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Vehicle Routing Decisions and Business Performance of Paint Manufacturing Firms in Rivers State, Nigeria

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ABSTRACT

This study investigated vehicle routing decisions and business performance of paint manufacturing firms in Rivers State, Nigeria. The study adopted the correlation survey design. Both primary and secondary methods of data collection were employed to obtain relevant data for analysis. The instrument of data collection employed was questionnaire. The study population was made up of the 30 registered paint manufacturing firms operating in Rivers State. The study selected two (2) managers from each of the firms as the respondents making it a total of 60 respondents for the study. The categories of managers selected include; Operations Managers and Logistics Managers. The data were analyzed using the Pearson's Product Movement Correlation statistic through the aid of statistical packages for Social Sciences (SPSS) version 23.0. Findings of the study showed evidence of significant and positive relationship between vehicle routing decisions and business performance among paint manufacturing firms in Rivers State. Based on the findings, the study concluded that vehicle routing decisions have significant relationship with business performance of paint manufacturing firms in Rivers State. The study therefore, recommended among others that managers of paint manufacturing firms should adopt appropriate vehicle routing in reaching their customers at different locations to aid efficiency in products distribution and improved business performance.

Key Words: *Business Performance, Vehicle Routing Decisions, Service Quality, Customer Retention.*

INTRODUCTION

The Nigerian paints industry has recorded tremendous growth and development since the last few years due to the increase in private and government investment in infrastructure and the growing demand for State of the Art infrastructural services. Lead Capital Limited (2008) notes that with Nigeria experiencing significant construction and infrastructure growth, and as economic boom is currently driving the country towards industrialization, the paints industry is quickly becoming a strategic growth market. Also, at the fore of the government's

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plans is turning Nigeria into a full-fledged industrialized country. According to Chen and Gong (2013) significant infrastructure investments over the last couple of years in building industrial plants, real estate properties, roads, bridges and manufacturing activities have provided decent opportunities for the paints industry. According to a report by the Lead Capital Limited (2008), the Nigerian paint industry has come a long way, from when paints were expensive and considered a luxury item till the present day. Today, individuals and companies have high awareness levels about the benefits of paints and this has provided a huge boost to the industry (Chen & Gong, 2013).

There are several paints manufacturing companies across Nigeria operating at varying capacities and scale, Rivers State is no exception. As a region in Nigeria, Rivers State is speedily evolving in terms of infrastructural development as many buildings and construction projects are going on both from government, private organizations and individuals; thus, one industry which is benefiting immensely from this process of infrastructural development is the paints industry (Lead Capital Limited, 2008). Given the fact that Rivers State is predominantly surrounded by rivers, swamps and creeks, one notable challenge impeding on business performance within the paint manufacturing sector in the state, is the issue of vehicle routing decisions (Chen & Gong, 2013).

However, the competitive nature of the industry and the fact that some of the companies lack good distribution network, access to financing and economies of scale, means very few companies dominate the paints manufacturing market (Lead Capital Limited, 2008). Although, there have been several researches both empirical and theoretical, that highlight the pivot role and relationship between vehicle routing decisions and business performance, there are little or no empirical evidence showing the relationship between vehicle routing decisions and business performance particularly among paint manufacturing firms in Rivers State. To breach the existing gap in literature, this paper sought to empirically investigate ways of delivering business performance through vehicle routing decisions among paint manufacturing firms in Rivers State.

Concept of Vehicle Routing Decisions

Battarra, Cordeau and Iori (2014) define vehicle routing as the process of creating the most cost effective transport means through minimization of distance or travel time necessary in order to reach a set of planned stops. Vehicle routing is a crucial process of logistics systems, especially due to the high competition and narrowing margins in the global market. Routing of goods and services incurs huge costs

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for vehicle operation, fuel, labor, and maintenance. Dorling, Heinrichs, Messier and Magierowski (2017) define routing in supply chain network, as systems that determine the shortest cut between two locations within a road network.

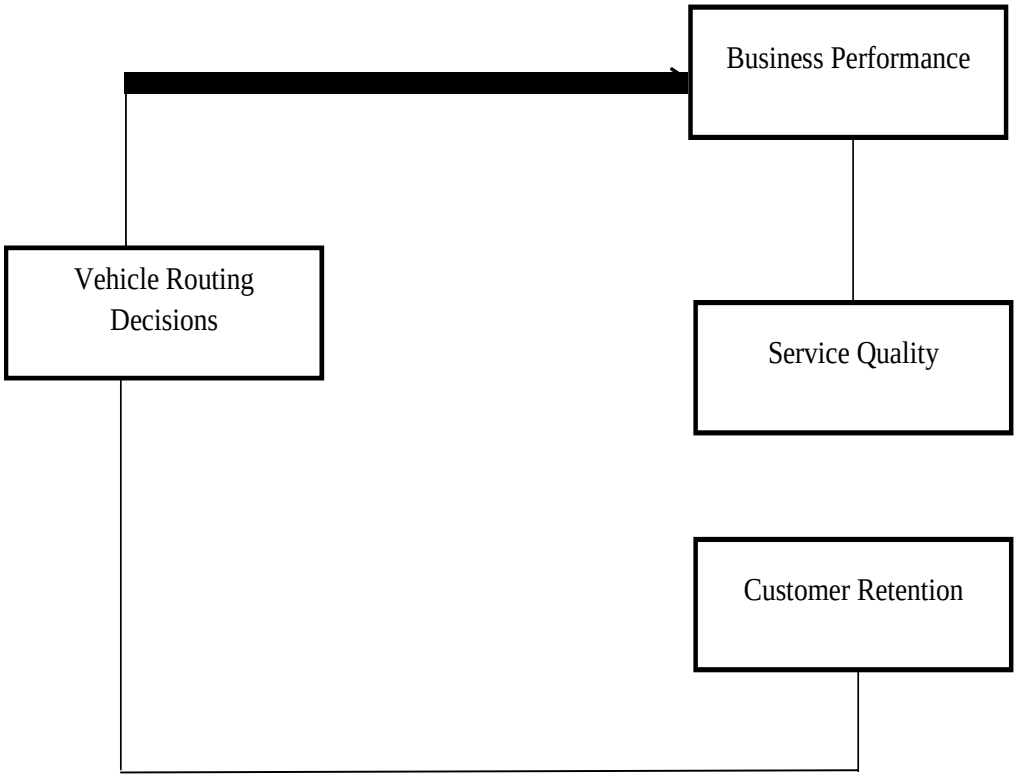

Figure 1: Conceptual framework of vehicle routing decisions and business performance of paint manufacturing companies in Rivers State.

However, following the advent of modern transport concepts, technology and high need for transportation, the idea of effectiveness in routing has become increasingly important (Bertsimas, Brown & Caramanis, 2011). Modern transport organizations which run on low operating margins and are governed by extreme market pressures must, as a normal part of business, drive costs down, utilizing a range of processes and/or technological means (Archetti & Speranza, 2012). Presently, the trends to reduce transportation cost among organizations have necessitated the need for efficiency and effectiveness in transportation. Vehicle routing problem has attracted many researchers in the past due to its interesting nature and economic scale (Ahmad, *et al*, 2014). Some of those researchers are involved in studying the mathematical nature of the problem; some concern

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themselves with the theoretical approaches for solving the problem, whereas others have tried to solve real-life problems and to produce implementable results (Cuda, Guastaroba & Speranza, 2015).

According to Errico, *et al* (2018), the objective of routing is to minimize the total cost of providing the service which includes vehicle capital costs, mileage, and personnel costs. Other objectives also may come into play, particularly in supply chain network designs decisions. For example, in school bus routing and scheduling, a typical objective is to minimize the total number of student-minutes on the bus (Crama, *et al*, 2018). This criterion is highly correlated with safety and with parents' approval of the school system. For Bolt or Ubber services for the handicapped or elderly, an important objective is to minimize the inconvenience for all customers. For emergency services, such as ambulance, police and fire service, minimizing response time to an incident is of primary importance in vehicle routing (Drexl, 2012).

Business Performance

Since successful development of an organization in the present day world is conditioned by flexible reaction on different requirements, it has become necessary to evaluate business performance and try to increase it. Performance in this sense means a business parameter that defines the size, strength, activity, proactiveness, competitive aggressiveness, autonomy and success of an organization (Bisbea & Malagueno, 2012). Amiri (2006) defines performance as an act of performing; of doing something using knowledge as distinct from merely possessing it and any recognized achievement. Business Performance helps firms in determining the relationship between organizations' marketing activities and its performance. Gimbert, *et al* (2010) emphasize that business performance embraces a broad spectrum of activities ranging from effectiveness of firms in achieving their goals.

Business performance is significant to business as it seeks to ensure what the customers' desires are and then directs resources towards fulfilling those needs. Dimoska and Trimcev (2012) remarked that business has transformed from just making a sale to having the objective of satisfying the customer's needs. Business performance is the extent to which business actions have helped the company to achieve its business goals (Grafton, Lillis & Widener, 2010).

From customers' perspective, business performance measures the degree of success recorded by organizations in evading the market place (needs of market), distinguishing the business opportunities, choosing the best market segments and offering them superior goods and/or services at reasonable price

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(Battara, Cordeau & Iori (2014). Success in achieving business performance is mainly attributed to top managers in any organization. According to Battara, *et al* (2014), identifying factors and its impact on the value of performance is an important tool of the management oriented on the growth of company value.

Practically, given its role, business performance calls for managers to have sufficient information for the purposes of planning and effective resource allocation to varying markets, products and territories. Business performance is also contingent upon the adeptness of managers to deliver profitable strategies from their philosophy, deliver qualitative and satisfactory products and services to bring about retention among customers (Parmenter, 2009). Ultimately, business performance depends on the ability to implement business plans successfully at various levels of the organization (Azman, *et al*, 2016).

Measures of Business Performance

A business performance measurement system refers to the use of a multi-dimensional set of performance measures for the planning and management of a business (Schmidt, 2010). Finding ideal concept for measuring and managing business performance is a complex problem yet; remains a topical discussion among experts, firms, business managers or academics in management and social sciences (Rodrigues & Raposo, 2011). Complex in the sense that there is a conflict between what customers define as performance and what constitutes performance to organizations (Ramezani, Kimiagari & Karimi 2014). Hence, there have been different approaches both traditional and modern that prescribe a standard for measuring performance.

Traditional approaches for measuring performance are mostly based on the primary company´s goal, which is considered as profit maximization and for its expression large number of indicators is used, but they are not always compatible with each other. Bisbea and Malagueno (2012) held that traditional business performance measurement can show just overall results but eludes what area a company should be better to accomplish its strategic goals. Modern approaches to value-based management of the company are trying to connect all company´s activities together with people who are involved in business process, using one criterion that results in increased value of the invested capitals by company´s owners (Parmenter, 2009).

Business performance is measured by various methods, some of them are essentially very simple and other methods are extremely sophisticated and complex, both conceptually and mathematically. Simply put, performance

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measurement systems are concise set of metrics (which may be financial and/or non-financial, long and/or short term, internal and/or external, ex post/or ex ante) that support the decision-making processes of an organization by gathering, processing, and analyzing quantified information about its success and presenting it in the form of a succinct overview (Bisbe & Malagueno, 2012).

Similarly, Ongore and Kusa (2013) determined performance using market share, profitability, quality service delivery, return on assets, retention of customers, charge in market share or profitability, new product success and customer satisfaction. Thus, this study adopts non-financial measures of service quality and customer retention as key attributes of business performance.

Service Quality

The enduring success and survival of any service organization is essentially determined by its ability to deliver qualitative service to its customers. The term service quality is a combination of two different words-service and quality. Services are an important segment of all economies and they become increasingly more a part of everyday life as economies develop. According to Azman, Hafizah and Ilyani (2016), service means any activity or benefit that one party can offer to another that is essentially intangible and does not result in the ownership of anything. Services are key factors towards retaining satisfied customers and ultimately, building successful business regardless of any industry (Akbar, *et al*, 2010).

Quality has been recognized as a strategic tool for attaining operational efficiency and high business performance (Azman & Norashyikin, 2009). Quality in a service measures the extent to which a delivered service meets the customer's expectations and is determined by the customer's perception and not by the perceptions of the providers of the service. Superior service is a key to customer satisfaction, retention and the overall business performance. Similarly, Azman and Norashyikin (2009) view service as a critical determinant of competitiveness which helps a firm to differentiate itself from other competitors and gain a competitive advantage. Service quality has become a significant subject because of its impact on customer satisfaction and has drawn attention of many researchers and managers in recent decades (Akbar, *et al*, 2010).

Service quality can be viewed as a perceived judgment, resulting from an evaluation process where customers compare their expectations with the service they perceive to have received. Ahmad, *et al* (2014) define service quality as a firm's ability to hang on to its customer through satisfactory performance

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obligation. That is, in their opinion customer retention is the best measure of service quality. Parasuraman, *et al* (1988) defined service quality as the degree of discrepancy between customers' normative expectations for the service and their perceptions of the service performance. Perceived service quality is then interpreted from the differences in degree and direction between perceptions and expectations.

According to Ismail and Yunan (2016), service quality means the ability of a service provider to satisfy customer in an efficient manner through which he can better the performance of business. It measures increase in customer satisfaction towards a firm's service and in turn helps the firm to position its service in the minds of the customers. By satisfying customers through high quality service, business firms not only retain their current customers, but also increase their effectiveness and overall performance due to its positive link with profits, increased market share, customer satisfaction and retention (Ismail & Yunan, 2016).

The reasons for such a treatment are inherent features of services like intangibility, inseparability from the provider, heterogeneous etc. Hence there is a distinct frame work for quality explication and measurement. However, customers satisfaction gained from customer experience and service quality is a veritable tool for winning customer loyalty and improving business performance (Azman & Norashyikin, 2009).

Service quality benefits organizations in a plethora of ways. While some service organizations adopt service quality in building the brand image of the service and positioning such brands in the mind of customers, some implement it to ensure customer satisfaction, high revenues, increased customer retention and customer purchase behaviour (Al-Borie & Damanhouri, 2013) all of which ultimately increases the market share and general business performance. According to Gagliano and Hathcote (1994), any act that predicts variety, quality, dependability and timely delivery of service can be attributed to service quality and leads to business performance.

Customer Retention

Customer retention is a strategic tool used by firms in striving to maintain long-term relationships with their customers. Customer retention discourages customer defection. According to Ismail and Yunan (2016), high customer retention rate means low defection rate or low rate of switching. Here, we define customer retention to mean the number of customers doing business with a paint

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manufacturer at the end of a financial year expressed as percentage of those that were active at the beginning of the year.

According to Ramakrisnan (2006), customer retention is a marketing goal of keeping our customers from going to the competitors. The success of customer retention depends on the firms' service environment which must meet or exceed the customer's expectation (Usen and Agburum, 2018). Therefore, taking care of the customer's need today is not sufficient but knowing and predicting the customers is paramount to the survival and growth of their business. Again, Usen and Agburum further propose that customer retention in the manufacturing industry can be carried out in numerous ways via customer loyalty schemes As in the case of paint manufacturers, they could offer customers free meal or the use of their vehicles for conveyance at a reduced price in line with their patronage weekly or monthly and yearly (Bardauskaite, 2014). Retaining customers can be done by providing efficient service beyond customer expectation as to maintain trust and satisfaction. Bellingkrodt and Wallenburg (2015) note that customers could be retained when there is a means for an open feedback from customers. This will ensure that the service delivery is in accordance with the customer's need expectation.

Keeping or retaining customers is very important when the cost of acquiring them is much greater than the cost of keeping or retaining them. Bardauskaite (2014) observes that the cost of acquiring a new customer has been estimated to be five-six times higher than that of retaining an existing customer. Bei and Chiao (2006) posit that customer retention or long-term customer has some benefits which are; ability to buy more and take less of the seller's time, less sensitive to price, creation of positive image and adding more new customers to the business, increased profit per customer as a result of increase in customer lifespan, this is so because the longer the customers are with a firm, the more their willingness to pay premium prices, become advocate, demand less and spend much time and more money (Azman & Norashyikin, 2009).

Therefore, the more and better approaches a firm adopts to improve its customer relationship, its marketing efforts in terms cost effectiveness will be. In line with this, paint manufacturing firms need to seek to use their lean resources to keep existing customers instead of attracting new ones. Retaining or keeping customers is a most and business managers must know those factors that may lead to increment in customer retention rates. The high cost of acquiring new customers and intense competition globally has compelled companies to fashion out techniques for building long-term mutually beneficial relationships with their existing customers (Azman & Norashyikin, 2009).

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The focus of the modern marketers has shifted away from a one-time sale to making repeated sales to the same customer. Bei and Chiao (2006) argue that increasing attention is being paid to medium and long term perspectives, rather than just the short-term perspective. This has been a major revolution in the field of marketing. If the customer remains loyal to the company, naturally, the repeated purchases represents a cumulative value which is quite substantial compared to any single transaction. Therefore, the focus of marketing has shifted away from the goal of mere customer acquisition to customer retention in order to substantially reduce marketing costs (Azman & Norashyikin, 2009).

The key differentiator between customer retention is customer satisfaction. Satisfaction results when the customer feels that the value of a service received by him is substantially higher than the price he paid for acquiring the service (Azman & Norashyikin, 2009). Customer satisfaction can be largely attributed to the quality of the service or product. Thus, delivery of high quality service is crucial to the high service value perception. When the major marketing goal of a company is customer retention, the quality of service delivery is, undeniably, the key differentiator (Azman & Norashyikin, 2009).

Theoretical Foundation and Empirical Evidence of the Study

This study is anchored on the contingency theory. The contingency theory holds that circumstances play a critical role in determining the best possible response (Qiu, *et al*, 2019). Consequently, there is not good fit for all situations as other theories of management may tend to suggest; each organization has unique circumstances and management has to tailor decision making to create best fits that address contextual issues. There are no predetermined notions that every organizations can fit into and there are no universal approaches that deliver results for every organization (Toumazis and Kwon, 2013). All organizations have to attempt to uniquely respond to their circumstances and create a good fit for the emergent circumstances.

When applied to the routing designs function, the contingency theory helps organizations to appreciate the fact that supply chain vehicle routes are very different and unique. There are no universal vehicle routing modes, the application of any network should be based on the nature of distribution, the recipient of the product, the time of distribution and the location of facility. The application of appropriate network decision will help organizations to achieve their business outcomes (Ramezani, *et al*, 2014). While one routing decision approach works in one context or organization, the same approach would lead to

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failure when applied to other organizations. These are important considerations when it comes to adoption of supply chain vehicle routing and actual distribution practices in organizations. Organizations should consider certain circumstances in their supply chain routing decisions in order to achieve optimal performance.

Studies have shown that vehicle routing is critical to supply chain network design decisions with evidence of positive impact on business performance, this statement is backed by several empirical evidence. Amiri (2006) carried out a study on designing a distribution network for efficient solution procedure in a supply chain system. The descriptive survey research used questionnaire and personal interview to generate the data. The study used Analysis of Variance to test the hypothesis between the variables and it found evidence of significant and positive relationship between vehicle routing dimension and efficient solution procedure in a supply chain system. Similarly, Chen and Gong (2013) conducted a study on performance evaluation of a supply chain network in the transportation industry and divided supply chain network into facility location, warehouse capacity, transportation mode, material flow, vehicle routing and warehouse layout. They found that there is strong significant and positive relationship between vehicle routing dimension and performance of transportation industry in China.

Again, Toumazis and Kwon (2013) determined the relationship between supply chain networks and urban logistics effectiveness. The study employed stochastic, mathematical and practical methods and found that vehicle routing and transportation mode dimensions of the study have the most significant relationship with urban logistics effectiveness. Qiang and Nagurney (2012) studied supply chain network performance for critical needs under capacity and demand disruptions. The study was characterized with dimensions such as location, capacity of facilities, distribution centre and technology facility and transportation network. Thus, it found that vehicle routing dimension impacts positively on performance and growth of firms.

Tsao and Lu (2012) examined effect of supply chain network design and transportation cost discounts in Kenyan transportation industry. The study defined supply chain network design in terms of transportation mode, warehouse capacity, location of facility, material flow and vehicle routing. Findings of their study indicated significant and positive relationships exist between vehicle and transportation cost discounts in Kenyan transportation industry.

Ho1: There is no significant relationship between vehicle routing and service quality of paint manufacturing firms in Rivers State.

Ho2: There is no significant relationship between vehicle routing and customer retention of paint manufacturing firms in Rivers State.

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METHOD

This study adopted the descriptive survey research design. The study population comprised of the thirty (30) registered paint manufacturing firms operating in Rivers State which are enlisted in the Rivers State Yellow Pages (2013/2014). The study selected two (2) managers from each of the firms as the respondents making it a total of sixty (60) respondents for the study. Categories of managers included Operations Managers and Logistics Managers of paint manufacturing firms in Rivers State. The 60 copies of questionnaire were usable for the data analysis. Pearson Product Moment Correlation (PPMC) technique was used in testing the hypotheses in order to determine the relationship between the predictor variable (vehicle routing decisions) and the criterion variable (business performance) with the help of the Statistical Packages for Social Sciences (SPSS) version 23.0.

RESULTS AND DISCUSSION

Table 1: Relationship between Vehicle Routing and Service Quality

		Vehicle Routing	Service Quality
Vehicle Routing	Pearson Correlation	1	.684**
	Sig. (2-tailed)		.000
	N	49	49
Service Quality	Pearson Correlation	.684**	1
	Sig. (2-tailed)	.000	
	N	49	49

Correlation is significant at the 0.01 level (2-tailed).

As can be observed from Table 1, there is a correlation coefficient of 0.684** between vehicle routing and service quality, indicating a strong and positive relationship between vehicle routing and service quality. More so, the probability value (0.000) is less than the critical value (0.05), this shows that there is a strong significant relationship between vehicle routing and service quality. This further implies that vehicle routing predicts most of the changes in service quality among paint manufacturing firms in Rivers State while others are caused by externalities. Based on this, we reject the null hypothesis that there is no significant relationship between vehicle routing and service quality of paint manufacturing firms in Rivers State.

From the SPSS output on Table 2, it can be observed that there is a correlation coefficient of 0.547** between vehicle routing and customer retention, indicating a moderate and positive relationship between vehicle routing and

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customer retention. More so, the probability value (0.000) is less than the critical value (0.05), this shows that there is a moderate significant relationship between vehicle routing and customer retention. This further implies that vehicle routing predicts some of the changes in customer retention among paint manufacturing firms in Rivers State while others are caused by externalities. Based on this, we reject the null hypothesis that there is no significant relationship between vehicle routing and customer retention of paint manufacturing firms in Rivers State.

Table 2: Relationship between Vehicle Routing and Customer Retention

		Vehicle Routing	Customer Retention
Vehicle Routing	Pearson Correlation	1	.547**
	Sig. (2-tailed)	.000	
	N 49	49	
Customer Retention	Pearson Correlation	.547**	1
	Sig. (2-tailed)	.000	
	N 49	49	

**. Correlation is significant at the 0.01 level (2-tailed).

The analysis of the study revealed a correlation coefficient of 0.684** between vehicle routing and service quality, indicating a strong and positive relationship between vehicle routing and service quality. More so, the probability value (0.000) is less than the critical value (0.05). This shows that there is a strong significant relationship between vehicle routing and service quality. Again, the result revealed a correlation coefficient of 0.547** between vehicle routing and customer retention, indicating a moderate and positive relationship between vehicle routing and customer retention. More so, the probability value (0.000) is less than the critical value (0.05). This shows that there is a moderate significant relationship between vehicle routing and customer retention.

These results are validated by the empirical findings of Luo, *et al* (2015) on-service consistency in multi-period vehicle routing among manufacturers. They used both mathematical and practical models in exploring the impact of multi-period vehicle routing on service delivery consistency. Their findings indicate that vehicle routing is crucial to service delivery consistency of manufacturers. Similarly, Qiu, *et al* (2019) carried out an empirical study on impact of routing on optimal production, replenishment, delivery and inventory management for products with perishable inventory. Their findings revealed that routing significantly impact optimal production, replenishment, delivery and inventory management for products with perishable inventory.

The results are *in tan dem* with the findings of Toumazis and Kwon (2013) who investigated routing hazardous materials on time-dependent networks using

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conditional value-at-risk. The study considered some hazard factors in supply chain networks and concluded that appropriate routing helps to reduce or eliminate road hazards. The results also conform with Boudoin, *et al* (2014) on the relationship between supply chain networks and urban logistics effectiveness. The study employed stochastic, mathematical and practical methods and found that vehicle routing dimension of the study has the most significant relationship with urban logistics effectiveness. Finally, the result of the analysis is supported by Bruck, *et al* (2018) who examined routing problem and practical time slot management for attended home services. The study used mathematical method to gather and analyze its data and it found that understanding and application of the right vehicle routing leads to effective time-slot management for attended home services.

CONCLUSIONAND RECOMMENDATIONS

This study has established that there is significant relationship between vehicle routing and business performance in Rivers State paints manufacturing sector. Drawing from the empirical findings and to the extent of its consistency with results of similar previous studies, the researcher concludes that vehicle routing decisions have significant relationship with business performance of paint manufacturing firms in Rivers State which implies that paint manufacturing firms can deliver healthy business performance through adoption of vehicle routing. Thus, vehicle routing is a critical supply chain network design decisions which accounts for business performance in most organizations.

Based on the findings and to the extent of its consistency with results of similar studies, this paper recommends that managers of paint manufacturing firms should adopt appropriate vehicle routing in reaching their customers at different locations to aid efficiency in products distribution improved business performance. Also, managers of paint manufacturing firms should be more careful when designing vehicle especially as they strive for profit maximization through quality service delivery, customer satisfaction and customer retention.

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