0.000)	(0.000)	(0.000)	(0.012)	(0.255)

N.B.: The value in parentheses represents the p-value. "2. *" indicates that the two-tailed test is significant at the 10% level, "**" indicates significance at the 5% level, and "***" indicates significance at the 1% level.

6. CONCLUSION

In our study, we based our research model on contingency theory, and we derived several key findings regarding the level of total quality management implementation, the administrative control system, and Companies' performance based on a modern scientific research model. We used a questionnaire as a research and survey tool in the selected Companies. To ensure the reliability and validity of the collected data, we employed rigorous measurement methods. Additionally, multivariate statistical analysis and econometric analysis were used to examine the relationship between total quality management, the administrative control system, and performance.

The results of our study indicate that Algerian Companies have achieved a certain level of total quality management and administrative control system implementation. However, there exists a significant variation among Companies. The administrative control system, as an important support mechanism for the total quality management strategy, is closely associated

with total quality management. When the level of total quality system implementation is high, the level of administrative control system implementation is also high. Furthermore, the interaction between total quality management and the administrative control system has clear economic implications. A higher degree of alignment between total quality management and the administrative control system leads to better Company performance, particularly in the context of total quality management. Both factors contribute to improved Company performance.

Although this study provides valuable evidence to verify the relationship between total quality management and supervision, there are a few limitations that should be acknowledged:

First, due to time and resource constraints, we were unable to conduct long-term and in-depth field studies on the management practices within the surveyed Companies. Long-term tracking of the design and implementation of quality management and the management control system would provide valuable insights for a more comprehensive understanding of quality management and control patterns in the management of national Companies, along with a more nuanced interpretation of a larger and more detailed sample of data.

Second, the majority of respondents were from the public administration and financial accounting departments, while fewer individuals were from the quality management department. This bias can be attributed to the fact that respondents with accounting knowledge have closer interactions with the accounting personnel of the Companies, and financial personnel naturally became the main contacts between us and the Companies. However, we ensured through phone calls and emails that most contacts sought assistance from the quality management staff in answering the questions related to total quality management. Additionally, given that the questionnaire covered a wide range of topics, accounting personnel, who hold pivotal positions within organizations and have a good understanding of total quality management, the management control system, and Company performance, were suitable respondents for the questionnaire. Therefore, we believe that the nature of the questions did not significantly impact the research conclusions.

Lastly, the sample size could be increased. Although the number of collected questionnaires in this study exceeded the minimum requirement for statistical calculations, a larger sample size would provide greater confidence in the stability of the research results.

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