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Demand Forecasting and Supply Chain Performance of Bakery Firms in Rivers State

Ikegwuru Mac-Kingsley (PhD)

Department of Logistics and Supply Chain Management, Rivers State University, Port Harcourt

Abstract: *The study examines demand forecasting and supply chain performance of bakery firms in Rivers State. The population of the study consists of two hundred and eleven (211) bakery firms registered with the Commercial Department of the Rivers State Ministry of Commerce and Industry, Port Harcourt. The sample size was 121bakery firms, and the number of respondents, was 363 management staff. Copies of questionnaire were used as primary source of data collection, and the simple regression analysis was employed to test the proposed hypotheses. Findings revealed that, demand forecasting has a strong influence on order lead time and very strong influence on on time delivery. The study therefore, concludes that, there is a significant influence of demand forecasting on supply chain performance of bakery firms on Rivers State, and recommends that, managers of bakery firms should identify several capabilities, their relative importance, and the processes for achieving demand forecasting policies which when properly executed can improve order lead time and on time delivery, in order to attain optimal supply chain performance and enhance their competitiveness in this 21st century business milieu.*

Keywords: *Demand forecasting, On time delivery, Order lead time, Supply chain performance.*

INTRODUCTION

The bakery firms play a key role in the society as they kindle the economy at large, proving that, they are among the prime food processing industry in Nigeria anchoring bread and biscuit that estimate 82 per cent of their yield in the industry under stiff competition (Onwumere *et al.,* (2012). In today's highly competitive global environment, performance can no longer solely be determined by the decisions and actions that transpire within a firm as the contribution of all are involved to give overall results of activities in the supply chain (SC). The competition has changed from being between individual organizations to being between supply chains.

Companies form global alliances fundamentally to understand how their supply chains management can be successfully implemented. The essence of supply chain is to satisfy customers' needs and, in the process, generate profits for itself. Supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and the end users themselves. Thus, a bakery supply chain consists of all stages involved directly or indirectly to fulfill a customer request for baked products. The maturity of this supply chain governs a bakery company's supply chain performance, affecting its order lead time and on time delivery.

As noted by Gunasekaran *et al.* (2004), a lot of companies have not succeeded in maximizing their supply chains prospective because they have failed to develop the performance measures and metrics desired to fully integrate their supply chain, thereby maximizing effectiveness and efficiency. Indeed, well-developed and evolved bakery firms are critical to conditions for economic development as like any other industry, it is expected to continue improving her performance so as to sustain its role in the society. The involvement of demand forecasting techniques in this direction cannot be overemphasized as it goes a long way to strengthen the supply chain performance of firms. Demand forecast plays a significant role in the decision-making process of a business. The is massive role of forecasting enthuse realistically proper output preparation, selection of procedures, regression testing and resource management etc. Forecasting of intermittent demand is imperative, nevertheless, it is a challenging problem. It is notable for various hollow requests, and tall non-zero variance values.

Some previous studies on demand forecasting have accumulated. For example, Syntetos *et.al.* (2021) investigated the reasons of the irregular performance of the Croston approach and progressed it, Erica *et.al.* (2020) studied a two-tier single item output network with a crystal-clear demand distribution that is controlled by the time-honored AR (1) technique however with indeterminate strictures, Niles Perera *et.al.* (2019) provided the first systematic literature survey of critical forecasting, Chang (2019) revealed problems in demand forecasting and supply chain management of financial forecast by developing time series models and vector auto regression method, Galina and Alexander (2019) looked at the new methods and key problems in demand forecasting for the pharmaceutical industry, Wang *et.al.* (2019) furnished the connection amid irregular demand indicator and predictive accuracy, and Paul *et.al.* (2018) introduced a framework for establishing consumer segments based on noisy past transaction data, generating segment level forecasts and then implementing consumer forecasts,

The studies above, indicate that, there is no all-embracing solution in forecasting techniques; since every application are shaped to the precise application. Demand forecasting as one of the vital elements of supply chain management that has critical impact on supply chain performance, and such activity should be performed to respond to the needs of the customers by using efficiently the accessible forecasting methods that are appropriate for a given problem. Hence, this current study seeks to contribute to literature, through a scientific exploration into the influence of demand forecasting techniques (quantitative and qualitative techniques) on supply chain performance of the bakery industry in Rivers State

REVIEW OF RELATED LITERATURE

The preceding section envelops the introductionof the study, while this sectionreviewedrelevant literatures centered on amplifying the theoretical under pinning on which this study is shaped.The study covered literature intensively in order to institute theoretical and empirical interactions.

Theoretical Foundation

This study is anchored on resource dependency theory.

Resource Dependency Theory

As cleared by Pfeffer and Salancik (1978), through the resource dependency theory, firms try to diminish vulnerability and oversee reliance by deliberately organizing their trade relationship, setting up formal and semi-formal association with other firms' (Mito, 2015). Through the created linkages and connections,

associations can diminish inconveniences that come because of market elements. This hypothesis can be connected in internal stock control. Organizations can form strategic, long term relationships with providers and product users to guarantee smooth and opportune conveyance of materials (Angel, 2015). With long haul provider client relationship, the association can support itself from inner and outer hierarchical and ecological changes and accomplish ideal stock control (Kitaeva, 2014).

Gerald (2014) has revealed that Resource Dependency Theory depends on the uncertainties that; first, organizations rely upon assets from diverse organizations for their internal activities. The successivepossibility that will be that the assets attained from diverse associations are required by assets (cash). Third, the assets are rare and engrossed and, in this manner, necessitatedynamic choices to be made about what to purchase, in what amount and at what times. By inference, asset reliance is straightforwardly connected to the association's capacity which is judicious, situational and shared for the classified achievement.

As per the authors (Pfeffer & Salancik 1978), the hypothesis takes a glimpse at how the assets outside the association decide interior tasks of the association which at last prompts operational execution. Association and control of secured materials is crucial in sourcing and control of assets utilized inside the association (Pfeffer & Salancik 1978).

Asset reliance hypothesis contends that an association must have inside structures all around incorporated and facilitated through viable correspondence frameworks and adjusted to authoritative methodology. There is have to create interior authoritative arrangements and techniques that guide benefiting assets required in completing inside hierarchical exercises. These arrangements are significant in materials sourcing and control choices.

Likewise, there is prerequisite for a well-overseen data agenda that permits expedient progression of stock data between the association and its outer partners (Hurley, 2016). The resource dependency theory will be used in illustrating the concept of demand forecasting. Based on the suggestions poised by the founders (Pfeffer & Salancik 1978), resource dependency theory reflects a proper planning for demand forecasting activities in the organization for operational excellence. The resource dependence theory is relevant to this study because, the capabilities of a supply chain can be connected in demand forecasting to enliven supply chain performance. Bread manufacturers can form strategic, long-term relationships with suppliers and product consumers to guarantee even and fittingdelivery of materials and attain favourable supply chain performance.

The Concept of Demand Forecasting

Demand forecasting refers to the process of predicting the quantity of goods and services that will be demanded by consumers at a future point in time (Acar, *et al.*, 2014). Demand forecasting is the process of using historical data to estimate future demand for products (Adhikari *et al.,* 2019). Demand forecasting is therefore, the process of understanding and predicting customer demand in order to make smart decisions about supply chain operations, profit margins, cash flow, capital expenditures, capacity planning, and more. Demand forecasting is the method where past sales data are used to create an estimation of the present customer demand outlook, and in competitive

market conditions proper decision making and planning for future business-related events such as sales, production, staff requirement, etc. is required. Intermittent demand arises when a commodity faces several zero demand cycles.

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Some previous studies on demand forecasting have amassed. For example, Ali *et.al*. (2017) gives demand inference techniques for supply chains in which information cannot be shared in view of simple smooth downstream moving strategy, Wood (2017) discussed factors touching demand forecast quality enhancement crosswise Sales Reporting Level. NematiAmirkolaii *et al.* (2017) contend that prevailing methods of forecasting to account for intermittent demand trends were not precise. Boylan *et.al*. (2016) analyzed the statistical performance of the non-overlapping and overlapping approaches and demonstrates that overlapping approach ensembles when demand history short, likewise greater for longer lead times. Fotios Petropoulos, *et.al*. (2016) debated the creative method of aggregating intermittent demand data momentarily to lessen supply volatility, Syntetos *et.al*. (2016) discoursed the impact of forecasting on inventory control output in several demand series, JuanPedrosepulved-Rojas, *et.al*. (2015) projected an alternative approach for estimating the finest forecast model deprived of estimating all of the forecast models or supplementing it, Fatios Petropoulos *et.al*. (2014) methodically examines the utility of intermittent demand forecast blends and addresses both the process and the period variations of forecasts, Babai *et.al*. (2014) examined the performance of Croston's and TSB method for intermittent demand, and Sanjita and Mahapatra (2014) presented a new approach of demand forecasting by integrated Discrete Wavelet Transforms (DWT),

Demand forecast research has repeatedly supposed that accurateness is the leadingstandards for one to hand-pick the superlative prediction model (Veiga, Veiga & Duclos, 2010, Romualdo, Baptista & Vieira, 2010; Chen, 2011), in spite of numerous principles being needed when one successfully 'conducts in practice prediction techniques´ assessments (Yokum & Armstrong, 1995). Empirical studies confirmed that exceedingly accurate demand forecasts yield energetic role in footings of retail profitability (Veiga, Veiga, Vieira & Tortato, 2012) and in a straight line stimulate customer service levels, safety stock levels, total costs and supply chain performance.

Supply Chain Performance

A supply chain (SC) is a network of organizations carrying out a variety of processes and activities to generate value in the form of products and services to end consumers (Christopher, 1992). Then again, a supply chain is a network of organizations that are involved, through upstream and downstream connections, in the diverse processes and activities that harvest value in the form of products and services in the hands of the end customer (Christopher, 1998). Supply chain is therefore, a grid of conveniences and events that accomplishes the purposes of product development, obtaining of material from suppliers, the transportation of materials amongst facilities, the engineering of products, the distribution of finished goods to customers, and after -sales backing for upkeep.

According to Ikegwuru and Olomi (2021) performance is a competence (both corporeal & emotional) to transporta scrupuloustask in a comprehensive routine that can be evaluated as outstanding, standard or profuse in equilibrium. Ikegwuru (2022) observed that, performance is every now and then replaced with productivity. Supply chain performance refers to the total supply chain's events in meeting end-users'necessities, together with product availability, timely delivery, and all the essential inventory and

volume in the supply chain to transport that performance in an approachable manner. Supply chain performance crosses company borders since it embraces basic materials, components, subassemblies and finished products, and distribution by means ofseveral channels to the end users. It also cuts across traditional purposeful organization positions such as procurement, manufacturing, distribution, marketing and sales, and research and development. Ikegwuru and Harcourt (2018) noted that, "supply chain performance improvement is an unceasing process that needs an analytical performance measurement system"Supply chain performance thus, necessitates a reliableessential and appraisable partnership with associates in visibly, discrete organizations, working in harmony, intrinsically for improved product or service conveyance to match customers' supplies.

Supply chain management (SCM) is a cohesive function with bursting concern on connecting business functions and process, with and through businesses, handling the energetic supply chain flows of financial, material and information, amid the different phases of supply chain, to attract optimal supply chain performance. Performance measurement is the procedure of measuring the efficacy and competence of actions. Gunasekaran *et al.* (2005) posit that, new organizations have to handle several categories of performance gravities and appropriate methods are required. The study also expresses direct justification for the need of performance measurement system, and in line with Kleverlaan (2008), adopts order lead time and on time delivery as the measure of supply chain performance.

Order Lead-Time

Lead time is a quantity which "indicates the amount of elapsed time from a story or chunk of work entering the backlog to the end of the iteration or the release. Lower lead time indicates a more effective process and a more productive project team." (Project Management Institute (2021). A lead time is the inexpressionamid the commencement and accomplishment of a process. Business dictionary (2019) describes "lead time" as the overallperiodvital to make an item, plus order preparation time, queue time, setup time, run time, move time, inspection time, and put-away time. For example, the lead time between the placement of an order and delivery of bread by a specified baker might be between 2 days and 2 weeks, contingent on various particularities.

Order lead time is defined by Storhagen (2003) as the whole time elapsed from when an order has been made, pending the date when the ordered materials arrive at the receiver. Stevenson (2012) defined order lead time as the time estimated from the instant the customer sends a purchase order till the customer receives the order. Mills (2023) defined order lead time as the time from beginning a process to completing it. Kenton (2022) perceived order lead time as the quantity of time that passes from the start of a process up until its conclusion. This study defines order lead time as the period desirable to assembly an item contingent upon, order preparation time, wait time, setup time, production run time, move time, inspection time, and even stocking time. It is basically the time that passes from the start of a process pending its finishing. An example of order lead time in a supply chain is when a company might need between two weeks and eight months, contingent on convinced variables, to transport a product after the buyer places an order. Order lead time is thus, a mechanism forstreamlining manufacturing time designs, swaying logistics and sales management.

On Time Delivery

On time delivery is an organization's capability to supply goods and services per the standards anticipated by its customers. On-time delivery mirrors whether seamless delivery has occurred or if not and is also a measure of customer service level. **On time delivery is** a scheming that is depended on the proportion of

sales orders that delivered on time. Usually, on-time delivery is appraised as the quantity of products divided by the quantity of total products transported once-a-month. It is a significant facet of a business as it echoes the latent of a business to match customer expectations vis-à-vis time and cost. Various factors that can stimulate delivery speed embrace vehicle speed, driver reliability, frequency of delivery, and location of depots.

According to Gunasekaran *et al.* (2001), on time delivery consists of the following:

1. **The quantity of deliveries**: The quantity of finished deliveries oraverage number of deliveries in a month.
2. **The quantity of on-time deliveries**: deliveries carried out on time to the customer. performance.
3. **Accuracy in order fulfillment** can be evaluated by computing the order accuracy rate.
4. One of the vital key performance pointers to estimate delivery is **on-time delivery.**

Once an order is placed, it is equally essential that the vendors provide the required items as promised without any changes in the quantity. That will ensure a smooth production process. To improve on-time delivery, the organization must boost the operation of all the departments by improving planning, monitoring, and working efficiency.

Empirical Studies

Hung *et al.* (2022) empirically embarked on comparison of the sales forecasting performance for plastic tray manufacturing by means oftwo propositions: a dedicated time series forecasting scheme, which is both precise and sustainable, anda realisticsurveillance of the data setting to handlequandary of missing data and to successfullyinventpostforecastmodification strategies. The results demonstrate that a definite product needs to be embodied by a keen model and, the gap amid forecast and tangible demand is linked by utilizing a validation set, and it is further used for preparemodification strategies concerning production volumes.

Karlsson and Abdul Aziz (2021) investigated how small sized wholesalers gain from demand forecasting, using a singular case study at a local small-sized furniture wholesalers in Sweden. The study employedtriangulation technique by means of interviews, document analysis and a survey as data collection methods to concentrate on downstream members of the wholesalers' chain, retailers. Findings portray the significance of deciding on a forecast model in line with the company's business state of affairs. In addition, aided by a self-designed four-step forecast procedure, the company could classify its influencing factors (seasonality, lead-times, lack of information sharing, etc.), accessible data, and lastlychoose the suitable model analogous with the business circumstances. Besides, the question regarding information sharing between supply chain partners was acknowledged where retailers endorse the performance of the entire supply chain and demands a partnership as a prerequisite for sharing information.

Matsumoto (2015) examined the effectiveness of demand forecasting using time series analysis in auto parts remanufacturing. The study employed the time series data of the shipments of an actual IR of auto parts for a total of 400 types of remanufactured alternators and starters over a period of 12 years, with the forecasting results providing an average error of 27.2% comparative to the definite shipments made over the forecasted year.

Pereira Da Veiga *et al*. (2012) examined the application of demand forecasting as a strategic sustainability device at a Brazilian SME by means of a descriptive, expost facto and cross-cut, sectional time case study, employing qualitative and historical quantitative and direct observational data, and revealed that, cause-effect relationships exist between prediction accuracy, demand responsiveness and process-resulting economic, environmental and social performances. Additionally, it was found that, demand forecasts guarantee the resourceful use of resources, improvements in customer responsiveness and as well moderate supply chain stock out and overstock losses. Besides, demand forecasting condensed the quantity of waste emanating from retail product shelf-life expiration, boosting demand and of customer satisfaction, thus powering resultant environmental and social growth.

From the review of literature, the following operational conceptual framework was designed:
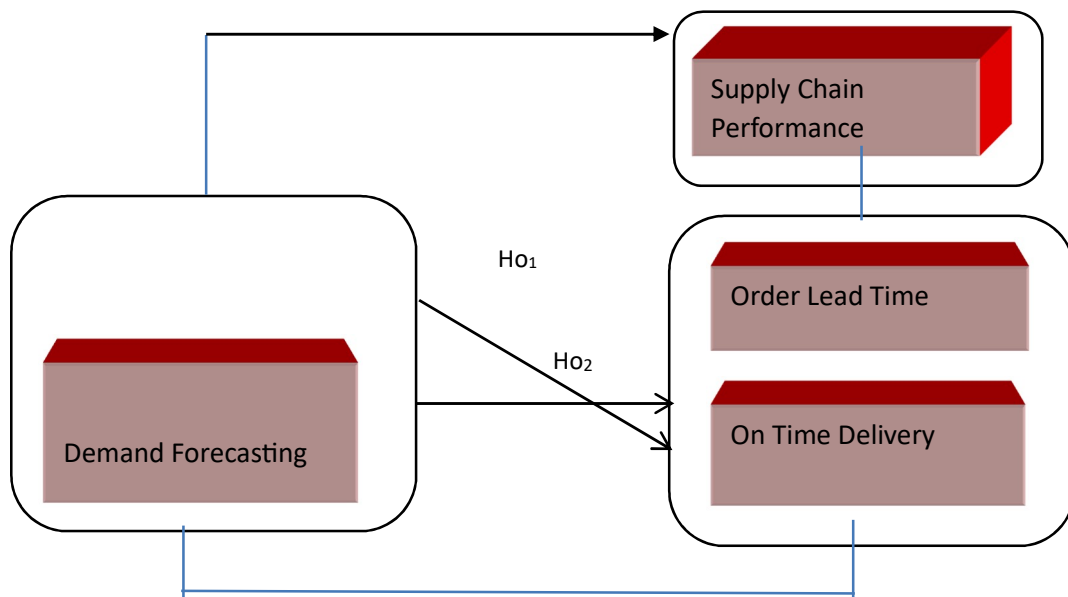

Figure 1: Operational Conceptual Framework of the influence of Demand Forecasting on Supply Chain Performance.

Source: Author's Research Desk, 2024.

From the operational conceptual framework, the following research hypotheses were raised:

Ho$_1$: Demand forecasting does not significantly influence order lead time of bakery firms in Rivers State.

Ho$_2$: Demand forecasting does not significantly influence on time delivery of bakery firms in Rivers State.

RESEARCH METHODOLOGY

The population consists of two hundred and eleven (211) bakery firms registered with the Commercial Department of the Rivers State Ministry of Commerce and Industry, Port Harcourt. The study acknowledged the entire companies as study units and employed the Taro Yamane's formula to arrive at the sample size for the study.Thus, the formulae n= N/1 +N (c) squared

Where n is the sample size

 N is the population

1 is constant and

 e is level of significance (i.e. 0.05).

 Therefore; n = 211/1+ 295 (0.05)2

$$n = 211/1+211(0.0025) = 211/1+0.7375$$

$$n= 211/1.7375 = 121$$

The sample size of this study was 121bakery firms. To arrive at the number of respondents, three (3) executives weredrawn from each company under study based on convenience sampling technique.The study identified three departments that are more of interest in the contemporary area which enclosed marketing, production and customer service. One management staff was conveniently drawn from each of the identified departments, to arrive at three management staff for each company and 363 management staff for the whole sample. This means that a total of 363 respondents were used for the study. Copies of questionnaire were used as primary source of data collection, and the simple regression analysis was employed to test the proposed hypotheses. All the statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 23.0. This version has the ability to transform scaled data into discrete or continues data and vice versa.

RESULTS

Test of Hypotheses Decision Rule

Significant/probability value (Pv) < 0.05 (level of significance = conclude significant influence.

Significant probability value (Pv) > 0.05 (level of significant = conclude insignificant influence.

Influence of Demand Forecasting on Order Lead Time

Ho$_1$: Demand forecasting does not significantly influence order lead time of bakery firms in Rivers State.

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Table 1: Influence of Demand Forecasting on Order Lead Time

Model	R	R Square	Adjusted R Square	Std. Error of the estimate
1	.633	.401	.395	.2.528

a. Predictors: (Constant), Demand forecasting

b. Criterion: Order lead time

Given that for hypothesis one, the significant is .000 which is less than 0.05; there is a significant, effect of demand forecasting on order lead time with the R (Coefficient of Correlation) that there is 63.3% direct relationship between demand forecasting and order lead time. R–square value of 46.4% shows that demand forecasting can affect order lead time to a high degree. The researcher also used ANOVA to test the hypothesis in this section. The results were presented in Table 2.

***Table 2: One way ANOVA for the difference in mean between* Demand Forecasting on Order   Lead Time.**

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	419.575	1	419.575	65.6706	.0000
Within Groups	626.135	199	6.389		
Total	1045.710	200			

a. criterion: Order lead time

b. Predictor: Demand forecasting

Table 2 shows that there is difference in mean between demand forecasting and order lead time F(dfB,dfw) =F(199,1) =65.6706, p<0.05. Significant value is 0.01, r (1,199).

Influence of Demand Forecasting on On Time Delivery

Ho$_2$: Demand forecasting does not significantly influence on time delivery of bakery firms in Rivers State.

H$_2$: Demand forecasting does not significantly influence on time delivery of bakery firms in Rivers State.

Table 3: Influence of Demand Forecasting on On Time Delivery

Model	R	R Square	Adjusted R Square	Std. Error of the estimate
1	.810	.656	.653	.50668

a. Predictors: (Constant), Demand forecasting

b. Criterion Variable: On time delivery

Given that for hypothesis two, the significant is .000 which is less than 0.05; there is a significant, influence of demand forecasting on on time delivery. The researcher also used ANOVA to test the hypothesis in this section. The results were presented in Table 4.

Table 4: One way ANOVA for the difference in mean between **Demand Forecasting on On Time Delivery**

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	55.771	1	55771	281.139	.0000
Within Groups	23.849	199	257		
Total	100.94	200			

a. Criterion variable: On time delivery

b. Predictor: Demand forecasting

Table 4 shows that there is difference in mean between demand forecasting and on time delivery. This agrees with the regression result in Table 3.

DISSCUSSION OF FINDINGS

Demand forecasting significantly and positively influences supply chain performance and as such enhances its measures (order lead time and on time delivery)
The results from the analysis identifies demand forecasting as having a positive and strong and significant impact on supply chain performance and as such enhancing outcomes such as order lead time and on time delivery.

Hypothesis one (H_{01}) was designed to examine the significant influence of demand forecasting on order lead time. Demand forecasting was hypothetically tested against order lead time using simple regression analysis tool. The analysis was aimed to examine the influence of demand forecasting on order lead time for which result showed that a significant   influence of demand forecasting on order lead time (R = 0.633; R^2 = 0.401 ~ 40.1%). It further revealed the existence of a strong, positive and significant influence of the independent variable on the dependent variable.

The second hypothetical statement (H_{02}) was designed to examine the influence of demand forecasting on on time delivery. The result revealed the existence of a significant influence of demand forecasting on on time delivery (R = 0.810; R^2 = 0.656~ 65.6%). The analysis showed the existence of a very strong, positive and significant influence of demand forecasting on on time delivery.

On the evidence of the outcome of the first and second hypotheses, all the null hypothetical statements were rejected as the results revealed that there is a strong and positive significant influence of demand forecasting on the measures of supply chain performance (order lead time and on time delivery). The evidence shows that demand forecasting contributes towards the success of bakery firms since they are able to drive

creativity and uniqueness and also enhancing their reputation and positioning within the business society. In business, forecasting is crucial in making thorough decisions. Although forecasting the impact of unexpected change in demand can be problematic, nevertheless it's a vital expertise for decision-makers. When the market demand for a product abruptly changes, it can have a significant impact on company profits and operations. By using forecasting, a company can prepare itself for regular demand as well as seasonal changes in demand, helping the company prevent stock-outs as well as overstocking.

These findings reiterate the views of scholars such as Hung *et al.* (2022) whose results demonstrate that a certain product needs to be personified by a keen model and, the opening within forecast and concrete demand is connected by exploiting a validation set, and it is further used for prepare adjustment strategies regarding production volumes, Pereira Da Veiga *et al*. (2012 who revealed that, demand forecasts guarantee the inventive use of resources, enhancements in customer responsiveness and also moderate supply chain stock out and overstock losses, and Boylan *et.al*. (2016) who demonstrated that overlapping approach ensembles when demand history short, likewise greater for longer lead times, The reason for this consistent result could be as a result of global sensitization on the importance of demand forecasting.

CONCLUSION

Premised on the first hypothesis, the results on the influence of demand forecasting on order lead time depict "*strong and positive influence*". Premised on the second hypothesis, the study revealed a *"very strong and positive significant influence of* demand forecasting on on time delivery. Thus, the findings on demand forecasting contribute significantly towards achieving successful supply chain performance (order lead time and on time delivery). Based on the findings as revealed in the statistical analysis, the study concludes that, there is a significant influence of demand forecasting on supply chain performance of bakery firms on Rivers State, and recommends that, managers of bakery firms should identify several capabilities, their relative importance, and the processes for achieving demand forecasting policies which when properly executed can improve order lead time and on time delivery, in order to attain optimal supply chain performance and enhance their competitiveness in this 21st century business milieu.

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