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REVERSE LOGISTICS AND FIRM COMPETITIVENESS IN FOOD AND BEVERAGES INDUSTRY IN NIGERIA: THE MODERATING ROLE OF TECHNOLOGY

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***Abstract*:** This study examines the relationship between reverse logistics and firm competitiveness in the Nigerian food and beverages industry. The study also considers the moderating role of technology in the relationship between reverse logistics and firm competitiveness. Reverse logistics is measured in terms of reuse, recycling, and repackaging, while firm competitiveness is measured in terms of productivity and cost reduction. The analysis is based on cross-sectional data collected through a structured questionnaire from 95 purposively selected managers representing 11 listed food and beverages firms. The Alpha method is used to determine the reliability of all measures. The regression results show that both productivity and cost reduction are positively and significantly related to all the three measures of reverse logistics (reuse, recycling, and repackaging). Also, there is evidence that technology exerts a positive and highly significant effect on the relationship between reverse logistics and firm competitiveness. The managerial implications of these findings are discussed.

Key words: Reverse Logistics, Firm Competitiveness, Technology

INTRODUCTION

In today's business, firms are increasingly faced with stiff competition, stringent regulations, and sustainability challenges. Managers are developing new capabilities and devising new ways of dealing with these external forces. Reverse logistics (RL) has been gaining both currency and importance because of its ability to deal with these challenges and its positive role in business success and sustainability. Reverse logistics has also received considerable scholarly attention and a major area of focus for industry players (Guide & Van Wassenhove, 2009a, 2009b; Stock et al., 2009). According to Rogers and Tibben-Lembke (1999, p. 2), reverse logistics is "the process of planning, implementing and controlling the efficient, cost-effective flow of raw materials, in process inventory, finished goods and related information from the point of consumption to the point of origin for purpose of recapturing value or proper disposal." It is the movement of products or materials in the reverse path with the aim of creating and recovering the residual value through proper disposal and reuse systems (Venkatesh, 2015).

According to Ilgin and Gupta (2010), reverse logistics can be said to be all activities that encompass every operation geared towards collection, recovery and/or disposal of end-of-life products. It has been found that disposal of products is no longer a responsibility undertaken solely by consumers. This is largely due to strict environmental regulations and diminishing raw material resources (Ravi & Shankar, 2005; Ilgin & Gupta, 2010). The quality and standard of packaging and environmental regulations are driving companies to be more accountable for residual and final products, even after product sale. Fewer disposal of a product can be achieved when firms have decided to focus on reverse logistic practice.

According to Srivastava and Srivastava (2006), organizations have given importance to reverse logistics mainly due to three reasons: (1) the growing importance of environmental issues and their impact on public opinion (De Brito, Dekker & Flapper, 2005); (2) the benefits that they gain by improving their return processes such as image enhancement, and improved market share; and (3) the stringent environmental regulations they must comply with as good corporate citizens (Stokes & Clegg, 2002; De Brito et al., 2005).

There is a vast but relatively new literature that attempts to determine the explanatory power of reverse logistics for firm performance and competitiveness. For example, Guta (2016), Mwaura, Letting, Nicholas, Ithinji and Orwa (2016), Mbovu and Mburu (2018), Piyachat, (2017) and Somuyiwa and Adebayo (2014) all examine the effects of reverse logistics on firm performance and competitiveness, focusing on the manufacturing sector. Although, these studies generally conclude that reverse logistics is important in attaining superior performance, they however, differ in the dimensions of firm performance and competitiveness used. For example, Somuyiwa and Adebayo (2014) measure performance in terms of cost reduction, customer satisfaction, profitability and value-added returns. Guta (2016) considers two dimensions of performance; financial (gross profit, return on investment, return on sales) and market-based (market share, sales volume and sale growth) indicators. Also, Mwaura, Letting, Nicholas, Ithinji and Orwa (2016) measures firm competitiveness in terms of costs, delivery flexibility, market share, sales turnover and gross profit while Mbovu and Mburu (2018) measure competitiveness in terms of profitability, cost reduction and market share. Thus, none of these studies considers productivity as a measure of firm performance or competitiveness. This study, therefore, fills this important gap by considering the effects of reverse logistics, focusing on productivity as well as cost reduction as measures of firm competitiveness.

The aim of this study is to examine the impact of reverse logistics on firm competitiveness in the food and beverages industry in Nigeria. We consider three dimensions of reverse logistics: namely, reuse, recycling, and repackaging, and link them individually and collectively to both cost reduction and productivity. The study also considers the moderating role of technology in the relationship between reverse logistics and firm competitiveness. The study addresses the following research questions:

1. To what extent does reverse logistics affect cost reduction of firms in the Nigerian food and beverages industry?
2. To what extent does reverse logistics affect productivity of firms in the Nigerian food and beverages industry?
3. To what extent does technology moderate the effect of reverse logistics on firm competitiveness?

The remainder of the study is structured as follows: The next section contains literature review on reverse logistics and firm competitiveness. Section 3 contains research methodology in terms of the data, sample, method, and models. Section 4 contains data analysis, while the study is concluded in section 5.

LITERATURE REVIEW

2.1 Theoretical Framework

The theoretical framework for this study is consistent with the resource-based theory of Barney (1991). This theory contends that firms can improve their financial results and remain highly competitive if they are in possession and control of valuable resources and capabilities that are distinct and rare. While resources can be classified as organizational capital, physical capital, and human capital (Barney, 1986), capabilities are complex bundles which includes individual skills, assets and accumulated knowledge which are through organizational processes that enable firms to co-ordinate activities and make use of their resources (Olavarrieta & Ellinger, 1997). It follows, therefore, that manufacturing firms can improve their competitiveness through productivity and cost saving by implementing reverse logistics strategies which requires effective communication network as well as huge investment in necessary equipment and training.

2.2 Review of Some Recent Empirical Studies

Somuyiwa and Adebayo (2014) empirically analyze the effects of reverse logistics objectives on economic performance of selected firms in the food and beverages industry. The study focuses on Lagos State and the sample includes 10 companies that were purposely selected. The results obtained from multiple regression analysis suggest that the companies can use reverse logistics to minimize their environmental impact as well as improve their economic performance, measured by cost reduction, customer satisfaction, profitability, and value-added returns.

Recently, Guta (2016) considers the relationship between reverse logistics practices and organizational performance focusing on East Africa bottling share company in Addis Ababa, Ethiopia. Based on data collected from a sample of 111 employees selected using the stratified random sampling method, it is reported that both reuse and recycle as dimensions of reverse logistics have strong positive correlations with both financial and marketing performance.

Piyachat (2017) use the structural equation modeling to examine empirically the link between reverse logistics innovation, performance, and cost savings in Thailand, focusing on both manufacturing and service sectors using both quantitative and qualitative approaches. The quantitative analysis is based on a sample of 330 randomly selected top and middle managers, while the qualitative analysis utilizes 40 top and middle managers. The results show amongst others a positive relationship between logistics performance and cost savings.

Mbovu and Mburu (2018) consider how reverse logistics practices can enhance the competitiveness of manufacturing firms in Kenya, focusing on East African Breweries Ltd. The study considers four dimensions of reverse logistic practices; remanufacturing practices, repackaging practices, recycling practices and warehouse management practices while competitiveness is measured in terms of profitability, market share and cost reduction. The empirical analysis is based on a sample of 72 selected from supply chain related departments. The regression results show that all the dimensions of reverse logistics have positive and significant effects on firm competitiveness.

In Pakistan, Waqas et al. (2021) investigate the effects of reverse logistics on firm performance in the context of manufacturing firms across different industries using structural equation modeling. Their analysis is based on data collected from a sample of 466 managers (low-level, middle-level, and top managers). They find that both reverse logistics and reverse logistics barriers have significant impact on firm performance. However, while reverse logistics have a positive impact on firm performance, reverse logistics have a negative impact.

RESEARCH METHODOLOGY

3.1 Data and Sample

The data used in this study consist of questionnaire responses from 95 purposively selected managers from 11 listed food and beverages companies in Nigeria. The companies are Cadbury, Champion Breweries, Dangote Flour, Flour Mill, Guinness, Honeywell Flour Mill, International Breweries, NASCON, and Nigerian Breweries, Unilever, and Nestle, and 7up.
The initial demographic analysis of the data reveals that 82% of the respondents are male, 76% are married and the average work experience is 17 years. The minimum educational qualification is secondary school.

3.3 Measurement, Validity and Reliability

We measure all variables on a Likert scale with five options from (1) strongly disagree to (5) strongly agree. The SPSS variable conversion procedure was used to convert the initial Likert responses into interval data. The reliability of the data is determined based on Cronbach Alpha method, while the face and content validity are achieved through expert opinions.

Table 1: Descriptive Analysis for Reverse Logistics Dimensions

Item	Description	$\bar{x}$	σ
Reuse Scale (Cronbach Alpha = 0.810)			
RU1	We recall faulty or damaged products for remanufacture and reuse as part of our competitive strategy.	3.36	1.212
RU2	Our company's use of incentives to encourage customers to return used containers for reuse has increased our productivity and decrease our production cost	3.51	1.011
RU3	Our company remanufacture products at reduced costs while increasing productivity.	3.73	1.228
RU4	Because our company considers reuse options at the initial manufacturing, products are remanufactured to improve productivity and reduce cost	3.87	0.865
Recycling Scale (Cronbach Alpha = 0.879)			
RC1	Product recycling is part of my company's cost reduction and productivity strategy	3.85	0.543
RC2	Product recycling enhances productivity and cost reduction	3.77	0.452
RC3	The incentives our company provides for returned used containers for recycling has enhanced cost reduction and increase productivity	2.99	1.268
RC4	Package recycling is part of our competitive strategy	3.90	0.311
Repackaging Scale (Cronbach Alpha = 0.771)			
RP1	We repackage returned products as part of our reverse logistics strategy aimed at reducing costs and increasing productivity	3.53	0.723
RP2	Repackaged products have the same quality and standard as new products and are used as a strategy to improve profitability, productivity and reduce cost	3.84	0.643
RP3	Repackaged products are used as a strategy to reduce production cost while increasing productivity	3.22	0.912
RP4	Product repackaging is part of our competitive strategy	4.21	0.344

Table 2: Descriptive Analysis for Explanatory Variables

Item	Description	$\bar{x}$	σ
Cost Reduction (Cronbach Alpha = 0.861)			
CR1	We have relatively cost advantage in repackaging of products	3.68	1.121
CR2	Our reverse logistics operations are cost effective	3.74	0.877
CR3	Products are remanufactured at relatively low costs	3.50	1.200
CR4	Materials are recycled at relatively low costs	3.72	1.001
Productivity Scale (Cronbach Alpha = 0.822)			
PD1	Reverse logistics is a good strategy for improved productivity	3.92	0.542
PD2	Our company's productivity level increases due to reverse logistics operations.	4.52	0.417
PD3	Product recycling, repackaging and reuse enhanced productivity in my organization	3.67	0.121
PD4	Our reverse logistics operations are strategically targeted at improving the productivity and competitiveness of our company.	3.89	0.766

Technology Scale (Cronbach Alpha = 0.888)			
TECH1	Our company's use of technology and automated systems to enhance package recycling has led to significant cost reduction.	3.98	0.521
TECH2	Our company's use of automated systems and procedures in product repackaging has increased our productivity and reduce production cost	4.51	0.211
TECH3	Our company's use of barcode and other automated systems in reverse logistics management has improved our productivity and reduce our production cost	4.33	0.272
TECH4	Our company's use of modern technology for material recycling, repackaging and other reverse logistics operations has significantly increased our competitiveness.	3.75	0.652

3.4 Model Specification

The functional models for the relationship between reverse logistics and competitiveness are given by:

$$COMP = f(RLGS) \quad (1)$$

$$CR = f(RU, RC, RP) \quad (2)$$

$$PD = f(RU, RC, RP) \quad (3)$$

$$COMP = f(RLGS, TECH,\ RLGC * TECH) \quad (4)$$

Where; *COMP* = Firm Competitiveness, *RLGS* = Reverse Logistics, *CR* = Cost Reduction, *PD* = Productivity, *RU* = Reuse, *RC* = Recycling, *RP* = Reuse, and *TECH* = Technology. Also, *RLGC*TECH* = The Interaction between Technology and Reverse Logistics composite. The Reverse logistic compositive is a compositive combining Reuse, Recycling and Repackaging scales.

The empirical models are given by:

$$CR_i = \alpha_0 + \alpha_1 RU_i + \alpha_2 RC_i + \alpha_3 RP_i + \epsilon_i \quad (5)$$

$$PD_i = \beta_0 + \beta_1 RU_i + \beta_2 RC_i + \beta_3 RP_i + \varepsilon_i \quad (6)$$

$$COMP_i = \phi_0 + \phi_1 RLGS_i + \phi_2 TECH_i + \phi_3 RLGC * TECH_i + u_i \quad (7)$$

The moderating effect of technology is captured in model (7) through the interaction variable. Specifically, while ϕ_2 captures the direct effect of technology on firm competitiveness, ϕ_3 captures its moderating effect.

4 Empirical Analysis and Discussion of Findings

4.1 Reverse Logistics and Cost Reduction

Table 3 shows the cross-sectional regression results for the relationship between reverse logistics and cost reduction. Panel A shows the estimates of the individual coefficients, while Panel B shows the model fit statistics.

Table 3: Estimation Results for Reverse Logistics and Cost Reduction

Variable	Beta	*p*-value
Panel A: Model Estimates		
Intercept (α_0)	0.9306	0.0411
RU (α_1)	0.5090	0.0050
RC (α_2)	0.1065	0.0285
RP (α_3)	0.3324	0.0110
Panel B: Goodness of Fit Statistics		
R^2	0.558	
Adjusted R^2	0.491	
F-Statistic	4.243	0.0021
Durbin-Watson	1.873	

Our first objective is to determine the extent to which reverse logistics strategies can lead to cost reduction. The resource-based theory implies that implementing reverse logistics strategies can lead to cost reduction and thereby enhance firm competitiveness. From Panel A of Table 3, the coefficients on RU ($\alpha_1 = 0.5090$), RC ($\alpha_2 = 0.1065$) and RP ($\alpha_3 = 0.3324$) all enter the cost reduction model positively, indicating that reuse, recycling and repackaging all move in same direction with cost reduction. The associated probabilities show that the effects of these dimensions of reverse logistics re all statistically significant. Further, the adjusted R^2 in Panel B indicates that the estimated model is moderately explained, with nearly half of the total variation in cost reduction due to the combined effect of reuse, recycling, and repackaging. The F-statistic is associated with a p-value of 0.0021, suggesting that the three reverse logistics dimensions have highly significant joint influence on cost reduction. The Durbin-Watson value of 1.873 is higher than the $R^2 (= 0.558)$, suggesting that the regression results are not spurious, and hence are valid.

Consistent with the resource-based theory, these results suggest that all the three dimensions of reverse logistics are good cost reduction strategies for food and beverages firms that are listed in the Nigerian stock exchange. This evidence also agrees with previous studies such as Somuyiwa and Adebayo (2014), Guta (2016) and Mbovu and Mburu (2018). These studies all find that reverse logistics can lead to firm improved financial performance and competitiveness. We, therefore, argue that food and beverages firms can be more competitive by reselling recycled and repackaged products at discount or reduced prices. This would reduce operational costs, increase customer patronage, increase sales and lead to the full recovery of the economic value of life products.

4.2 Reverse Logistics and Firm Productivity

Table 4 shows the cross-sectional regression results for the relationship between reverse logistics and firm productivity. Panel A shows the estimates of the individual coefficients, while Panel B shows the model fit statistics.

Table 4: Estimation Results for Reverse Logistics and Firm Productivity

Variable	Beta	*p*-value
Panel A: Model Estimates		
Intercept (β_0)	0.5063	0.0186
RU (β_1)	0.4374	0.0200
RC (β_2)	0.1887	0.0321
RP (β_3)	0.0805	0.2111
Panel B: Goodness of Fit Statistics		
R^2	0.3846	
Adjusted R^2	0.3786	
F-Statistic	10.964	0.0033
Durbin-Watson	1.634	

Our second objective is to determine the extent to which reverse logistics strategies can enhance firm productivity. The resource-based theory implies that implementing reverse logistics strategies can lead to increased productivity and thereby enhance firm competitiveness. From Panel A of Table 4, the coefficients on RU ($\beta_1 = 0.4374$), RC ($\beta_2 = 0.1887$) and RP ($\beta_3 = 0.0805$) all enter the productivity model positively, indicating that reuse, recycling and repackaging all move similar direction with firm productivity. However, the associated probabilities show that while the effects of reuse (p-value = 0.0200) and recycling (p-value = 0.0321) are both significant at the 5% level, the effect of repackaging (p-value = 0.2111) is not significant. Further, the adjusted R^2 of 0.3786 in Panel B indicates that the combined effect of the three explanatory variables account for about 38% of the model variance, while the F-statistic (p-value = 0.0021) shows that this combined effect is highly statistically significant. The Durbin-Watson value of 1.634 is higher than the $R^2 (= 0.3846)$, suggesting that the regression results are not spurious, and hence are valid.

Consistent with the resource-based theory, these results suggest that all the three dimensions of reverse logistics are good strategies for improving firm productivity listed food and beverages firms in Nigeria. This evidence also agrees with previous studies such as Somuyiwa and Adebayo (2014), Guta (2016), Mbovu and Mburu (2018), Waqas et al. (2021). The findings of these studies suggest that reverse logistics can help firms achieve higher competitiveness. We, therefore, argue that food and beverages firms can be more productive by reselling recycled and repackaged products at discount or reduced prices.

4.3 The Moderating Role of Technology

Table 5 shows the cross-sectional regression results for the role of technology on the relationship between reverse logistics and competitiveness. Panel A shows the estimates of the individual coefficients, while Panel B shows the model fit statistics.

Table 5: Estimation Results for the Moderating Role of Technology

Variable	Beta	*p*-value
Panel A: Model Estimates		
Intercept (ϕ_0)	0.2344	0.0007
$RLGC$ (ϕ_1)	0.3575	0.0006
$TECH$ (ϕ_2)	0.3854	0.0002
$RLGC * TECH$ (ϕ_3)	2.9481	0.0000
Panel B: Goodness of Fit Statistics		
R^2	0.6939	
Adjusted R^2	0.6477	
F-Statistic	101.453	0.0000
Durbin-Watson	1.9202	

Our third objective is to determine the extent to which technology can moderate the impact of reverse logistics strategies can firm competitiveness. The moderating role of technology is examined in terms of the interaction between reverse logistics and technology. From Panel A of Table 5, $TECH$ ($\phi_2 = 0.3854, p$-value = 0.0002) is positive and significant at the 1% level. This shows that technology has a highly significant positive effect on firm competitiveness. Further, the coefficient on $RLGC * TECH(\phi_3 =$

2.9481, p-value = 0.0000) is positive and highly significant, the interaction of reverse logistics and technology has a positive effect on firm competitiveness. Hence, technology enhances the positive relationship between reverse logistics and firm competitiveness. Further, the adjusted R^2 of 0.6477 in Panel B indicates that the estimated model has a good fit, while the F-statistic (p-value = 0.0000) shows that this combined effect of all the explanatory variables is highly statistically significant. The Durbin-Watson value of 1.9202 is higher than the $R^2(= 0.6939)$, suggesting that the regression results are not spurious, and hence are valid.

Our findings suggest that technology shows that technology plays a direct positive role in the reverse logistics model as well as moderates the relationship between reverse logistics practices and firm competitiveness. Hence, technology, when used effectively, can enhance the positive effect of reverse logistics and firm competitiveness.

5 Conclusion

This study examines empirically the effect of reverse logistics on firm competitiveness for a sample of 95 production and marketing selected managers from 11 quoted food and beverages companies in Nigeria. The study also examined the influence of technology on the relationship between reverse logistics and firm competitiveness. Reverse logistics is measured by the 3Rs; namely, reuse, recycling, and repackaging, while cost reduction and productivity are used as proxies for firm competitiveness.

The results from regression analysis showed evidence that reuse, recycling and repackaging all exert positive and significant impact on both cost reduction and productivity. There is further evidence that technology exerts a highly significant positive moderating influence on the relationship between reverse logistics and firm competitiveness. These findings imply that reverse logistics can help food and beverages firms to reduce costs, improve productivity and become more competitive. Therefore, for listed oil and gas firms in Nigeria, effective use of technology is required for the benefits of reverse logistics to be fully realized.

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