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THE IMPACT OF QUALITY RESULTS AND IMPORTANT INNOVATION AS TQM PRACTICES ON ORGANISATIONAL PRODUCTIVITY: THE CASE OF RAILWAY SECTOR

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A B S T R A C T

Studies that have empirically investigated the impact of total quality management practices on organization productivity have presented both positive and negative results. This study attempted to investigate the impact of total quality management practices using important innovation as a predictor variable and quality results as a moderating variable to comprehensively understand their impact on productivity in the railway sector by gathering sample data from employees in management of Tanzania Zambia Railway Authority. Model fit, reliability and validity were checked using Principal Component Analysis, Regression Analysis, and Factor Analysis with the help of Jamovi software. The results present a positive significant association between important innovation and productivity. The results also indicate that quality results moderate the relationship between quality results and productivity. The results of this study presents a great theoretical contribution to literature as there has been no study in any sector that attempted to empirically test this relationship using quality results as a moderating variable. Decision makers in organizations are strongly recommended to ensure that they focus and pay attention to quality results at all time in order to encourage innovations that foster higher productivity in their organizations. I hope that this study will be replicated to other industries and that future studies will include other practices of total quality management as mediating and moderating variables to further bring more insights on this association.

1. INTRODUCTION

The 21st century is the century which is unique and centred on quality unlike the twentieth century that was centred on productivity (Juran, 1993). In today's 21st century era, each and every company is making every effort to survive this competitive market environment (Yadav, 2022), as companies are aware of the fact that to attain higher level of customer satisfaction, provision of quality products and services is the key.

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The focus on quality by organisations has been accompanied by the desire of improving productivity across all operations in the organisations. In the last few decades, there has been an increase in the application of total quality management practices in operations by organisations. This is because the practices have proved to be the key to improved quality and productivity (Chauhan and Nema, 2017; Putrì et al., 2017).

1.1 Purpose of Study

Even though some studies have presented TQM practices to have a positive significant impact on organizational productivity (Mitreva et al., 2016; Chauhan and Nema, 2017; Putrì et al., 2017),other studies have failed to find the link between TQM practices and productivity/success (Yeung et al., 2006; Beaumont and Sohal, 1999; Powell, 1995).This uncertainty prompted me to conduct this study by selecting some practices of TQM (quality results and important innovation) to determine their effect on productivity through a moderation effect.

Despite the fact that there has been an increase in studies on TQM in the past few decades, there have been little studies conducted on the railway transport sector. It is unfortunate that the railway sector has been receiving little attention in research in spite of contributing much to world economy (Talib and Rahman, 2010). The last decade for instance, recorded only one study relating to TQM in the railway sector conducted in Macedonia by Mitreva et al. (2016). This gap also prompted me to undertake this study in railway sector context.

The other main objective of the study was to explore the relationship among quality results, important innovation and productivity. This was the first study to explore this association.

2. LITERATURE REVIEW

2.1 Total Quality Management

Total quality management is an approach that involves employees in the continuous improvement (Ahmad et al, 2022). Total quality management is a philosophy and it is composed of guiding principles for every staff (employee) regardless of function or position in organization that represent the basis of continuous improvement in every aspect of every process, level, and activity in organization (Chang & Sun, 2007). Literature has grouped the practices of TQM into hard and soft (Abdullah et al., 2009;Ho et al., 2001; Leavengood et al., 2014; Powell, 1995; Vouzas and Psyhogios, 2007). The hard critical success factors refer to the quality techniques, tools, technical aspects, and production (Vouzas and Psyhogios, 2007). The examples of hard critical success factor include: process management, quality results, service or product design etc. Examples of soft critical success factors (practices) include: human aspects that are related to employee relations, top management leadership commitment, customer focus etc.

Based on literature (Terziovski, 2006; Ang et al., 2000; Coşkun, 2011; Claver et al., 2003; Prajogo and Sohal, 2006; Aquilani et al., 2017), two critical success factors of TQM were identified and selected as important to this study namely: quality results and important innovation.

2.1.1 Important Innovation

This is an important critical success factor and the main driving factors of quality improvement (Ang et al., 2000).

2.1.2 Quality Results

Conformity to requirements is called quality. Quality results include higher levels of customer satisfaction, reduced costs, higher profitability, and increase in customer loyalty and retention. Just like what Raynor (1992) predicted, in today's twenty first century firms whose focus is not quality fail to retain customers (p.3).

2.2 Productivity

Productivity is the association between a provided amount of output and amount of input required to produce it. Productivity is referred to as a measure of efficiency in production of goods or/and services. "Productivity is a multidimensional term, the meaning of which can vary, depending on the context within which it is used" (Prasad et al., 2015, p.274). Productivity is a summary measure of quality and quantity of work performance, with resources utilisation put into account (Innocent and Levi (2017). It is also expressed as success into dimensions of efficiency, performance and effectiveness.

2.3 Quality Results and Productivity

Usually, when quality increases, productivity also does improve. This is attributed to the fact that wastes and rework are reduced, and resources are optimally used. When productivity is improved, an organization is capable of reducing the price and gain competitiveness both in terms of quality and price. Customers are also satisfied in the process because they get value for their money.

Nanda et al. (2022) carried out a study to comprehend the co-associations of variables and how product quality improves productivity of DRI in rotary kiln. The results revealed that quality improves productivity.

Lee et al. (2007) investigated the relationship between quality and productivity in the manufacturing industry.

The study results did substantiate the belief that indeed quality and productivity were related and that lead to increased profits.

McCracken and Kaynak (1996) conducted an investigation on the association between quality and productivity. The results indicated that quality and productivity are related directly and that as scrap, defects, and rework decrease, productivity increases thereby showing that when quality increases, productivity also increases and vice versa.

A number of most recent studies have presented a positive association between quality and productivity (see Luo et al., 2022; Qiu et al.,2022; Abolghasem & Mancilla-Cubides, 2022).

2.4 Innovation and Productivity

Kahn et al. (2022) analyzed the impact of technological innovation on productivity in manufacturing firms of South African. The outcome of the study revealed that innovation has a positive effect on productivity of the firms.

A study conducted to examine the association between innovation and productivity in SMEs in tourism by Nguyen et al. (2021) indicated that marketing and technological innovations increase tourism productivity.

Hall (2011) investigated the impact of innovation on productivity in firms. The study findings presented a positive significant association between product innovation and revenue productivity.

2.5 Innovation and Quality

Innovation and quality are significant and important business factors in any firm even when they are separate field of knowledge. Quite typically quality professionals are not much aware of the innovation phenomena, and neither are innovation experts familiar with the quality principles and procedures (Anttila & Jussila, 2016). Quality does improve innovation process and at the same time innovation does provide different ways to achieve customer satisfaction and meet quality organization's objectives.

Schniederjans and Schniederjans (2015) carried out a study on quality management and innovation. The study presented a positive significant association between quality management and innovation.

A number of other studies have also found a positive association between quality and innovation (see Jasmani et al., 2021; Zeng et al., 2017; Prajogo & Sohal, 2004; Zeng et al., 2015).

3. CONCEPTUAL FRAMEWORK

Based on the association of variables under this study and literature review, a conceptual framework was formulated as shown on Fig 1.

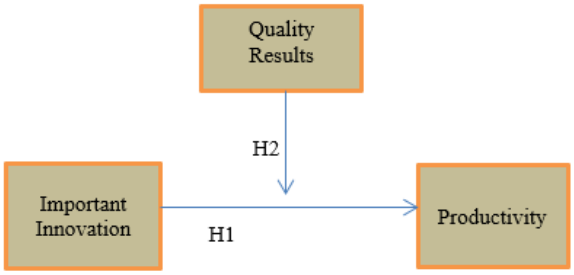

Figure 1. Hypothesized Model

3.1 Research Hypotheses

The hypotheses are outlined below based upon the objective of this study, obtained insights from literature review and a formulated conceptual framework.

Hypothesis 1: *Important innovation has a positive significant effect on productivity.*

Hypothesis 2: *Quality results have a moderating effect on the relationship between important innovation and productivity.*

4. METHODOLOGY

Tanzania Zambia Railway Authority was selected for this study. Tanzania Zambia Railway Authority owned by two states, Zambia and Tanzania on 50/50 basis and has been operating since it was constructed in 1970s. A structured questionnaire was distributed to 195 management employees against target population of 240. One hundred sixty three (163) respondents completed and did submit back the questionnaire. Data collected was analysed using quantitative research method by Jamovi software. Sample adequacy was verified using Krejcie and Morgan (1970) formula and it was proved to be very much adequate see Table 1 and the formula below for verifications.

$$s = W^2 NA(1 - A) \div d^2(N - 1) + W^2 A(1 - A)$$

s = required sample size.
W2 = table of value of chi-square for 1 degree of freedom @ confidence level 3.841.
N = population target.
A = Population proportion on assumption of 0.50 to give maximum sample size.
d = degree of accuracy (0.05).

Table 1. Determining Sample Size of a given Population by using Krejcie and Morgan (1970) formula

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note: N is the population size. *S* is size of the sample.

4.1 Measures

The five point Likert scales was utilised in measuring constructs with (1) representing strongly disagree whereas (5) representing strongly agree. The measures of important innovation, quality results and productivity were adopted from a number of studies (see Terziovski, 2006; Ang et al., 2000; Coşkun, 2011; Claver et al., 2003; Prajogo and Sohal, 2006; Aquilani et al., 2017; Grayson et al., 2016).

5. DATA PRESENTATION AND ANALYSIS

The results of this research study have been presented in descriptive statistics, figure, tables, and hypothesis tests.

5.1 Response Rate

Out of the hundred and ninety five (195) questionnaire against the respondents target of 240, hundred and sixty three (163) questionnaire were completed and returned representing 83.59% performance.

5.2 Respondent's Demographic Characteristics

Demographic profile of 195 respondents who participated in this study based upon their experience and gender are presented in Table 2.

Table 2. Demographic Profile

Description	**Frequency**	**Percentage (%)**
Gender		
Female	27	16.56
Male	136	83.44
Total	**163**	**100**
Years-Experience		
< 10	51	31.29
10-20	57	34.97
> 20	55	33.74
Total	**163**	**100**

Out of 195 respondents, 83.44% were male and 16.57% were female. On the profile of experience with the company, out of the total 195 respondents, 31.29% had below 10 years work experience, 34.97% had 10 to 20 years of experience whereas 33.74% had over 20 years work experience.

5.3 Descriptive Statistics

The mean, standard deviation, kurtosis and skewness for the three constructs used this study are shown on Table 3.

Table 3. Mean, Standard Deviation, Kurtosis & Skewness of Constructs (N = 163)

	QR	II	P
N	163	163	163
Mean	3.15	2.95	2.89
Standard deviation	0.733	0.786	0.722
Skewness	-0.373	-0.0239	0.0524
Std. error skewness	0.190	0.190	0.190
Kurtosis	0.600	0.354	0.326
Std. error kurtosis	0.378	0.378	0.378

The values of mean for the constructs indicate favourable responses from respondents. Kurtosis as well as skewness are in the recommended range threshold of –2 of +2 showing no serious deviation from normality for each and every construct.

5.4 Reliability and Validity

The sample data was subjected to reliability and validity test using Factor Analysis. In order to use principal component analysis, data collected must fulfill four assumptions in order to give valid results that include; linear association between variables; no significant outliers, multiple variables measured either at ordinal or continuous levels, as well as sampling adequacy (Laundau &Everitt, 2003). The data sample of this study fulfilled the four assumptions after being checked. A minimum of 150 cases is required in order to conduct a principal component analysis (Fan et al., 2008), therefore, the sample size of 163 of this study was adequate to conduct principle component analysis.

In order to get reliable measures to determine a good internal consistency and suitability of measures, a reliability test was conducted. The Cronbach alpha for constructs scale was computed by carrying out a reliability analysis with recommended threshold of (0.7) point seven (Nunnally, 1978; Hair et al., 2006).

5.4.1 Results of Reliability and Validity Tests

Factorability of 19 items in the instrument was measured. It was seen that 19 items did correlate at least point three (0.3) with one other item showing a good reasonable factorability. Kaiser Meyer Olkin- (KMO) measure of sampling adequacy was 0.907 above 0.6 value. The proportion variance in variables that might be caused by underlying factors are presented by KMO measure of sampling adequacy. On the other hand, Bartlett's test of sphericity was statistically significant ($\chi 2$ (171) = 1274, p < .001). It was deemed that principal components analysis was suitable for 19 items as presented on Table 4 based upon the described above findings.

Table 4. Kaiser-Meyer-Olkin and Barlett's Test result

Kaiser-Meyer-Olkin and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.907
Bartlett's Test of Sphericity	Approx. Chi-Square	1274
	Degrees of freedom	171
	Significance	.000

The outcomes of analysis show that Cronbach's alpha for instrument was above recommended threshold of (0.7) point seven (Nunnally, 1978; Hair et al., 2006). Alpha coefficients for instrument did range between 0.773 and 0.852. The alpha coefficient for quality results scales was 0.773, the alpha coefficient for important innovation scales was 0.76 and alpha coefficient for productivity scales was 0.852. All three Cronbach alpha coefficients were in the recommended acceptable range of above 0.7 as presented in Table 5.

Table 5. Test Results of Cronbach Alpha

Items	Cronbach's Alpha	McDonald's Mega	Number of Items	Comment
Overall	.911	.912	19	Accepted
Quality Results	.773	.780	5	Accepted
Important Innovation	.796	.800	5	Accepted
Productivity	.852	.853	9	Accepted

5.4.2 Linearity

The relationship between variables is linear. The assumption was checked by the calculation of Pearson and Spearman correlation coefficients as shown on Table 6.

The results present positive significant correlations among quality results, important innovation and productivity. Quality results and important innovation have positive significant Pearson and Spearman correlation coefficients of 0.714 and 0.610, quality results and productivity have positive significant Pearson and Spearman correlation coefficients of 0.619 and 0.58, important innovation and productivity have positive significant Pearson and Spearman correlation coefficients of 0.637 and 0.578.

Table 6. Correlation Matrix

		QR		II		P	
QR	Pearson's r	—					
	p-value	—					
	Spearman's rho	—					
	p-value	—					
II	Pearson's r	0.714	***	—			
	p-value	< .001		—			
	Spearman's rho	0.610	***	—			
	p-value	< .001		—			
P	Pearson's r	0.619	***	0.637	***	—	
	p-value	< .001		< .001		—	
	Spearman's rho	0.598	***	0.578	***	—	
	p-value	< .001		< .001		—	

Note. * p < .05, ** p < .01, *** p < .001

5.5 Fitness of Model

A test of regression model was run before estimating the proposed model of the study.

5.5.1 Testing of Overall Regression Model

The regression models were tested with the following hypotheses.

H0 : β1=β2= ..……. Bi = 0
Ha : Atleast one regression coefficients not equal to zero

Table 7 presents that there were significant strong relations between constructs based on regression analyses conducted. First model that presented the proposed effect of quality results on productivity indicated a good fit and a significant values of R(0.619), R^2(0.383) and significant F-Value of 100. This shows that quality results elaborate 38.3% of variation in productivity. The second model that suggested impact of quality results on important innovation , indicates good fit and values that are statistically significant of R (0.714), R^2(0.509) and significant F-Value of 167. This is an indication that quality results elaborate 50.9% of variation in important innovation. The last model that suggested the effect of important innovation on productivity indicate a good fit and significant values of R(0.637), R^2(0.405) and significant F-Value of 110. This shows that important innovation explains 40.5% of variation in productivity.

Table 7. Regression Model Fit Measure Summary

					Overall Model Test	
Model		**R**	**R²**	**Adjusted R²**	**F**	**P**
1	QR predicting P	0.619	0.383	0.380	100	< .001
2	QR predicting II	0.714	0.509	0.506	167	<. .001
3	II predicting P	0.637	0.405	0.401	110	< .001

QR = Quality Results
P= Productivity
II= Important Innovation

5.6 Testing of the Hypotheses

The study undertook two hypotheses with respect to direct association, and moderating effect. Tables 8, 9,10, and Figure 2 presents results of the hypothesis tested.

Table 8. Impact of Important Innovation on Productivity

Model Fit Measures

				Overall Model Test		
Model	**R**	**R²**	**Adjusted R²**	**F**	**df1**	**df2**	**p**
1	0.637	0.405	0.401	110	1	161	001

Model Coefficients - P

Predictor	**Estimate**	**SE**	**t**	**p**
Intercept	1.169	0.1705	6.86	< .001
II	0.585	0.0559	10.47	< .001

Table 9. Moderation effect of Quality Results on Important Innovation and Productivity

Moderation Estimates

	Estimate	**SE**	**Z**	**p**
QR	0.368	0.0577	6.38	< .001
II	0.359	0.0521	6.89	< .001
QR ✻ II	0.110	0.0491	2.23	0.026

Simple Slope Estimates				
	Estimate	**SE**	**Z**	**p**
Average	0.368	0.0581	6.34	< .001
Low (-1SD)	0.282	0.0614	4.60	< .001
High (+1SD)	0.454	0.0774	5.87	< .001

Note. shows the effect of the predictor (QR) on the dependent variable (P) at different levels of the moderator (II)

Table 10. Hypothesis Summary

No	Hypothesis	Results
1.	Hypothesis 1: Important innovation has a positive significant effect on productivity.	Supported
2.	Hypothesis 2: Quality results have a moderating effect on the relationship between important innovation and productivity.	Supported

Figure 2 shows Moderation Effect of Quality Results on Important Innovation and Productivity

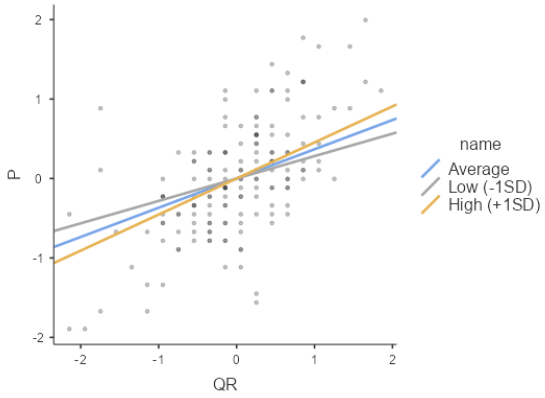

Figure 2. Moderation Effect of Quality Results on Important Innovation and Productivity

Model path coefficients of this research and their results are shown on Tables 8 and 9. The relationship and moderation effect hypothesized in this research are both supported.

The results of hypothesis 1, on the effect of important innovation on productivity indicates positive significant ($\gamma = 0.585$, $p<0.001$), thus, hypothesis 1 is supported.

5.6.1 Analysis of Moderation Effect

The moderation effect of quality results on important innovation and productivity indicates a positive statistically significant ($\gamma = 0.110$, $p<0.05$). This is an indication that quality results positively moderates the association between important innovation and productivity. Thus, hypothesis 2 supported. Figure 2 and Table 9 show that quality results at all levels (low, average , high) has an influence on the relationship between important innovation and productivity with low impact on low level moderation and high impact with high level moderation.

6. DISCUSSION

The overall results provide a strong support for the theoretical model of the relationship among important innovation, quality results and productivity.

Based on results of this study, most TAZARA employees in management are male accounting for 83.44%, whereas female managers accounting for 16.56%. The results also show that majority of employees in management who have work experience with TAZARA from 10 to 20 years accounts for 34.97%, followed by employees with over 20 years work experience accounting for 33.74% . Employees in management with less than 10 year of experience with the company, accounts for 31.29%. This shows that TAZARA has a workforce which is very experienced.

In investigating whether important innovation has a significant positive effect on productivity, the study results confirm and support that important innovation has a significant positive effect on productivity. This finding is consistent with studies that have presented quality to have a significant impact on productivity (see Kahn et al., 2022; Nguyen et al, 2021; Hall, 2011).

This study further investigated whether quality results moderates the association between important innovation and productivity. The results show that quality results at all levels (whether low, average or high) moderates the effect of important innovation on productivity. What this means is that quality results through quality training and education enhances knowledge and skills of employee's to efficiently and effectively improve teamwork, thereby reducing costs, reducing errors and enhancing job satisfaction which impacts product or/and service innovation. The outcome of this study on moderation effect of quality results on the relationship between important innovation and productivity, presents a great theoretical contribution to literature as there has been no study in any sector that attempted to empirically test this relationship using quality results as a moderating variable. It is therefore, recommended to replicate this study to other sectors.

7. CONCLUSIONS

This study is the first to explore the relationship among important innovation, quality results and productivity. I found that important innovation has a positive effect on productivity, and that quality results moderate the association between important innovation and productivity. This research gives empirical evidence on the association between important innovation and productivity. The study also contributes towards a better comprehension of the association between important innovation and productivity by including a moderating variable of quality results. Hence, incorporating practice of quality results is an investment that improves productivity. The strong theoretical contribution of this research is the incorporation of quality results as a moderator on the relationship between important innovation and productivity. The study has proved that a focus on quality results is consistently and constantly required to enhance productivity.

Decision makers in organisations are strongly recommended to ensure that they focus and pay attention to quality results at all time in order to encourage innovation that would then foster higher productivity in their organisations.

7.1 Limitation and Future Research

This study focused only on the railway company thereby narrowing generalisation of study findings to other sectors. I hope that this study will be replicated to other industries and continents. I also recommend that future studies include other practices of TQM as mediating and moderating variables on this association under this study for more insights.

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