ISBN: 978-628-95207-8-1. ISSN: 2414-6390. Digital Object Identifier: 10.18687/LACCEI2024.1.1.1164

Optimizing Nanostore Performance in Honduras: Interplay of Total Quality Management, Adaptability, and Reconfigurability

Cesar H. Ortega Jimenez, PhD[1], Andrea Amador Matute, MBA[2], Jennifer D. Cruz-Amaya, Eng[3] and Narciso Antonio Melgar-Martinez, Eng.[4]

[1,] Faculty of Engineering-CU, Universidad Nacional Autónoma de Honduras, Honduras, cortega@unah.edu.hn,
[2]Faculty of Engineering, Universidad Nacional Autónoma de Honduras, Honduras, andrea_amador@unah.hn,
[3]Faculty of Engineering, Universidad Nacional Autónoma de Honduras en el Valle de Sula, jdcruza@unah.hn,
[4]Faculty of Engineering-UNAH-VS, Universidad Nacional Autónoma de Honduras, Honduras, narciso.merlgar@unah.edu.hn

Abstract- This study presents a theoretical model rooted in Resource Theory and Contingency Theory, examining the integration of Total Quality Management (TQM) and reconfigurability with adaptability and performance in nanostores. With responses from 143 nanostore owners, regression analysis supports two key findings: (i) higher TQM implementation increases the likelihood of nanostores adopting adaptability as an operational strategy; (ii) reconfigurability moderates the relationship between TQM levels and adaptability implementation, contributing to enhanced efficiency. Incorporating resource-based theory, the study explores the role of TQM and reconfigurability in achieving performance through adaptability. Practical guidance for practitioners and nanostore owners seeking improved performance through adaptability is provided, along with proposed avenues for future research.

Keywords: adaptability, total quality management, nanostore, performance, reconfigurability.

I. Introduction

In recent years, adaptability (ADA) has garnered significant attention due to its responsiveness to sudden market changes, offering unique advantages over traditional operations in terms of cost and affordability[1][2]. ADA, synonymous with agility, emerges as a pivotal operations strategy contributing to retail survival[3][4]. Despite abundant literature on ADA design, research on its implementation and impact on nanostore performance remains scarce. Conditions favoring ADA improvement in nanostore performance and the unexplored role of Total Quality Management (TQM) and reconfigurability (REC) in ADA necessitate empirical investigation[5][6][7]. This study addresses these three gaps through a survey of 143 nanostore owners, developing and evaluating a theoretical model that explores the moderating role of REC in the influence of TQM on ADA, and the subsequent impact of ADA on nanostore performance.

Furthermore, grounded in Contingency Theory (CT)[8], we posit that TQM's effectiveness in achieving ADA in nanostores depends on organizational context and external factors, moderated by REC. Additionally, drawing on Resource-Based Theory (RBT) [9], we argue that an organization's unique resources and capabilities, when aligned with TQM practices, are key determinants of competitive advantage. Despite RBT's popularity, its application to explore TQM within ADA in nanostores remains unexplored, making this study a novel contribution to Operations Management (OM) and Supply Chain Management (SCM) research [10][11].The first objective is of this study is to investigate the influence of TQM on ADA in nanostores, closing the research gap in understanding this relationship, especially within the unique context of nanostores[12][13]. The second objective explores the influence of TQM on ADA, considering the moderating role of REC in nanostores, shedding light on specific mechanisms through which TQM practices can enhance ADA. The third objective examines the relationship between ADA and Performance in nanostores, addressing the research gap in understanding the impact of adaptability on competitive performance within the distinct context of nanostores.

The section II presents the literature review and theoretical framework integrating RBT, followed by the section III, which explains the development of the research model, operationalization of constructs and data collection, model testing results, and a comprehensive discussion of findings, their theoretical and managerial implications, and avenues for future research in section IV. The paper concludes by summarizing key findings and outlining future research directions (section V).

II. Concepts and Hypothesis

We have structured our literature review and theoretical framework based on two foundational elements: Resource-Based Theory (RBT) and Contingency Theory (CT) (See Fig. 1).

Digital Object Identifier: (only for full papers, inserted by LACCEI).
ISSN, ISBN: (to be inserted by LACCEI).
DO NOT REMOVE

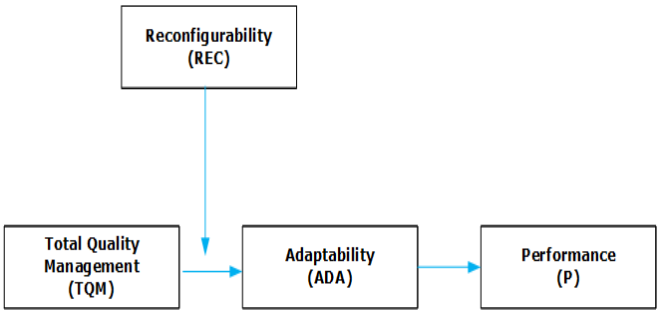

Figure 1. Theoretical framework.

The definitions of the basic concepts of our framework are extrapolated in Table I (which also includes the measures for each of our concepts, to be introduced later in the study).

TABLE I
THEORETICAL MODEL BUILDING BLOCKS AND THEIR ELEMENTS.

Scale	Reference	Interpretation
Total Quality Management (TQM)	[14]	In this world of stiff competition and globalization, total quality management has become the need and requirement of every customer; since it is imperative to win the competitive game, quality is a mandatory factor to retain customers.
Reconfigurability (REC)	[15]	According to the author, high-performance supply chains must be agile, adaptable, and aligned with the interests of the supply network if they are to have a sustainable competitive advantage.
Adaptability (ADA)	[16]	Supply chains in Latin America face several challenges, such as poor infrastructure, expensive and inefficient logistics networks, lack of economic integration, limited supply of skilled professionals, political and economic uncertainty, social concerns, geographic obstacles, poor supplier relationships, among others.
Performance (PR)	[16]	Measuring the performance of organizations is increasingly becoming an element of competitiveness and differentiation between those companies capable of doing so and those that are not.

Source: Own elaboration

A. *Adaptability and Competitive Performance*

While TQM is acknowledged as vital in various developments, its influence on ADA, especially in nanostores, is underexplored. The research context delves into the effectiveness of TQM practices in fostering ADA, considering factors like organizational structure, leadership style, and market conditions. TQM's emphasis on continuous improvement, customer satisfaction, and employee involvement aligns with adaptability principles. Previous studies in manufacturing industries demonstrate a positive relationship between TQM practices and organizational adaptability [17]. Our study extends this understanding to nanostores, investigating the impact of TQM on ADA.

B. *Reconfigurability, Total Quality Management and Adaptability*

Reconfigurability, denoting an organization's restructuring ability to adapt, enhances ADA by enabling quick responses to environmental changes. TQM practices contribute to adaptability, but their effectiveness may vary based on reconfigurability levels within the organization. High reconfigurability enables swift implementation of TQM practices, enhancing adaptability. The research model posits that the influence of TQM on ADA is amplified with high reconfigurability. This hypothesis addresses the moderating role of REC in the relationship between TQM and ADA in nanostores.

Several studies have explored the relationship between TQM, REC, and ADA in the general organizational context. For example, the impact of TQM practices on organizational adaptability in the manufacturing sector has been investigated[18]. In addition, the role of reconfigurability as a moderating factor in the relationship between TQM practices and ADA has been explored[19].

Several studies have explored the impact of adaptability on organizational performance in various industries and contexts. For example, Chatman [12] found a positive relationship between organizational adaptability and performance in the technology manufacturing sector. Similarly, Diaz [20] examined the relationship between adaptability and performance in service organizations. They found that service firms characterized by higher adaptability were more successful in achieving competitive advantage and superior financial performance.

Competitive performance refers to the ability of an organization to achieve superior results compared to its competitors in a specific industry. It often involves outperforming others in areas such as sales, market share, profitability, customer satisfaction, innovation, or other relevant metrics[21]. Thus, this research provides valuable information on how adaptability can contribute to the success and performance of these small retail establishments. In addition, it investigates the specific mechanisms through which adaptability influences the performance of nanostores, such as reconfiguration capacity, customer market knowledge, competitor knowledge, and change adaptation design.

C. *Adaptability and Competitive Performance of Nanostores*

Nanostores, operating in dynamic and competitive markets with resource constraints, rely on adaptability for survival and success. ADA facilitates quick adjustments in strategies, product offerings, and customer engagement, crucial for achieving higher performance results. Nanostores with higher ADA are better positioned to identify market trends, capitalize on opportunities, and improve customer satisfaction.[22] The proposed research model aims to examine the direct positive influence of ADA on the performance of nanostores.

D. *Confounding Variable*

To account for differences in nanostores, the study incorporates a confounding variable: nanostore operation time. This variable is assumed to affect adaptability as one of the operational strategies. The effect of the confounding variable is illustrated in Figure 2.

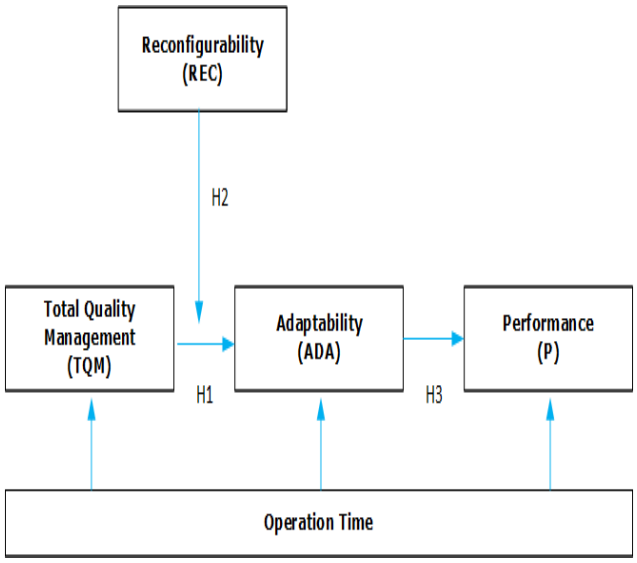

Figure 2. Research Model
Source: Own elaboration

The subsequent sections will elaborate on the hypotheses, discuss the research model, and present the methodology, results, and implications for both theory and practice.

In our study, a survey-based technique was employed to gather data. A questionnaire was meticulously developed, drawing upon existing literature to ensure comprehensive coverage of constructs in the research model (see Table I). To avoid scale proliferation, we adopted or modified measures from previously validated scales. To enhance reliability and validity, multiple-item constructs were utilized [23]. A minimum of four items was employed for each construct, and Exploratory Factor Analysis (EFA) was conducted to assess the operationalization of constructs [23].

III. Research Design

A. *Methodology and Data Collection*

The survey targeted owner-managers of nanostores in Honduras. The research instrument consisted of a 114-question questionnaire designed to assess various scales of nanostore performance over a period of approximately 2 months. The questionnaires were administered via online platforms, including [mention specific platforms], with the assistance of interviewers to aid in the understanding of the questions.

A total of 143 potential nanostores were directly selected for participation. The selection process involved [mention specific criteria or method, e.g., random sampling, stratified sampling]. Efforts were made to ensure a diverse representation of nanostores across different regions and socio-economic backgrounds.

A two-stage approach was utilized for data collection, involving direct questionnaires, online or email surveys, and follow-up calls. The rationale behind this approach was to maximize response rates and ensure data completeness. Interviewers helped in clarifying questions and addressing any language barriers that respondents may have encountered.

Respondents were assured of the confidentiality of their personal data, and informed consent was obtained before participation. Ethical considerations were paramount throughout the research process, with measures in place to uphold the rights and privacy of all participants.

B. *Demographic Profiles of Respondents*

A 100% response rate was achieved, with all 143 responses deemed complete and usable for analysis. The demographic profiles of the respondents are summarized in Table II.

TABLE II
Demographic Profiles of Respondents

	Range	Number of respondents	Percentage of respondents
Money invested in the business per year (USD)	>80,000	1	1%
	61,001-80,000	3	3%
	40,001-61,000	3	3%
	20,500-40,000	3	3%
	<20,500	105	91%
Operation time (years)	>20	24	17%
	15y20	22	15%
	10y14	21	15%
	5y9	27	19%
	1y4	48	34%
Weekly income (USD)	>80	95	84%
	60-80	10	9%
	40-59	4	4%
	20-39	3	3%
	<20	1	1%
Number of employees	Over 5	7	5%
	4 y 5	21	15%
	3	28	20%
	1 y 2	87	61%

Source: Own elaboration

Table II illustrates the distribution of respondents based on key demographic variables, including money invested in the business per year, operation time, weekly income, and number of employees. It provides insights into the diversity of nanostores represented in the study, spanning different investment levels, operational durations, and workforce sizes.

C. *Non-response Bias*

A non-response bias test was conducted in two waves, comparing early and late respondents. The t-test analysis revealed no statistically significant differences (p=0.36), indicating that non-response bias is not a significant issue in our study.

D. *Assessment of Psychometric Properties*

All survey items were measured using five-point Likert-type scales (1=strongly disagree to 5=strongly agree). Before evaluating reliability and validity, we checked for constant variance, outliers, and normality. EFA was employed for convergent validity and unidimensionality testing.

We use residual plots by predicted values, residual range plots, and skewness and kurtosis statistics. To detect multivariate outliers, we use Mahalanobis distances of predicted variable [25]. The maximum absolute value of skewness is less than 2 and the maximum absolute value of kurtosis is less than 5, which is within the limits[26]. Cronbach's value was found to be greater than 0.7 for each construct item, indicating that the questionnaire is reliable and suitable for a survey [27].

The reliability and validity of measurement items were assessed using Cronbach's alpha, Spearman-Brown coefficient, Bartlett's sphericity test, and Kaiser-Meyer-Olkin measure of sampling adequacy (KMO). The factor analysis results are presented in Table III, indicating satisfactory reliability and validity.

A center-level reliability analysis was conducted for each scale to assess internal consistency. Reliability was measured using Tau equivalent reliability (ρτ), also known as Cronbach's alpha. Following Nunnally & Bernstein [28], we used a score of 0.6 or higher as a criterion for a reliable scale.

TABLE III
FACTOR ANALYSIS FOR INDEPENDENT VARIABLES

Item	F1	F2	F3
I care about what my customers think about my shop and the products I offer.	0.62		0.55
People who come to my shop always find what they are looking for.	0.54		0.55
The customers we serve always come back to buy again.	0.86		
The quality of my products makes my customers happy.	0.85		
We make the best use of resources, such as space, shelves, when introducing new products and services.		0.60	
We are accessible when we implement changes (deals, promotions, new services) to improve our service and meet the needs of our customers.		0.66	
We consider the needs of our customers when ordering products.		0.74	
We take advantage of social networks to increase proximity and attention to clients			0.43
Manage in-store inventory of best-selling products to supply customers.		0.52	0.36
I have alternative suppliers in case one of them does not deliver.		0.39	
Eigenvalues	2.32	2.02	1.11
Percentage of variance	23.2	20.2	11.1
Cronbach's α	0.89	0.75	0.6

Source: Own elaboration

The construction of TQM (F1) emphasizes the incorporation of happiness caused by products in the customer. It characterizes the concept of happiness oriented towards customer satisfaction. Since there is no theoretical basis, we use judgement and inductive reasoning to develop the F1 program construct.

Underlying measures of the F1 program construct include knowledge of customer feedback, customers find the products they are looking for, customers return to the shop, product quality makes customers happy. The F2 construct captures the essence of the ECN. The importance of F2 in supply chain management is well documented in the literature[29]. Specific measures underlying the F2 connectivity construct include Use of social networks, utilization of physical space, implementation of changes, attention to customer needs. The F3 construct captures the essence of the ADA. The importance of F3 in supply chain management is well documented in the literature[2].Specific measures underlying the F3 connectivity construct include change appropriateness design.

The dependent variable Performance (Z) is a multidimensional construct, which captures the different characteristics of competitive performance. Thus, in this exploratory study, we first conduct a factor analysis to extract the relevant factors for the study. A separate analysis is performed for the independent and dependent variables. To begin with, we use many items, but subsequently we eliminate items with low factor loadings or very high cross-loadings.

We obtain 4 factors: Program Adaptability, Total Quality Management, and Reconfigurability, as independent variables and Competitive Performance as our outcome variable. The results of the factor analysis are shown in Table IV (performance).

TABLE IV
FACTOR ANALYSIS FOR DEPENDENT VARIABLES

Item	Z
High product quality	0.74
Diversity of products and presentations	0.74
Timely and prompt service	0.71
Opening hours	0.70
Payment methods and cash handling	0.69
Product/service performance	0.57
Low prices	0.51
Eigenvalues	3.18
Percentage of variance	45.4
Cronbach's α	0.841

Source: Own elaboration

Table IV shows the analysis carried out for the conformation of the aforementioned factors, where the selected items have a factor load greater than 0.3. Reliability was measured by calculating Cronbach's alpha, where a score greater than or equal to 0.6 was used as a reliability criterion, in this case the value obtained was 0.841, well above the cut-off value; the percentage of variance obtained was 45.4%, which indicates that the 7 items evaluated are attributed this percentage of variation in the data analyzed.

To evaluate the measurement model before testing the research model, JAMOVI and SPSS were used to run an exploratory factor analysis (EFA). This study extensively investigated previous studies and identified each construct with tested reliability and validity. Experts in operations assessed the content validity of 3 scales and 11 items after reviewing them. In addition, an AFE was used to test whether the measured items, which are observed variables, adequately constitute the latent variables. Table V and VI present the reliability and validity of the measurement model, where 3 valid and reliable scales for each construct and their relationships are developed with the SFA. For both tables, we used dimension reduction by extraction method, principal component analysis (PCA); varimax rotation method with Kaiser normalization, where the rotation converged in 10,000 iterations.

E. Reliability and Validity Assessment Independent Variables

Tables V and VI present reliability and validity assessments for the independent variables, focusing on Total Quality Management (TQM), Reconfigurability (REC), and Adaptability (ADA).

TABLE V
RELIABILITY AND VALIDITY AFE FOR INDEPENDENT VARIABLES

Item	TQM	REC	ADA
Spearman-brown Coefficient	0.51	0.394	0.33
Cronbach's α based on standardized items (α) and no. of scales representing the formation of components	α=0.89 N= 4	α= 0.75 N= 5	α= 0.68 N= 4
Bartlett's sphericity test	χ^2=70, df=3, p= 0.00(<0.01)		
Kaiser-Meyer-Olkin measure of sampling adequacy (KMO)	0.66>0.5		

Source: Own elaboration

The principal component method with Varimax rotation is used to include as many factors as possible for easy identification of constructs and to avoid multiple loadings on the constructs[30]. The PFA is run by JAMOVI, to automatically calculate the number of factors to be extracted, with specified suppression value below 0.33. Item-total correlations for all 3 scales were >0.33, suggesting that no scale modification is necessary [31]. The internal consistency reliability, (Cronbach's α) for 3 extracted components was observed to range from 068 to 0.89 which was above 0.6 and therefore accepted. Internal consistency is also tested by split-half technique, which showed higher correlation with Spearman-Brown coefficient for all the items of the scale which ranged from 0.335 to 0.511 and were observed above the requirement level.

TABLE VI
RELIABILITY AND VALIDITY AFE FOR DEPENDENT VARIABLE

Item	PR
Spearman-brown Coefficient	0.23
Cronbach's α based on standardized items (α) and no. of scales representing the formation of components	α= 0.84; N=7
Bartlett's sphericity test	χ^2=642, df=45, p= 0.01 (<0.05)
Kaiser-Meyer-Olkin measure of sampling adequacy (KMO)	0.89>0.5

Source: Own elaboration

The 7 scale items exhibited a high level of potential for factoring, with a Kaiser-Meyer-Olkin (KMO) statistic of 0.893 (>0.5) and significant results pertaining to Bartlett's test of sphericity (ρ=0.01 <0.05 with χ2=642, df=45) indicating suitability for factor analysis ((Watkins, 2018). A sample size ten times larger than the scales to be measured is recommended. In this case, the adequacy of the sample size sounds good, as the study has sampled 143 and 6 scales (ratio >10). The test suggested that sampling adequacy is good with all scale constructs suitable for factor analysis.

These tables underscore the reliability and validity of the scales used in our study, affirming their suitability for further analysis. In summary, the research design ensures robust data collection, addresses potential biases, and employs rigorous methods to assess the psychometric properties of the survey instrument. The comprehensive approach supports the reliability and validity of the constructs, paving the way for subsequent hypothesis testing and analysis.

The construct validity of the data relates to the extent to which the scale items correlate positively with the other similar scale under the same component. Validity refers specifically to convergent and discriminant validity within and between sets of scale items, respectively. To assert convergent validity, scales must load strongly and significantly in the hypothesized direction. For the inclusion of a scale in a component of a similar construct, factor loadings above 0.4 are recommended. The factor loadings on the 3-item scales showed that all scales are a good construct of a similar component. There are 2 scales that have factor loadings ranging from 0.51 to 0.745, (Table IV).

Here the sample size N=143 is well above the requirement. Secondly, the average variance extracted (AVE) calculated for each construct obtained by AFE showed a value above 0.5 and the composite reliability values were found to be between 0.64 and 0.89, suggesting good convergent validity [32]. To test discriminant validity, the cross loadings of the 3 scales on the 3 constructs (between the components) were analyzed to test factor loadings above 0.4 for more than one scale between the components. However, no factor loadings above 0.4 were found across constructs for the same item scales. Discriminant validity was also confirmed by engaging pairwise scales (two constructs at a time) to perform

Principal Component Analysis (PCA) [33] which showed the extraction of two components (constructs) for each pair of constructs. This procedure demonstrated robust discriminant validity between all pairs of constructs.

For downscaling and component extraction, 10 components are extracted from 3 scales consisting of TQM, reconfigurability and adaptability items that accounted for 54.5% of the variance that exhibited an eigenvalue of 3.81 (above 1.0). The labelling of components F1, F2, F3 is based on the type of scale items they include and their relevance to the literature reviewed as presented in Section II and Table IV.

Component F1. The first latent variable (TQM), Component F1, accounted for 23.2% of the variance and arose from 4 observed items in total with Cronbach's $\alpha = 0.89$ Where, 4 observed items are related to the item of customer satisfaction.

Component F2. The second latent variable (REC), Component F2, accounted for 20.2% of the variance and emerged from 5 observed items in total with Cronbach's $\alpha = 0.75$ where, 5 observed items are related to the Reconfiguration Capability item.

Component F3. The third latent variable (ADA), Component F3, accounted for 11.1% of the variance and arose from 4 observed items in total with Cronbach's $\alpha = 0.68$ where, 2 observed items are related to the Customer Satisfaction element and 2 items are associated with the Design Adequacy of Change element.

IV. Results and Implications

We employed hierarchical regression analysis to evaluate our research hypotheses, opting for this technique due to the non-confirmatory nature of our study and the complexity of the model and data. The results of our hypotheses are summarized in Table VII, providing evidence that all three research hypotheses are supported. It is noteworthy that for Hypothesis H3, the Variance Inflation Factor (VIF) statistic exceeded the cutoff value, indicating a moderation effect.

TABLE VII
Reliability and Validity AFE for Independent Variables

Hypothesis	R^2	F	β	p	Conclusions
H1	0.169[a]	28.724	0.411	0.000	Compliant
H2	0.196[a]	4.740	0.313	0.031	Compliant
H3	0.346[a]	8154.21	0.411	0.000	Compliant

[a] Bootstrapping with 10,000 iterations, maximum likelihood model
Source: Own elaboration

We agree that ADA is associated with the reasons why companies face difficulties in implementing total quality management systems due to their lack of flexibility and adaptability. However, we also suggest that this may be beneficial in improving the performance of nanostores. Our results support the idea that the higher the adoption of ADA, i.e. the adaptability of operations within a nanostore, the higher its performance (H1); The results suggest that reconfigurability REC moderates the relationship between TQM and ADA in nanostores (H2) that the level of ADA within nanostores directly influences their performance. (H3).

A. Theoretical Implications

Our exploration of Total Quality Management (TQM) on nanostore performance, mediated by Adaptability (ADA) and moderated by Reconfigurability (REC), yielded several theoretical insights. The study indicates that TQM positively influences ADA adoption, motivating nanostore owners to actively engage in processes related to ADA, ultimately contributing to better performance. However, conflicts may arise, suggesting that the implementation of TQM might be met with resistance from owners. This extends existing research by emphasizing the nuanced relationship between TQM, ADA, and nanostore performance.

The study bridges the gap in literature related to Resource-Based Theory of the Firm (RBT) and Transaction Cost Theory (TCT). By conceptualizing TQM as operations practices translating nanostore objectives into desired actions, it sheds light on the role of TQM and its impact on nanostore performance. The study aligns with scholars suggesting that TQM affects performance both as a capability of nanostores to create or acquire resources and by contributing to Transaction Cost (TC) analysis. Our results underscore the intricate relationship between specific resources (ADA), capabilities (TQM), and performance in nanostore supply chain reconfiguration capability.

Moreover, the study contributes to the literature by demonstrating that Reconfigurability (REC) moderates the relationship between TQM implementation and ADA adoption. This addresses a gap in literature, offering insights into the role of REC in the adoption of performance operations technologies, specifically ADA, and its subsequent impact on nanostore performance.

B. Practical Implications

Our findings hold practical implications for operations managers, supply chain managers, nanostore owners, and industrial engineers. The mediating role of ADA suggests that implementing TQM practices and enhancing nanostore performance can be achieved through adaptability. Furthermore, REC is identified as a moderator that can contribute to gaining a competitive advantage through ADA.

Recommendations for nanostores include aligning ADA strategies with reconfigurability. Although this recommendation may seem generic, it emphasizes the potential benefits for nanostores actively embracing ADA in conjunction with TQM. Proper alignment between TQM, ADA, and REC can yield benefits for nanostores seeking to enhance their operational objectives and overall performance.

C. Operational Implications

Operational managers and supply chain managers should consider integrating TQM practices that foster ADA adoption, understanding the potential conflicts that may arise. Moreover, acknowledging the moderating role of REC, operational strategies should be tailored to enhance adaptability and align with ADA for improved competitive advantage.

The study highlights the importance of understanding the dynamics between TQM, ADA, and REC in the unique context of nanostores. Operational strategies should be designed to accommodate the specific challenges and opportunities posed by the nanostore environment, emphasizing the need for flexibility, adaptability, and effective resource utilization. In summary, the results provide actionable in sights for practitioners to optimize their operational strategies, enhance ADA adoption, and ultimately improve the performance of nanostores in a dynamic and competitive retail landscape.

V. Conclusions

In recent years, the importance of Adaptive Decision-making (ADA) in operations management has become increasingly apparent. To bridge these gaps in research, correlation analyses were employed to assess three hypotheses, offering empirical evidence to support our findings. Additionally, insights gleaned from a thorough review of existing literature complemented our empirical approach, providing a comprehensive understanding of the subject matter.

For this process, we formulated an integrated model that hypothesized relationships drawing from Resource-Based Theory (RBT) and Transaction Cost Theory (CT), linking TQM, REC, and ADA (Fig. 2). Our analysis, based on 143 responses, lends support to the envisioned relationships within the framework. Through the correlation analysis, it was possible to verify that TQM practices positively influence the Adaptability of nanostores (H1) as it resulted in a positive correlation between the two variables; at the same time, it was verified that REC moderates the relationship between TQM and ADA in nanostores (H2) given the correlation score obtained. It is therefore concluded that ADA positively influences nanostore R (H3) as shown in the value of R^2 of Table VII. In the subsequent section, we discuss the limitations of our study, which in turn, pave the way for future research directions.

A. Limitations of the Study

While our study offers valuable insights, it is not without its limitations. Focusing solely on nanostore operations, the results may vary when compared across different industries. The data collection being a snapshot in time raises the need for longitudinal data to establish causal relationships adequately. Additionally, the exclusion of social and economic dimensions in our model, reliance on subjective measures, and the omission of external contextual pressures all represent potential avenues for further investigation.

These limitations, rather than constraining our study, present opportunities for future research. Future studies could explore the applicability of our model across diverse industries, leveraging benchmark samples or longitudinal data to unravel causality. The inclusion of various dimensions of nanostore performance, encompassing environmental, social, and economic aspects, along with the incorporation of competitive performance constructs, offers a rich landscape for exploration.

B. Future Research Directions

Expanding the scope of our study, future research could delve into a more comprehensive analysis of various operations strategies, unraveling how each strategy complements others under varying conditions. Utilizing samples from diverse industries, employing benchmark sizes, or integrating longitudinal data can facilitate a nuanced understanding of the causal relationships between antecedents and dependent variables. The exploration of multiple cases could further illuminate the nuanced roles of TQM, ADA, and REC.

While our study pioneers the amalgamation of RBT and CT to scrutinize TQM's role in nanostore performance, its application can be extended to unravel TQM's impact on the outcomes of different operations programs such as information systems or new product development. Future studies may also broaden the REC study to analyze its implications within the national and international environment, providing a more comprehensive perspective on TQM in nanostore performance.

Considering contemporary operational trends, future research avenues might explore operating system models with a specific focus on nanostore performance. This could potentially necessitate the development of novel measures for nanostore performance, keeping pace with evolving operational landscapes. As the retail industry continues to evolve, ongoing research endeavors are crucial to illuminate and adapt to emerging paradigms in nanostore operations and performance.

Acknowledgment

Grupo de Investigación de Cadena de Suministro y Operaciones GICSO-2021-04, Facultad de Ingeniería, Universidad Nacional Autónoma de Honduras

References

[1] G. D. Whitten, W. G. Kenneth, and P. J. Zelbst, “Triple-A supply chain performance,” *Int. J. Oper. Prod. Manag.*, vol. 32, no. 1, pp. 28–48, Jan. 2012, doi: 10.1108/01443571211195727/FULL/XML.

[2] R. Dubey, N. Altay, A. Gunasekaran, C. Blome, T. Papadopoulos, and S. J. Childe, “Supply chain agility, adaptability and alignment: Empirical evidence from the Indian auto components industry,” *Int. J. Oper. Prod. Manag.*, vol. 38, no. 1, pp. 129–148, 2018, doi: 10.1108/IJOPM-04-2016-0173/FULL/XML.

[3] R. Escamilla, J. C. Fransoo, and C. S. Tang, "Improving Agility, Adaptability, Alignment, Accessibility, and Affordability in Nanostore Supply Chains," *Prod. Oper. Manag.*, vol. 30, no. 3, pp. 676–688, 2021, doi: 10.1111/poms.13309.

[4] A. Almutairi and A. Ghandour, "Enterprise Systems Adaptability and its Role to Determine Organisation Sustainability and Resilience: A Systematic Literature Review," *MENACIS2021*, Nov. 2021, Accessed: Jun. 01, 2023. [Online]. Available: https://aisel.aisnet.org/menacis2021/4

[5] D. Leończuk, "Major Features of Adaptive Supply Chains – Literature Review," *Logist. Transp.*, vol. 45–46, pp. 43–54, 2020, doi: 10.26411/83-1734-2015-1-45-3-20.

[6] S. Kjeldgaard, A. L. Andersen, and T. D. Brunoe, "Enabling adaptability and resilience of a global production network: A model to evaluate capital and operational expenses of reconfigurable production systems," *J. Manuf. Syst.*, vol. 66, pp. 142–162, Feb. 2023, doi: 10.1016/J.JMSY.2022.12.003.

[7] M. Asif, E. J. de Bruijn, A. Douglas, and O. A. M. Fisscher, "Why quality management programs fail: A strategic and operations management perspective," *Int. J. Qual. Reliab. Manag.*, vol. 26, no. 8, pp. 778–794, 2009, doi: 10.1108/02656710910984165/FULL/XML.

[8] G. J. Zapata Rotundo and A. M. Martínez, "El cambio en la organización: un estudio teórico desde la perspectiva de control externo," *Estud. Gerenciales*, vol. 27, no. 119, pp. 79–98, Apr. 2011, doi: 10.1016/S0123-5923(11)70158-9.

[9] P. Bromiley and D. Rau, "Operations management and the resource-based view: Another view," *J. Oper. Manag.*, vol. 41, pp. 95–106, Jan. 2016, doi: 10.1016/J.JOM.2015.11.003.

[10] I. A. Arana-Solares, R. Alfalla-Luque, and J. A. D. Machuca, "Análisis de las variables que proporcionan una competitividad sostenible de la cadena de suministro," *Intang. Cap.*, vol. 8, no. 1, pp. 92–122, 2012, doi: 10.3926/IC.255.

[11] R. McIvor, A. Wall, P. Humphreys, and A. McKittrick, "A Study of Performance Measurement in The Outsourcing Decision," *A Study Perform. Meas. Outsourcing Decis.*, 2009, doi: 10.1016/C2009-0-20132-2.

[12] M. R. Acevedo-Amaya and C. H. Ortega-Jimenez, "Caracterización de las nanostore durante el período 2020-2022.," *Univ. y Soc.*, vol. 15, no. 1, pp. 571-587., Jan. 2023, Accessed: Jun. 17, 2023. [Online]. Available: https://rus.ucf.edu.cu/index.php/rus/article/view/3574

[13] R. Escamilla, J. C. Fransoo, and C. S. Tang, "Improving Agility, Adaptability, Alignment, Accessibility, and Affordability in Nanostore Supply Chains," *Prod. Oper. Manag.*, vol. 30, no. 3, pp. 676–688, Mar. 2021, doi: 10.1111/POMS.13309.

[14] H. Singh and B. Singh, "Total Quality Management: Today's Business Excellence Strategy," *Int. Lett. Soc. Humanist. Sci.*, vol. 32, pp. 188–196, Jun. 2014, doi: 10.18052/WWW.SCIPRESS.COM/ILSHS.32.188.

[15] T. N. Company, "The sustainabilit y imperative Brands that," no. October, pp. 1–19, 2015.

[16] A. José Juan Saiz and O. B. Ángel, "La medición del rendimiento en el ámbito de la cadena de suministro," 2004.

[17] P. Durana, P. Kral, V. Stehel, G. Lazaroiu, and W. Sroka, "Quality Culture of Manufacturing Enterprises: A Possible Way to Adaptation to Industry 4.0," *Soc. Sci. 2019, Vol. 8, Page 124*, vol. 8, no. 4, p. 124, Apr. 2019, doi: 10.3390/SOCSCI8040124.

[18] H. Balfaqih, Z. M. Nopiah, N. Saibani, and M. T. Al-Nory, "Review of supply chain performance measurement systems: 1998–2015," *Comput. Ind.*, vol. 82, pp. 135–150, Oct. 2016, doi: 10.1016/J.COMPIND.2016.07.002.

[19] K. Baird, K. J. Hu, and R. Reeve, "The relationships between organizational culture, total quality management practices and operational performance," *Int. J. Oper. Prod. Manag.*, vol. 31, no. 7, pp. 789–814, Jun. 2011, doi: 10.1108/01443571111144850/FULL/XML.

[20] A. Díaz, C. Zarate, and G. de Organizaciones, "Cultura organizacional y desempeño laboral de la Dirección Regional de Salud Cusco, 2021," *Repos. Inst. - UCV*, 2021, Accessed: Jun. 18, 2023. [Online]. Available: https://repositorio.ucv.edu.pe/handle/20.500.12692/67634

[21] I. Maganha, C. Silva, and L. M. D. F. Ferreira, "The impact of reconfigurability on the operational performance of manufacturing systems," *J. Manuf. Technol. Manag.*, vol. 31, no. 1, pp. 145–168, Jan. 2020, doi: 10.1108/JMTM-12-2018-0450/FULL/XML.

[22] C. H. O. Jiménez, A. M. A. Matute, J. S. P. López, N. A. M. Martínez, and J. D. C. Amaya, "Entorno competitivo de Nanostores durante Covid-19: Adaptabilidad para mayor rendimiento en Honduras.," *Univ. y Soc.*, vol. 14, no. 6, pp. 473-483., Nov. 2022, Accessed: Feb. 26, 2023. [Online]. Available: https://rus.ucf.edu.cu/index.php/rus/article/view/3397

[23] M. Martínez Miguélez, "Validez y confiabilidad en la metodología cualitativa," *Paradígma*, vol. 27, no. 2, pp. 07–33, 2006, Accessed: Jun. 18, 2023. [Online]. Available: http://ve.scielo.org/scielo.php?script=sci_arttext&pid=S1011-22512006000200002&lng=es&nrm=iso&tlng=es

[24] C. H. Ortega-Jimenez, A. Amador-Matute, J. Parada-Lopez, D. Zavala-Fuentes, and S. Alvarado-Sevilla, "A meta-analysis of Nanostores: A 10-year assessment," in *Proceedings of the LACCEI international Multi-conference for Engineering, Education and Technology*, 2022, vol. 2022-Decem. doi: 10.18687/LEIRD2022.1.1.101.

[25] H. Ghorbani, "MAHALANOBIS DISTANCE AND ITS APPLICATION FOR DETECTING MULTIVARIATE OUTLIERS," *Facta Univ. Ser. Math. Informatics*, p. 583, Oct. 2019, doi: 10.22190/FUMI1903583G.

[26] D. Dorić, E. Nikolić-Dorić, V. Jevremović, and J. Mališić, "On measuring skewness and kurtosis," *Qual. Quant.*, vol. 43, no. 3, pp. 481–493, May 2009, doi: 10.1007/S11135-007-9128-9/METRICS.

[27] M. Tavakol and R. Dennick, "Making sense of Cronbach's alpha," *Int. J. Med. Educ.*, vol. 2, p. 53, Jun. 2011, doi: 10.5116/IJME.4DFB.8DFD.

[28] J. Nunnally and I. H. Bernstein, "The Assessment of Reliability. Psychometric Theory, 3, 248-292. - References - Scientific Research Publishing," 1967. https://www.scirp.org/(S(i43dyn45teexjx455qlt3d2q))/reference/ReferencesPapers.aspx?ReferenceID=1960143 (accessed Jul. 30, 2022).

[29] S. Zidi, N. Hamani, and L. Kermad, "New metrics for measuring supply chain reconfigurability," *J. Intell. Manuf.*, vol. 33, no. 8, pp. 2371–2392, Dec. 2022, doi: 10.1007/S10845-021-01798-9/FIGURES/6.

[30] A. D. Wu, "Varimax Loadings," *Encycl. Qual. Life Well-Being Res.*, pp. 6915–6916, 2014, doi: 10.1007/978-94-007-0753-5_3150.

[31] M. W. Watkins, "Exploratory Factor Analysis: A Guide to Best Practice," *J. Black Psychol.*, vol. 44, no. 3, pp. 219–246, Apr. 2018, doi: 10.1177/0095798418771807/ASSET/IMAGES/LARGE/10.1177_0095798418771807-FIG1.JPEG.

[32] S. Lloret-Segura, A. Ferreres-Traver, A. Hernández-Baeza, and I. Tomás-Marco, "El análisis factorial exploratorio de los ítems: una guía práctica, revisada y actualizada," *An. Psicol. / Ann. Psychol.*, vol. 30, no. 3, pp. 1151–1169, Aug. 2014, doi: 10.6018/ANALESPS.30.3.199361.

[33] I. T. Jollife and J. Cadima, "Principal component analysis: a review and recent developments," *Philos. Trans. R. Soc. A Math. Phys. Eng. Sci.*, vol. 374, no. 2065, Apr. 2016, doi: 10.1098/RSTA.2015.0202.