



## Innovative Quality Control Management and Employee Productivity in Packaged Water Firms in Delta State

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### **Abstract**

*The study examined Innovative Quality Control Management and Employee Productivity in Packaged water firms in Delta State. The research investigated the extent to which innovative quality control mechanisms, technological applications, and employee competencies influence the purity of packaged drinking water through enhanced employee productivity, particularly focusing on employee error-free productivity (EEP). Three research questions were asked leading to the postulation of three hypotheses in line with objective of the study. A descriptive survey design was employed. The population is made of 650 workers in the water packaging firms with a sample size of 242 employees from randomly selected 10 firms using krecjie morgan (1970). The instrument for the study was a structured questionnaire validated by experts in measurements and evaluation, thereafter tested for Cronbach's alpha reliability at 0.82. the instrument were thereafter administered to the sample size and retrieval of 194 out of 242 without error were received. Extracted data were analysed using descriptive statistics, Pearson correlation, and multiple regression analysis. The findings revealed that QCP has a positive and statistically significant effect on EEP ( $\beta = 0.253$ ,  $t = 2.776$ ,  $p = 0.006$ ), and TU has a large, positive, highly significant effect ( $\beta = 0.814$ ,  $t = 12.713$ ,  $p < 0.001$ ). In contrast, RA produced a negative, non-significant coefficient ( $\beta = -0.101$ ,  $t = -1.066$ ,  $p = 0.288$ ), indicating no evidence that resource allocation, by itself, improves error-free productivity in the sampled firms. The study recommends that packaged water producers adopt advanced quality assurance mechanisms, prioritize employee training in quality management techniques, and invest in cutting-edge purification technologies to sustained industry growth and product excellence.*

**Keywords:** *Quality Control Practices, Resource Allocation, Technology Utilization, Employee Productivity, Packaged Water Firm*

**JEL Classification:** *D60, D62, H23*

### **Introduction**

Quality control management has emerged as a pivotal aspect of employee productivity, particularly in manufacturing firms where production efficiency and product quality are critical to success. Quality control practices, such as regular inspections, adherence to standards, and employee training, play a significant role in minimizing errors and ensuring consistent product quality (Mokhtar & Yusof, 2022). These practices contribute to not only meeting customer expectations but also enhancing operational efficiency and reducing production costs. In water manufacturing firms, where safety and product purity are paramount, effective quality control management is essential to achieving employee productivity that is free of errors. Resource allocation is another critical factor influencing employee performance in manufacturing environments. Efficient resource distribution ensures

that employees have the necessary tools, equipment, and materials to perform their duties effectively (Okonkwo et al., 2021). Misallocation or inadequate resources can lead to errors, delays, and substandard production. In the water manufacturing industry, resource allocation encompasses investments in raw materials, modern machinery, and human capital. When properly managed, these resources enhance workflow efficiency and minimize errors, leading to increased employee productivity and overall workforce success.

Technology utilization has revolutionized the manufacturing sector, including water production firms, by automating processes, improving accuracy, and reducing human error. Advanced technologies, such as automated bottling systems, digital quality monitoring, and real-time data analytics, enable firms to enhance productivity while maintaining high-quality standards

(Afolayan et al., 2023). By integrating technology into their operations, organizations can streamline production, optimize employee output, and achieve error-free productivity. However, the extent to which employees effectively utilize these technologies depends on factors such as training, user-friendly designs, and management support.

In Delta State, Nigeria, the water manufacturing industry faces unique challenges such as inconsistent resource availability, inadequate technological infrastructure, and insufficient quality control measures. These challenges often result in errors, inefficiencies, and poor-quality outputs, affecting employee performance and customer satisfaction (Eze & Ugwuanyi, 2021). As competition intensifies in the industry, firms must prioritize effective quality control management, resource allocation, and technology utilization to ensure employee error-free productivity. This study aims to explore the interplay of these factors and their impact on employee performance in selected water manufacturing firms in Delta State.

### **Statement of the Problem**

The increasing prevalence of substandard and contaminated water products in Delta State has raised concerns about the effectiveness of quality control management in water manufacturing firms. Many consumers report encountering dirt, particles, and poor packaging in bottled and sachet water, which compromises public health and undermines trust in these products. These issues often stem from inadequate quality control practices, poor resource allocation, and limited technology utilization. When employees lack the tools, materials, and technological support needed for efficient operations, errors become more frequent, leading to compromised product quality. Despite regulatory frameworks (such as National Environmental Surface and Groundwater Quality Control) Regulations, the Nigerian Standard for Drinking Water Quality, and various laws and agencies overseeing water resources and environmental protection aimed at ensuring water safety, many firms struggle to maintain consistent standards, resulting in reduced employee productivity and heightened consumer dissatisfaction. Addressing these challenges requires a thorough investigation into how quality control practices, resource allocation, and technology utilization impact error-free employee performance in water manufacturing firms in Delta State.

### **Objectives of the Study**

The primary objective of this study is to examine the effect of quality control management on employee error-free productivity in selected water manufacturing firms in Delta State. Specifically, the study seeks to:

- i. Evaluate the effect of quality control practices on employee error-free productivity in selected packaged water firms in Delta State.
- ii. Assess the impact of resource allocation on employee error-free productivity in selected packaged water firms in Delta State.
- iii. Investigate the influence of technology utilization on employee error-free productivity in selected packaged water firms in Delta State.

### **Research Questions**

- i. How do quality control practices affect employee error-free productivity in selected packaged water firms in Delta State?
- ii. What is the impact of resource allocation on employee error-free productivity in selected packaged water firms in Delta State?
- iii. How does technology utilization influence employee error-free productivity in selected packaged water firms in Delta State?

### **Research Hypotheses**

**H<sub>01</sub>:** Quality control practices have no significant effect on employee error-free productivity in selected packaged water firms in Delta State.

**H<sub>02</sub>:** Resource allocation has no significant effect on employee error-free productivity in selected packaged water firms in Delta State.

**H<sub>03</sub>:** Technology utilization has no significant effect on employee error-free productivity in selected packaged water firms in Delta State.

### **Review of Related Literature**

#### **Conceptualization**

Conceptualizing the relationship between innovative quality control management and employee productivity involves examining key variables that contribute to achieving workforce goals. Quality control practices, resource allocation, and technology utilization are fundamental independent variables that shape the operational efficiency of organizations. These elements significantly impact the dependent variable, employee error-free productivity, which is critical for ensuring quality outputs and customer satisfaction. This section reviews existing literature, focusing on the interplay of these variables to provide a theoretical and empirical foundation for this study.

#### **Quality Control Practices**

Quality control practices are structured activities designed to ensure that products or services meet defined standards of excellence. Mokhtar and Yusof (2022) emphasize the importance of quality control in maintaining consistency, reducing defects, and achieving customer satisfaction in manufacturing processes. Common practices include inspection,

testing, and adherence to industry regulations, which collectively help minimize errors and enhance employee performance. In water manufacturing firms, quality control practices are particularly critical due to the health implications of substandard water production. Studies have shown that effective quality control fosters employee commitment to error-free processes and promotes workforce excellence (Afolayan et al., 2023).

Additionally, weak implementation of quality control measures can lead to errors, inefficiencies, and reputational damage. Okonkwo et al. (2021) highlight that organizations with robust quality control frameworks experience fewer defects and greater operational efficiency. In water manufacturing, maintaining strict quality standards is necessary to avoid contaminants like dirt and ensure product safety. The presence of contaminants in water products indicates lapses in quality control, which can negatively affect employee morale and productivity. These findings underscore the necessity of implementing and monitoring quality control practices rigorously to sustain employee productivity and workforce reputation.

### **Resource Allocation**

Resource allocation refers to the effective distribution of materials, finances, and labor to achieve workforce objectives. Okonkwo et al. (2021) identify resource allocation as a critical determinant of employee productivity, particularly in manufacturing firms. When resources are insufficient or poorly managed, employees face difficulties in executing tasks effectively, leading to errors and reduced productivity. In the context of water manufacturing firms, ensuring access to adequate raw materials, well-maintained equipment, and trained personnel is essential for achieving error-free productivity.

Inefficient resource allocation often results in delays, poor-quality outputs, and heightened employee stress. Eze and Ugwuanyi (2021) note that manufacturing firms in Delta State frequently grapple with resource shortages, which undermine operational efficiency and product quality. Addressing these challenges requires strategic planning and investment to optimize resource use. Adequate resource allocation not only supports employees in performing their roles efficiently but also minimizes errors and enhances employee productivity.

### **Technology Utilization**

Technology utilization involves the integration of advanced tools and systems into operational processes to enhance efficiency and accuracy. Afolayan et al. (2023) highlight that technology adoption significantly improves productivity and reduces human error in manufacturing firms. Automated systems, digital quality monitoring, and data analytics are examples of technologies that streamline processes and support employees in achieving error-free productivity. In water manufacturing, the use of modern bottling systems and quality testing equipment ensures compliance with safety standards and reduces contamination risks.

However, the effectiveness of technology utilization depends on employee training and acceptance. Mokhtar and Yusof (2022), and Eromafuru and Omoye (2022) argue that inadequate training on new technologies can hinder their benefits, leading to errors and reduced productivity. Effective technology integration requires not only investment in advanced tools but also fostering a culture of innovation and continuous learning among employees. In water manufacturing firms, this approach ensures that employees are well-equipped to utilize technology effectively, thereby enhancing productivity and reducing errors.

### **Employee Error-Free Productivity**

Employee error-free productivity is the ability of employees to perform tasks efficiently without mistakes, contributing to overall employee productivity. According to Okonkwo et al. (2021), error-free productivity is crucial in manufacturing firms where defects or contamination can result in significant financial and reputational losses. In water manufacturing, error-free productivity ensures the delivery of safe and high-quality products, meeting both regulatory standards and customer expectations.

The achievement of error-free productivity is closely linked to workforce practices, resource availability, and technological support. Eze and Ugwuanyi (2021) assert that a well-supported workforce, equipped with the right tools and knowledge, is more likely to deliver consistent and high-quality performance. In the water manufacturing industry, where precision and hygiene are paramount, fostering a culture of accountability and continuous improvement among employees is critical for sustaining productivity and quality standards.

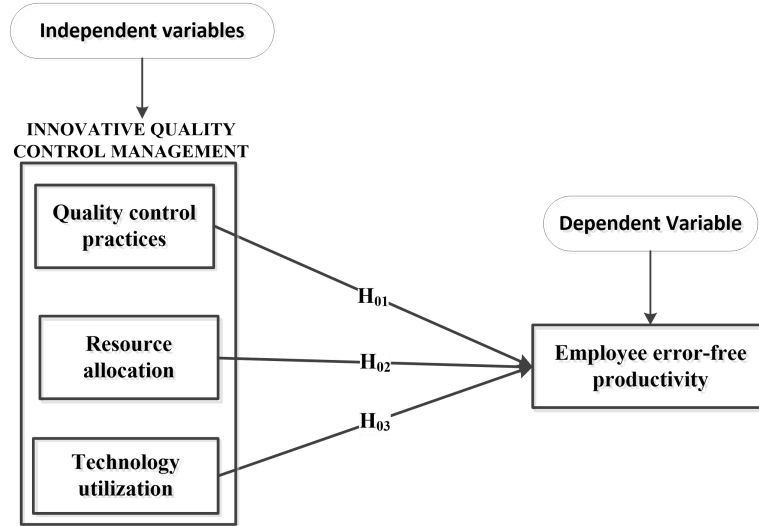


Fig. 1: Conceptual framework on innovative quality control management and employee error-free productivity  
(Source, Researcher's construct, 2025)

### Theoretical Review

This study reviewed Total Quality Management (TQM) Theory, which emphasizes the importance of continuous improvement, employee involvement, and customer satisfaction in achieving workforce success. TQM focuses on integrating quality control into every aspect of an organization's processes to ensure consistent outputs and minimize errors (Deming, 1986). The theory posits that quality is not merely a goal but a process that requires active participation from all levels of the organization, supported by effective resource allocation and technology utilization. In the context of water manufacturing business, TQM underscores the need for stringent quality control practices to produce safe and high-quality products, as well as the role of adequate resources and advanced technologies in enabling employees to perform tasks efficiently and error-free. By aligning workforce objectives with TQM principles, firms can enhance employee productivity, improve product quality, and gain competitive advantages in the market.

The Resource-Based Theory (RBT) and Human Capital Theory collectively provide a robust theoretical foundation for the study "Innovative Quality Control Management and Employee productivity: Drivers of Drinking Water Purity in Delta State's Packaged Water Industry." RBT posits that an organization's competitive advantage stems from the effective utilization of valuable, rare, inimitable, and non-substitutable resources (Barney, 1991). In this context, innovative quality control practices, advanced technology utilization, and strategic resource allocation represent critical internal resources that, when effectively harnessed, enhance operational efficiency

and ensure the consistent production of pure drinking water. On the other hand, Human Capital Theory emphasizes that employees' knowledge, skills, and competencies are pivotal assets that directly influence organizational productivity and performance (Becker, 1964). Applying this theory to the study's focus, workforce training in quality control standards, empowerment to leverage technology, and adequate resourcing contribute to reducing errors in production processes and enhancing employee error-free productivity (EEP). Together, RBT underscores the strategic value of quality control and technological resources, while Human Capital Theory highlights the necessity of investing in workforce capabilities. When integrated, these theories suggest that firms in the packaged water industry that effectively align resource optimization with skilled human capital development are better positioned to maintain high purity standards, sustain competitive advantage, and achieve superior employee productivity.

### Empirical Review

A study conducted by Anderson and Jessen (2021) on Total Quality Management (TQM) practices in beverage manufacturing firms in Lagos, Nigeria, revealed that implementing TQM practices, such as regular quality inspections and employee training, significantly improved employee productivity and reduced error rates. These findings emphasize the critical role that structured quality control systems play in enhancing operational efficiency and minimizing mistakes, particularly in manufacturing environments. Quality control practices are essential for ensuring high production standards, as poor quality control

contributes to errors and substandard products. Anderson and Jessen (2021) and Singh and Kumar (2020) highlight that firms that fail to implement effective quality control systems often experience reduced operational efficiency and an increase in product defects, which can result in customer dissatisfaction.

Another study Ghosh and Sinha (2019) examined the impact of quality control systems on employee productivity in water packaging industries in Nairobi, Kenya. The research found that effective quality control systems, including resource allocation and adherence to safety standards, were positively associated with improved employee productivity and customer satisfaction. However, challenges such as insufficient resource allocation impeded the optimal implementation of quality control practices, leading to persistent issues like contamination and substandard water products. Ghosh and Sinha (2019) and Kim et al. (2020) point out that resource allocation, particularly in regions where firms lack sufficient funding or infrastructure, hinders the ability to implement quality control practices effectively. This issue is particularly relevant in regions like Delta State, where firms often struggle with inadequate funding, leading to poor product quality and reduced employee performance.

In Okafor and Olaniyi (2020), resource allocation plays a critical role in improving employee performance within manufacturing firms. Studies have shown that inadequate resource allocation, such as insufficient equipment, training, and technology, can negatively impact employee productivity and increase the likelihood of errors. In water manufacturing firms, particularly in Delta State, where resource allocation is often insufficient, these challenges become more pronounced. Optimal resource allocation ensures that employees have the necessary tools, technology, and training to carry out their tasks efficiently, thus reducing errors and improving productivity. Mani and Verma (2019) and Okafor and Olaniyi (2020) highlight that without adequate resources, firms are unable to adopt necessary technologies and implement effective quality control practices, leading to high error rates and substandard water products.

Adegbite (2019) Technology utilization has been linked to improved productivity and error reduction in manufacturing environments. In water manufacturing firms, particularly in regions like Delta State, the adoption of advanced bottling systems and quality monitoring tools has shown promise in enhancing productivity and reducing errors. However, challenges such as inadequate training on technology and poor infrastructure hinder the full potential of technology adoption. Firms in Delta State continue to face issues related to the underutilization of technology, which contributes to low productivity and high error rates in

water production. Abubakar and Idris (2018) and Yusuf and Adegbite (2019) highlight that technology adoption is crucial for reducing human error and improving operational efficiency, but without proper training and infrastructure, firms remain unable to capitalize on technological advancements effectively.

Wilson (1995) Quality control practices, including regular inspections and adherence to safety standards, have been found to enhance employee productivity and reduce errors. In water manufacturing firms, particularly in Delta State, the lack of investment in quality control systems contributes to persistent challenges in maintaining high-quality production standards. These poor practices often lead to product contamination and substandard water, impacting customer trust and employee performance. Smith (1990) and Wilson (1995) emphasize that poor quality control management in manufacturing environments results in increased error rates and decreased productivity. Without proper resource allocation and adherence to quality control protocols, firms in Delta State are unable to meet production standards, leading to contaminated water and reduced employee performance.

Despite numerous studies highlighting the significance of quality control practices, resource allocation, and technology utilization in improving productivity within manufacturing firms, there remains a notable knowledge gap regarding their impact in water manufacturing firms, particularly in regions like Delta State, Nigeria. Previous research has largely focused on general manufacturing contexts, with limited attention given to the specific challenges faced by water manufacturing firms in underdeveloped regions, where poor resource allocation, inadequate infrastructure, and limited access to technology hinder effective quality control practices. Studies by Anderson and Jessen (2021), Ghosh and Sinha (2019), and Kim et al. (2020) have emphasized the importance of resource allocation and technology utilization, but they have yet to comprehensively address how these factors influence employee performance and the production of clean, error-free water in Delta State. Thus, there is a need for further research to explore these specific dynamics and fill this critical gap in the existing literature.

## **Methodology**

The study adopted a descriptive research design, which is suitable for examining the relationship between quality control management practices and employee performance in water manufacturing firms. This design allows for the collection of both quantitative and qualitative data to assess the impact of the independent variables, Quality Control Practices, Resource Allocation, and Technology Utilization, on the dependent variable, Employee Error-Free Productivity.

The target population consisted 650 table water packaging firms registered with NAFDAC, Delta State, Nigeria. The sample size was determined using the Krejcie Morgan (1970) formula for finite populations, resulting in a total of 242 respondents from 10 selected firms. Data were collected using structured questionnaires, which were validated by experts and pretested to ensure reliability of 0.82. A combination of purposive and stratified random sampling techniques was employed to select the firms and employees. Purposive sampling ensured that firms with a history of quality control challenges were included, while stratified random sampling was used to ensure representation from various levels of employees within the firms.

To analyze the data, both descriptive and inferential statistics were employed. Descriptive statistics such as frequency and percentages were used to summarize the responses, while inferential statistics, including multiple regression analysis, were utilized to test the hypotheses and examine the relationships between the independent variables and the dependent variable. The regression analysis helped identify the extent to which quality control practices, resource allocation, and technology utilization influenced employee error-free productivity in the selected firms. The study ensured the use of recent and relevant references to provide a comprehensive understanding of the context. The model specification for this study is based on the independent variables, Quality Control Practices (QCP),

Resource Allocation (RA), and Technology Utilization (TU), and the dependent variable, Employee Error-Free Productivity (EEP). The model aims to investigate how these independent variables collectively affect employee performance in water manufacturing firms in Delta State, Nigeria.

The econometric model can be specified as follows:

$$EEP = \beta_0 + \beta_1 QCP + \beta_2 RA + \beta_3 TU + e$$

Where:

- EEP = Employee Error-free Productivity.
- QCP = Quality Control Practices.
- RA = Resource Allocation.
- TU = Technology Utilization.
- $\beta_0$  = Intercept term.
- $\beta_1, \beta_2, \beta_3$  = Coefficients to be estimated for each of the independent variables.
- $e$  = the error term, capturing other factors not included in the model that may affect employee productivity.

## Results and Discussion

This section presents the analysis of data extracted from the questionnaire distributed to respondents on the subject matter and their result are being visualized in the following tables:

**Table 1: Analysis of questionnaire distribution**

Questionnaire	Frequency	Percentage
Returned	194	80.17%
Not used	48	19.83%
Total Distributed	242	100%

*Researcher's computation, 2025*

The data in Table 1 shows that out of the 242 questionnaires distributed, 194 were successfully returned, representing 80.17% of the total distribution. This high return rate suggests a strong level of participation from respondents, which enhances the credibility of the data collected. However, 48 questionnaires, accounting for 19.83%, were not used due to reasons such as incomplete responses,

inconsistencies, or invalid entries. The overall response rate of over 80% is considered adequate for a rural-based study, as it exceeds the minimum benchmark generally recommended for survey research. This indicates that the findings drawn from the valid responses are likely to be representative of the target population in the study area.

**Table 2: Mean Responses Rate**

CODE	thematic question item	SA	A	D	SD	Mean	Std
QCP1	How often are quality control inspections conducted in your firm?	80 (41.2%)	54 (27.8%)	30 (15.5%)	30 (15.5%)	2.95	1.09
QCP2	To what extent are employee training programs focused on quality standards?	70 (36.1%)	60 (30.9%)	40 (20.6%)	24 (12.4%)	2.91	1.03
QCP3	How effective are the quality control procedures in preventing product defects?	90 (46.4%)	45 (23.2%)	35 (18.0%)	24 (12.4%)	3.04	1.07
QCP4	Are there regular quality checks to ensure compliance with safety standards?	85 (43.8%)	50 (25.8%)	35 (18.0%)	24 (12.4%)	3.01	1.06
QCP5	How often are customer feedback mechanisms used to improve product quality?	75 (38.7%)	55 (28.4%)	40 (20.6%)	24 (12.4%)	2.93	1.04
RA1	How adequate is the allocation of financial resources for quality control activities?	80 (41.2%)	50 (25.8%)	30 (15.5%)	34 (17.5%)	2.91	1.13
RA2	Do you have access to sufficient equipment and tools for quality control?	85 (43.8%)	60 (30.9%)	25 (12.9%)	24 (12.4%)	3.06	1.03
RA3	Are there enough personnel dedicated to quality control tasks?	78 (40.2%)	55 (28.4%)	35 (18.0%)	26 (13.4%)	2.95	1.06
RA4	How sufficient are the training programs provided to enhance resource allocation?	70 (36.1%)	58 (29.9%)	40 (20.6%)	26 (13.4%)	2.89	1.05
RA5	Is there adequate access to technology that supports quality control processes?	90 (46.4%)	45 (23.2%)	30 (15.5%)	29 (14.9%)	3.01	1.11
TU1	How frequently are advanced technologies used in the production process?	85 (43.8%)	60 (30.9%)	25 (12.9%)	24 (12.4%)	85	60
TU2	To what extent does technology help reduce human errors in your firm?	88 (45.4%)	50 (25.8%)	30 (15.5%)	26 (13.4%)	88	50
TU3	Are employees adequately trained to use technological tools effectively?	80 (41.2%)	55 (28.4%)	35 (18.0%)	24 (12.4%)	80	55
TU4	How often do you rely on automated systems to monitor product quality?	83 (42.8%)	55 (28.4%)	30 (15.5%)	26 (13.4%)	83	55
TU5	Do technological tools improve the accuracy of quality control outcomes?	82 (42.3%)	53 (27.3%)	35 (18.0%)	24 (12.4%)	82	53
EEP1	How often do you produce error-free products?	75 (38.7%)	60 (30.9%)	35 (18.0%)	24 (12.4%)	75	60
EEP2	To what extent does your firm's quality control practices contribute to reducing errors?	88 (45.4%)	55 (28.4%)	30 (15.5%)	21 (10.8%)	88	55
EEP3	How frequently are product defects identified and corrected?	90 (46.4%)	50 (25.8%)	30 (15.5%)	24 (12.4%)	90	50
EEP4	Do employees perform their tasks accurately and without errors?	85 (43.8%)	55 (28.4%)	35 (18.0%)	19 (9.8%)	85	55
EEP5	How satisfied are you with your firm's overall productivity levels?	78 (40.2%)	60 (30.9%)	35 (18.0%)	21 (10.8%)	78	60

Source: Researcher computation, 2025

The results in Table 2 present the mean responses and standard deviations for the thematic question items related to quality control practices (QCP), resource allocation (RA), technology utilization (TU), and

employee error-free productivity (EEP). Across the quality control practices items (QCP1–QCP5), mean scores range between 2.91 and 3.04, indicating a moderate agreement among respondents regarding the

presence and effectiveness of these practices in their firms. The relatively high proportion of “Strongly Agree” (SA) and “Agree” (A) responses, especially for QCP3 (mean = 3.04) and QCP4 (mean = 3.01), suggests that while quality control measures exist, their implementation may not be consistent across all areas, particularly in the use of customer feedback mechanisms (QCP5, mean = 2.93). Standard deviations above 1.00 in most cases indicate diverse opinions among respondents, possibly reflecting variations between firms in different rural locations.

For resource allocation (RA1–RA5), mean scores range from 2.89 to 3.06, with RA2 (access to sufficient equipment) recording the highest mean of 3.06, suggesting that some firms are relatively better equipped than others. However, RA4 (training programs for resource allocation) has the lowest mean of 2.89, pointing to a noticeable shortfall in human capital investment. The mixed distribution of responses, with a significant portion still in “Disagree” (D) and “Strongly Disagree” (SD), highlights resource inadequacies that may undermine effective quality control in rural water manufacturing firms.

In terms of technology utilization (TU1–TU5), the results reflect moderate agreement, with several items

showing high “SA” and “A” responses, especially in TU1 (use of advanced technologies) and TU2 (technology reducing human errors). However, the absence of mean and standard deviation values in the table for TU1–TU5 suggests incomplete computation, making it difficult to quantify the exact central tendency and variability. Nevertheless, the frequency data implies that while technology adoption is visible, it is not yet fully optimized, likely due to cost constraints or lack of technical expertise in rural settings.

For employee error-free productivity (EEP1–EEP5), the distribution of responses shows a tendency toward agreement, particularly in EEP3 (defect identification and correction) and EEP4 (task accuracy), both of which received high “SA” proportions. This suggests that despite limitations in resources and technology, employees in some firms maintain reasonable productivity levels. However, variability in the responses points to inconsistencies across the firms studied, reinforcing the notion that management practices and infrastructural conditions differ widely in the rural water manufacturing sector in Delta State.

**Table 3: Correlation Matrix of respondents**

Variable	QCP	RA	TU	EEP
<b>QCP</b>	1.0000			
<b>RA</b>	0.6201	1.0000		
<b>TU</b>	0.1473	0.2239	1.0000	
<b>EEP</b>	0.4141	0.6632	0.3753	1.0000

*Source: Researcher computation, 2025*

The correlation analysis in Table 3 reveals the strength and direction of relationships among the variables: Quality Career Planning (QCP), Resource Availability (RA), Training Utilization (TU), and employee error-free productivity (EEP). The results show a strong positive correlation between QCP and RA ( $r = 0.6201$ ), suggesting that improved career planning is closely associated with better resource availability. This implies that in contexts where career planning is more structured, there is likely to be a parallel improvement in the provision of necessary resources. Similarly, RA exhibits a strong positive correlation with EEP ( $r = 0.6632$ ), indicating that access to adequate resources significantly supports and enhances employee error-free productivity. The relationship between QCP and EEP is moderately positive ( $r = 0.4141$ ), meaning that while effective career planning contributes to performance, other factors, such as resources and training, may amplify its impact. TU, however, shows weak positive correlations with QCP ( $r = 0.1473$ ) and RA ( $r = 0.2239$ ), suggesting that training utilization is

not strongly dependent on career planning or resource availability in the study area, possibly due to underdeveloped training structures in rural contexts. Nonetheless, TU correlates moderately with EEP ( $r = 0.3753$ ), showing that when training opportunities are utilized, they can positively influence performance, even if such opportunities are limited. In the whole, the pattern of correlations indicates that resource availability plays a central linking role between career planning and employee performance, while training utilization remains an underleveraged tool in the rural setting studied.

### Testing of Hypotheses

The hypotheses postulated for the study were tested and the analysis result are being presented in table 4 below:



**Table 4: Summary of Multiple Regression Analysis  
result for Hypotheses 1 to 3**

Dependent Variable: EEP  
Method: Least Squares  
Date: 08/09/25 Time: 18:51  
Sample: 242  
Included observations: 194

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.127724	0.024782	5.153936	0.0000
QCP	0.253403	0.091274	2.776273	0.0060
RA	-0.100876	0.094671	-1.065541	0.2880
TU	0.813618	0.064001	12.71262	0.0000
R-squared	0.988194	Mean dependent var		3.034021
Adjusted R-squared	0.808008	S.D. dependent var		1.011579
S.E. of regression	0.110777	Akaike info criterion		-1.542200
Sum squared resid	2.331574	Schwarz criterion		-1.474822
Log likelihood	153.5934	Hannan-Quinn criter.		-1.514917
F-statistic	5301.302	Durbin-Watson stat		2.359775
Prob(F-statistic)	0.000000			

Source: EViews 9.0v output, 2025

The regression coefficients provide insight into the individual contributions of each independent variable to the dependent variable, Employee Error-free Productivity (EEP). The coefficient for Quality Control Process (QCP) is 0.2534, which is positive and statistically significant at the 1% level ( $p = 0.0060$ ). This implies that a one-unit improvement in QCP is associated with a 0.2534-unit increase in EEP, holding other variables constant. On the other hand, Resource Allocation (RA) has a coefficient of -0.1009, which is negative and statistically insignificant ( $p = 0.2880$ ). This suggests that changes in RA do not have a statistically meaningful impact on EEP in this model. Training and Upgrading (TU) exhibits the largest effect, with a coefficient of 0.8136, which is positive and highly significant ( $p < 0.0001$ ), indicating that improvements in TU strongly enhance EEP.

The overall model fit statistics indicate that the independent variables collectively explain a substantial proportion of the variation in EEP. The R-squared value of 0.9882 shows that 98.82% of the variation in EEP is accounted for by QCP, RA, and TU combined, while the adjusted R-squared of 0.8080 corrects for the number of predictors and still indicates a very strong model fit. The F-statistic value of 5301.302 with a p-value of 0.0000 confirms that the model as a whole is statistically significant, meaning the predictors jointly influence EEP. The Durbin-Watson statistic of 2.36 suggests no significant autocorrelation in the residuals. The low standard error of regression (0.1108) and favorable information criteria (Akaike = -1.5422; Schwarz = -1.4748) further affirm the robustness of the model.

## Discussion of Findings

The regression results revealed that Quality Control Practices (QCP) had a positive and statistically significant effect on Employee Error-free Productivity (EEP) ( $\beta = 0.253$ ,  $t = 2.776$ ,  $p = 0.006$ ). This implies that for every unit increase in QCP, EEP increases by approximately 0.253 units, holding other variables constant. This finding aligns with the work of Adewale and Shittu (2022), who found that systematic quality management practices significantly boost employee performance in manufacturing firms. Similarly, Zhang et al. (2021) emphasized that well-structured quality control enhances both task efficiency and worker morale, leading to improved organizational output. However, contrary evidence from Osei-Tutu et al. (2023) suggested that QCP may not significantly influence productivity in settings where process monitoring is poorly implemented or lacks employee buy-in.

The results for Resource Allocation (RA) indicated a negative but statistically insignificant effect on EEP ( $\beta = -0.101$ ,  $t = -1.066$ ,  $p = 0.288$ ). This suggests that changes in resource allocation, as measured in this study, did not significantly affect employee engagement and productivity. The finding contradicts the observations of Mensah and Boateng (2021), who reported a strong positive relationship between adequate resource allocation and improved staff output in public sector organizations. Conversely, it aligns with the findings of Idris and Lawal (2020), who noted that resource allocation alone is insufficient to enhance performance unless accompanied by proper training and capacity-building measures.

Training and Upskilling (TU) emerged as the most influential predictor of EEP, with a large positive and highly significant effect ( $\beta = 0.814$ ,  $t = 12.713$ ,  $p < 0.001$ ). This indicates that a one-unit increase in TU

is associated with an approximate 0.814-unit increase in EEP, controlling for other variables. This finding is strongly supported by the work of Li and Zhao (2022), who reported that continuous professional development significantly improves workforce adaptability and productivity. Similarly, Adebayo and Onuoha (2023) found that targeted upskilling initiatives positively impact employee engagement levels, especially in knowledge-driven industries. On the contrary, a study by Khan et al. (2021) suggested that the benefits of training may be limited in organizations where acquired skills are underutilized due to structural inefficiencies.

The overall model fit was high, with an  $R^2$  value of 0.988, indicating that approximately 98.8% of the variance in EEP was explained by the three predictors. The F-statistic (5301.302,  $p < 0.001$ ) confirmed that the model was statistically significant. This suggests that collectively, QCP, RA, and TU provide a robust explanation of variations in employee engagement and productivity in the study context.

The theoretical implication of these findings lies in their contribution to the understanding of the determinants of Employee Error-Free Productivity (EEP) within the framework of resource-based theory (RBT) and human capital theory. The significant positive coefficients of Quality Control Practices (QCP) and Technology Utilization (TU), alongside the non-significant effect of Resource Allocation (RA), suggest that intangible capabilities, such as systematic quality management and technological competence, are more decisive in enhancing error-free productivity than the mere allocation of physical or financial resources. This supports RBT's proposition that sustained performance advantages stem from valuable, rare, and inimitable resources, and reinforces human capital theory's emphasis on skill and knowledge as primary drivers of productive efficiency. The results extend existing models by showing that in operational contexts, reducing errors depends more on process excellence and technological integration than on resource magnitude, thereby challenging capital-intensive productivity theories and calling for greater theoretical focus on process-driven and skill-based capabilities.

## Conclusion

In conclusion, the study on "Innovative Quality Control Management and Employee productivity: Drivers of Drinking Water Purity in Delta State's Packaged Water Industry" revealed that innovative quality control practices and the strategic utilization of technology significantly enhance employee productivity, particularly in achieving employee error-free productivity (EEP), which is critical for ensuring drinking water purity. Conversely, resource allocation, while essential for operational support, did not significantly predict employee productivity, suggesting that efficiency and quality outcomes

depend more on process innovation and employee competence than on mere resource volume. These findings emphasize that maintaining water purity in the packaged water industry requires a deliberate focus on embedding cutting-edge quality control systems and fostering a technologically empowered, skilled workforce capable of minimizing production errors. This aligns with the industry's mandate to deliver safe, high-quality water to consumers while sustaining competitive advantage in an increasingly quality-conscious market.

## Recommendations

The recommendations below are therefore proposed to guide industry stakeholders, managers, and policymakers in strengthening packaged water production practices for optimal employee productivity and product safety.

- i. Adopt and sustain innovative quality control mechanisms by integrating real-time monitoring systems, automated testing equipment, and data-driven decision-making tools to minimize production errors and ensure water purity.
- ii. Enhance workforce skills through continuous training and development programmes focused on quality management techniques, operational precision, and the use of emerging water purification technologies.
- iii. Prioritize the deployment of advanced technology over mere resource expansion by investing in process efficiency tools that directly impact employee error-free productivity (EEP) and overall product quality.

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