

## **REAL TIME TRACKING AND OPERATIONAL EFFICIENCY OF BAKERY FIRMS IN RIVERS STATE**

**SAMUEL Kalode Mikel**

Department of Marketing, Faculty of Administration and Management  
Ignatius Ajuru university of Education Rumuolemeni, Port Harcourt  
kalode.samuel@iaue.edu.ng

**IKEGWURU Mac-Kingsley**

Department of Logistics and Supply Chain Management, Faculty of Administration and Management  
Rivers State University Nkpolu-Oroworukwo, Port Harcourt

**WORDU Benjamin Chinuru**

Department of Logistics and Supply Chain Management, Faculty of Administration and Management  
Rivers State University Nkpolu-Oroworukwo, Port Harcourt

### **Abstract**

This study focused on real time tracking and operational efficiency of bakery firms in Rivers State; specifically, to ascertain the relationship between real time tracking and operational efficiency. A correlational framework research model was formulated to take on board the two (62 hypotheses formulated for the study. The survey research method was adopted for the study on a population comprised of twenty-four (24) bakery firms in Rivers State. General managers, Bakery operations managers and Logistics managers were identified for the study. Subsequently, the simple random sampling technique was adopted to draw each of the identified managers to arrive at three management staff for each company and 96 respondents for the whole sample. A 5-point likert-scale questionnaire was administered to respondents, of which, of the 96 copies of questionnaire distributed to respondents, 69 were returned, resulting in a response rate of 72. However, after data cleaning, 53 returned copies of questionnaire were usable, represent 77% and were used for analysis. The study adopted descriptive statistics and Pearson's moment correlation analysis to establish that real time tracking was constructive in relating to operational efficiency. The results showed that real time tracking had a very strong, significant and positive relationship with optimal resource utilization and waste minimization. Therefore, the study, concludes that, transportation management systems positively and significantly relate with operational efficiency of bakery firms in Rivers State, and recommends amongst others that, the management of bakery firms should maintain or improve on real time tracking that edifice their business in line with optimal resource utilization and waste minimization as part of strategies for effective operation of their business in the 21<sup>st</sup> century.

**Keywords:** real time tracking, operational efficiency

### **Introduction**

Bakery firms operate in a competitive market, focusing on product development, quality control, marketing, customer service and operational efficiency. They develop new products and improve existing ones to differentiate themselves and attract customers. Quality control measures ensure high-quality products, build customer trust and loyalty, effective marketing strategies, including social media utilization and implementation of real time tracking, helps bakery firms engage with customers, promote products and facilitate operational efficiency.

Providing excellent customer service and building strong customer relationships are also crucial. To remain competitive, bakery firms adopt sustainable practices, implement efficient production processes and utilize technologies such as real time tracking to streamline operations. Bakery firms are therefore required to reprioritize and discern fascinating real time tracking, programs that can profitably and competitively position them in the marketplace to attain significant operational efficiency.

Scholars (Nurmasari et al., 2025; Moronge et al., 2021; Adebayo, 2020) argue that transportation management systems (TMS) is a reliable digital solution for enhancing operational efficiency by increasing logistical flexibility, optimally utilizing resources and minimizing waste. Real-time tracking provides live visibility into vehicle movement, enable faster response to delays or demand changes, and improve delivery economics (Sivakumar et al., 2024; Sakr, El-Afifi, & Plvar, 2023). Yet, most bakeries in Rivers State have not adopted these technologies or integrated them into their transport planning processes. This technology gap perpetuates inefficiencies in resource usage and limits the agility required to compete in today's dynamic food distribution landscape. Without flexible logistics systems and effective cost controls, these businesses remain ill-equipped to scale or sustain profitability. In contemporary supply chain practices, operational efficiency is a key performance indicator, especially in time-sensitive industries such as the food and bakery sector (Rushton, Croucher & Baker, 2022).

Operational efficiency is a key determinant of long-term success of businesses (Ndolo, 2015). Firm-specific indicators of corporate' monetary health evolve around operational efficiency (Ndolo, 2015). In today's fast-paced and globalized economy, supply chain management (SCM) has emerged as a critical component of business operations. Efficient operations ensure the smooth flow of goods, information, and finances from suppliers to end consumers. Managing these complex networks involves numerous challenges that can disrupt the supply chain, leading to significant operational and financial repercussions. Real-time data monitoring presents a transformative solution to these challenges, enabling organizations to maintain visibility, improve decision-making, and enhance overall supply chain operational efficiency.

Supply chain management has become increasingly complex in today's fast-paced business environment, with companies facing challenges such as globalization, increased competition, and rapidly changing customer demands. To address these challenges, organizations are turning to real-time data monitoring as a means of enhancing visibility, agility, and efficiency throughout their supply chains. This paper therefore explores the real time tracking and operational efficiency of bakery firms in Rivers State by survey method. Real-time tracking enhances distribution performance by providing visibility over fleet operations, enabling prompt responses to delays, and improving communication with customers (Olusegun, & Okafor, 2021). It significantly reduces uncertainty and improves the reliability of deliveries, which is key to maintaining customer satisfaction and loyalty.

In the context of Rivers State, Nigeria, where infrastructure challenges and traffic congestion are prevalent, the implementation of effective TMS could significantly benefit bakery firms. These firms often deal with highly perishable goods and require swift, efficient, and reliable delivery mechanisms. Despite the critical nature of distribution in this region, research on the specific effects of real time tracking functionalities on bakery firms' operational efficiency remains scant. Thus, this study aims to investigate the relationship between real time tracking and operational efficiency of bakery firms in Rivers State.

Despite extensive research linking real time tracking to operational efficiency, most existing studies are context-specific and concentrated in sectors such as automotive, e-commerce, pharmaceuticals, and fast-moving consumer goods (e.g., Nurmasari et al., 2025; Chen & Paulraj, 2019; Jiang et al., 2019). Also, empirical investigations that focus specifically on real-time tracking are relatively few and often lack alignment with operational efficiency indicators relevant to bakeries. Moreover, most prior studies have not examined real-time tracking functionalities within the geographical and infrastructural context of Rivers State, Nigeria,

where bakery firms often face logistical challenges such as inconsistent road conditions, power interruptions, and limited digital infrastructure.

Although recent studies like Olusegun and Okafor (2021) and Nwankwo and Chukwu (2022) have made progress in evaluating tracking systems and last-mile delivery, their scope remains narrow. Consequently, there is a gap in literature on how real-time tracking relates to operational efficiency in terms of optimal resource utilization and waste minimization, of bakeries in Rivers State. Thus, this study sought to contribute to knowledge by providing empirical evidence on the relationship between real-time tracking and operational efficiency of bakeries in Rivers State.

### **Theoretical Framework**

This study is anchored on Technology Acceptance Model (TAM) proposed by Davis (1989). TAM provides a robust framework for understanding how users come to accept and use technology. It posits that two main factors: perceived usefulness and perceived ease of use significantly influence users' decisions to adopt new technologies (Holden & Karsh, 2010). Perceived usefulness refers to the extent to which a person believes that using a particular system would enhance their job performance, while perceived ease of use refers to the degree to which a person believes that using the system would be free of effort (King & He, 2006).

In the context of bakery firms, the adoption of real time tracking hinges on how decision-makers perceive their usefulness in streamlining delivery operations and reducing flexibility. Real-time tracking must be seen as contributing to operational goals such as efficiency, timeliness, and customer satisfaction. When perceived as useful and easy to use, these technologies are more likely to be adopted by bakery firms seeking to improve logistics performance. TAM remains a relevant and empirically supported theory in logistics and supply chain studies. It explains why some bakery firms readily embrace TMS innovations while others remain hesitant. Studies such as those by Alalwan et al. (2017) and Dwivedi et al. (2019) demonstrate TAM's validity in various sectors, providing a theoretical basis for understanding technology adoption behavior in bakery logistics operations.

### **Real-Time Tracking**

Real-time tracking refers to continuous monitoring and recording of location and movement of goods, vehicles or assets during transport, using technologies such as GPS, IoT, and RFID (Kinyua et al., 2024). It provides logistics managers with instant access to transit information and allows rapid responses to delays, rerouting, or emergency conditions. According to Helo and Shamsuzzoha (2020), real-time tracking enables a unified and transparent view of distributed supply chains through integrated portals supported by RFID, IoT, and blockchain technologies. Xiao (2020) also notes that in cold chain logistics, GPS-based real-time tracking systems support product freshness and maximize economic transport efficiency.

These systems provide stakeholders with continuous insight into delivery progress, asset conditions, and performance metrics. Real-time tracking is typically implemented through onboard vehicle telemetric, mobile apps, and cloud-based dashboards that communicate positional data to logistics centers. Dhanasekar and Kumar (2024) found that firms leveraging real-time data visibility tools achieved improved customer satisfaction, cost savings, and inventory performance compared to those without such technologies.

### **Operational Efficiency**

Operational efficiency is the ability of an organization to deliver products with minimal wasted effort or expense while maximizing output quality and customer satisfaction (Xuan et al., 2023). It is especially relevant in logistics-intensive sectors like food distribution, where precision, timeliness, and cost control are vital. Stevenson (2018) defines operational efficiency as the ratio between input resources and output performance, emphasizing the importance of streamlined processes, automation, and productivity.

Christopher (2016) expands this concept to logistics, suggesting that efficiency involves cost minimization, improved delivery speed, and maintaining service quality. According to Pham et al. (2020), operational efficiency plays a critical role in sustaining the solvency and competitive strength of logistics firms (Pham et al., 2020). In bakery logistics, achieving operational efficiency reduces spoilage, delays, and cost overruns, ensuring fresher deliveries and higher customer retention. Operational efficiency is typically measured using performance indicators such as Optimal Resource Utilization, fleet utilization, on-time delivery rate, and logistics cost per unit. These metrics help organizations evaluate how effectively resources are allocated and how quickly services are delivered. The measures of operational efficiency derived from Muralidhar (2018) and utilized in this study are optimal resource utilization and waste minimization.

### **Optimal resource utilization**

Resource utilization has long been a topic of interest, especially in operations research (Lazarov, 2016) where researchers have been concerned with determining necessary decisions made with respect to acquiring, allocating and using resources to create and deliver value that satisfies the requirements of relevant stakeholders in the most effective and efficient manner. Optimal utilization of resources is associated with several benefits. It ensures that resources are not underutilized, maintains productivity, ensures better visibility, increases yields and enhances managers' agility in rescheduling resources as quickly as possible, and avoids problems of resource redundancy. The continuously shifting shape of the business environment means that, even with all the resources in the world, businesses can still have trouble if their resources are not utilized properly. Optimal resource utilization is a formula for success, especially if managers can leverage the many benefits of efficient resource utilization (Hans et al., 2008).

### **Waste minimization**

Wastes are materials or resources that are no longer useful to the firm. Most business activities generate waste which may be byproducts of their main products or resources that have been used improperly, partially or sub-optimally. This discourse on waste reduction is focused on waste resulting from improper, partial or suboptimal use of resources. This class of waste has remained a major concern since the industrial revolution.

However, there has been an increase in waste generation in recent times; and this costs organizations a fortune and hurts the planet. Waste minimization is concerned with how firms manufacture products without engaging in any form of waste of resources, so that the planet's resources are not depleted faster than they are replenished (Pellegrini et al., 2019, as cited in Attiq et al. 2021). Waste of resources results in resource overconsumption, which will leave future generations with less resources than they require.

### **Empirical Review**

There are studies that provide insights into the interconnection between real time tracking and operational efficiency. Kinyua et al. (2024) examined the effect of vehicle tracking on operational performance of road transporters in Mombasa County, steered by Technology Diffusion Theory. The study engaged a descriptive research design on a population of 250 registered road transport companies in Mombasa County, and a sample size of 154 participants by means of stratified random sampling. Data was composed using structured questionnaires and analyzed with descriptive and regression techniques. The findings show that vehicle tracking significantly boosts operational performance, while significant practices, such as speed monitoring, route management, and real-time vehicle dispatch tracking, were acknowledged as vital contributors to this enhanced performance. The study concludes that vehicle tracking systems foster accountability, decrease fuel consumption, and boost overall productivity.

Dhanasekar and Kumar (2024) examined the effectiveness of logistics services in real time data visibility. This study investigates how supply chain management's logistics services perform when real-time data visibility is available. The requirement for timely and reliable information has grown in importance due to the rising complexity and globalization of supply networks. This paper investigates the effects of real-time data visibility on inventory management, transportation logistics, and order fulfillment through an extensive examination of literature and empirical analysis. The sample size of the study was 150. The Statistical tool used in the study is ANOVA. Results indicate that companies using advanced data visibility solutions save money, have more satisfied customers, and operate more efficiently. The report also emphasizes how crucial it is to make strategic investments in data visibility solutions if you want to stay competitive in the fast-paced corporate world of today.

Jean (2024) investigated the impact of real-time tracking technologies on supply chain operations, focusing on how they facilitate improved visibility, responsiveness, and communication among stakeholders. The study analyzed the benefits of real-time freight tracking on key performance indicators, including delivery accuracy, lead times, and customer satisfaction. Case studies were presented to illustrate how companies implementing these technologies have achieved substantial improvements in delivery performance and operational efficiency. Additionally, the paper discussed the challenges associated with adopting real-time tracking systems, such as integration with existing supply chain infrastructure and the need for reliable data sources. Through empirical research, the study demonstrated that organizations leveraging real-time freight tracking in their e-supply chains experience significant enhancements in coordination and overall delivery performance. Holloway (2024) investigated how real-time supply chain data influences marketing and operational decisions in service industries.

Through in-depth interviews with logistics and marketing professionals across telecommunications, retail, and transportation sectors, the study found that real-time tracking data improved inventory forecasting, allowed dynamic route adjustments, and supported tailored marketing promotions based on delivery timelines. Respondents reported improved customer satisfaction, lower fulfillment errors, and more responsive delivery capabilities. The study concluded that real-time data integration not only supports operational efficiency but also acts as a strategic asset for customer-centric decision-making in highly competitive service markets.



Singh and Rajesh (2020) investigated the adoption of IoT-enabled tracking in pharmaceutical logistics in India. The researchers used a mixed-method approach involving surveys and interviews with 105 logistics officers. Findings indicated that IoT-based tracking improved inventory visibility, delivery compliance, and auditability.

Jiang et al. (2019) investigated the effect of TMS on distribution cost efficiency among e-commerce firms in Shanghai. A total of 170 logistics personnel from 30 e-commerce companies were surveyed using self-administered questionnaires. Data was analyzed using multiple regression in STATA. The study found that integrated TMS systems significantly reduced transportation costs, optimized vehicle usage, and enhanced order tracking. The researchers recommended further investments in digital logistics tools to support e-commerce growth.

Zhang et al. (2017) studied how real-time tracking affects operational efficiency in electronics supply chains in China. A sample of 160 logistics staff was surveyed, and data were analyzed using regression analysis. Results showed that tracking significantly improved responsiveness and reduced lead times. The authors emphasized the strategic role of tracking in high-demand sectors.

**H01:** There is no significant relationship between real-time tracking and Optimal Resource Utilization of bakery firms in Rivers State.

**H02:** There is no significant relationship between real-time tracking and Waste Minimization of bakery firms in Rivers State.

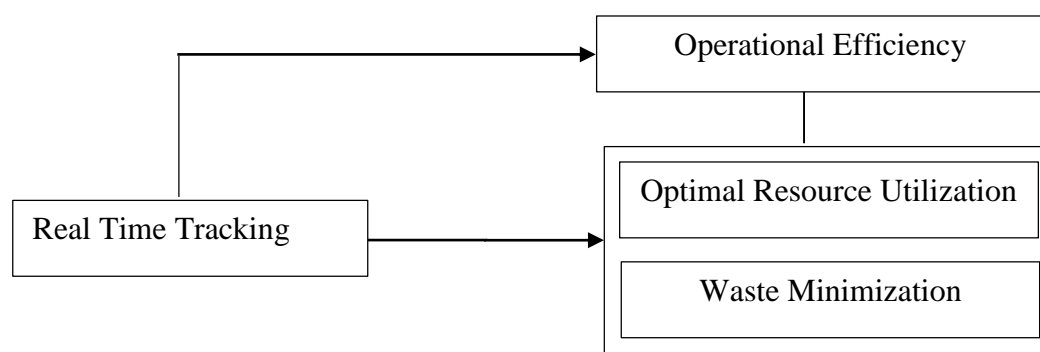


Fig. 1: Conceptual framework of relationship between real time tracking and operational efficiency

### Methodology

This section outlines the methodology adopted for examining the relationship between real-time tracking and operational efficiency of bakery firms in Rivers State. The study adopted positivist ontology, interpretative approach, survey design, and chose the questionnaire method as a source of data collection. The cross-sectional field survey of the quasi-experimental research design was employed as a useful aid in examining the extent to which real time tracking interacts with the variables in operational efficiency, on a population consisting of the 24 bakeries operating in Rivers State as listed in the Finelib.com Nigeria Directory and Search Engine (2024). A census approach, given the relatively small population of 24 bakery firms were adopted, and all 24 firms were included in the study, and at least one key logistics personnel from each firm was surveyed. Categories of respondents were general managers, bakery operations managers, and logistics managers Primary data was collected through the administration of structured questionnaires designed to measure the key variables: real-time tracking, Optimal Resource Utilization and Waste Minimization. And data was analyzed using

Pearson Product Moment Correlation (PPMC) to test the relationships between real time tracking and operational efficiency indicators.

## Results

The data for this study were obtained from questionnaires administered and compiled by the management of twenty-four firms in the bakery sector. The analysis of the distribution and collection plan for the respondents' survey of real time tracking and operational efficiency is divided into three parts. 72 copies of questionnaire were distributed to respondents while 57 were returned, representing 79% response rate. In addition, of the 57 copies of questionnaire returned, 53% were used.

**Table 1: Relationship between Real Time Tracking and Optimal Resource Utilization**

		Real Time Tracking	Optimal Resource Utilization
Real Time Tracking	Pearson's correlation	1	.998
	Sig. (2-tailed)		.000
	N	53	53
Optimal Resource Utilization	Pearson's correlation	.998	1
	Sig. (2-tailed)	.000	
	N	53	53

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

Source: Output of data analyses (2025).

Table 1 shows that the correlation coefficient between real time tracking and optimal resource utilization is 0.998 implying there is a very strong positive correlation. This implies that increase in real time tracking by bakery firms in their transportation management has significant relationship with optimal resource utilization.

**Table 2: Relationship between Real Time Tracking and Waste Minimization**

		Real Time Tracking	Optimal Resource Utilization
Real Time Tracking	Pearson's correlation	1	.902
	Sig. (2-tailed)		.000
	N	53	53
Optimal Resource Utilization	Pearson's correlation	.902	1
	Sig. (2-tailed)	.000	
	N	53	53

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

Source: Output of data analyses (2025).

Table 4.10 shows that the correlation coefficient between real time tracking and waste minimization is 0.902 implying there is a very strong positive correlation. This implies that an increase in real time tracking by bakery firms in their transportation management has significant relationship with waste minimization.

The results of the first and second hypotheses show that the real time tracking is high, effective and useful for optimal resource utilization (0.998: 0.000 < 0.05) and waste minimization (0.902: 0.000 < 0.05). As an important part of the transportation management strategy, real time tracking shows that it is relevant, effective and important with the blend of optimal resource utilization and waste minimization in bakery companies in Rivers State. This is evidenced by the results in Tables 4.9 and 4.10 with beta values of .990 and .902 and p-values of 0.000 making

us reject the negative assumption of no correlation. This corroborates Smith (2024) who found that, showed that organizations using real-time tracking systems reported a 15–25% reduction in lead times and enhanced forecasting precision, and Zhang et al. (2017), whose study showed that tracking significantly improved responsiveness and reduced lead times.

According to our preliminary expectations, these findings show that real time tracking can relate positively with optimal resource utilization and waste minimization. It is also the finding of this study that the combination of more than one operational efficiency metric with one piece of real time tracking in business is not the same. Given the difference, the relationship between a good real time tracking and optimal resource utilization and waste minimization in business is a joint venture.

### Conclusion and Recommendations

The study examined how real time tracking relates with operational efficiency of bakery firms in River State by several estimates, and it is clear that real time tracking has a very strong, positive and significant relationship with optimal resource utilization and a very strong, positive and significant relationship with waste minimization. Existing research has strongly linked real time tracking to operational efficiency, providing the best solution to delivery efficiency in bakery firms in Rivers State. The study therefore concludes that transportation management significantly relates to operational efficiency of bakery firms in Rivers State.

Since real time tracking has a very strong, positive and significant relationship with optimal resource utilization and waste minimization, the study therefore recommends that the management of bakery firms should strive to attain stable and more realistic real time tracking programs that will boost optimal resource utilization and waste minimization. This is because companies with a high degree of poor optimal resource utilization and waste minimization will lose out on competitiveness to companies with more stable real time tracking programs.

### References

- Adebayo, T. (2020). *Transportation management systems and supply chain performance of Nigerian firms. Journal of Logistics and Transportation, 12*(3), 45–58.
- Attiq, S., Chau, K. Y., Bashir, S., Habib, M. D., Azam, R. I., & Wong, W.-K. (2021). Sustainability of household food waste reduction: A fresh insight on youth's emotional and cognitive behaviors. *International Journal of Environmental Research in Public Health, 18*, 7013. <https://doi.org/10.3390/ijerph18137013>
- Christopher, M. (2016). *Logistics and supply chain management (5th edition)*. Pearson Education Limited.
- Hans, E., Wullink, G., van Houdenhoven, M., & Kazemier, G. (2008). Robust surgery loading. *European Journal of Operational Research, 185*(3), 1038-1050.
- Helo, P., & Szekely, B. (2005). Logistics information systems: An analysis of software solutions for supply chain co-ordination. *Industrial Management and Data Systems, 105*(1), 5-18.
- Helo, P., (2006). Agile production management: An analysis of capacity decisions and order fulfillment time. *International Journal of Agile Management Systems, 1*(1), 2-10
- Holden, R. J., & Karsh, B.T. (2010). The technology acceptance model: Its past and its future in health care. *Journal of Biomedical Informatics, 43*(1), 159–172.
- King, W. R., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information & Management, 43*(6), 740–755.



- Kinyua, N. N., Arani, W., & Egessa, M. M. (2024). Effect of fleet vehicle tracking on operational performance of road transporters in Mombasa County. *Asian Business Research Journal*, 9, 135-140.
- Moronge, M., Muturi, W., & Iravo, M. (2021). Transportation management and its impact on supply chain performance. *International Journal of Supply Chain Management*, 10(1), 45.
- Muralidhar, P. (2018). Analysis on improving operational efficiency of construction project site. *Independent Journal of Management & Production*, 9(3), 827–839.
- Ndolo, P. S. (2015). *The relationship between operational efficiency and financial performance of firms listed at the Nairobi Securities Exchange*. Master of Science
- Rushton, A., Croucher, P., & Baker, P. (2022). *The handbook of logistics and distribution management (6th edition)*. Kogan Page Publishers.
- Sakr, D., Onukwulu, E. C., Fiemotongha, E., & Ezirim, C. (2023). *Transforming supply chain logistics in oil and gas: Best practices and applications*. **International Journal of Logistics Systems and Management**, 45(2), 198–212.
- Sivakumar, G., Abinayasri, B., Jayaprakash, M., & Kannan, M. (2024). Automated transport management system: Route optimization and attendance tracking for institutions. *Deleted Journal*, 2(12), 2707–2714.
- Smith, H. K. (2024). Impact of real-time data sharing on supply chain agility and performance. *Journal of Business Logistics*, 45(3), 210–225.
- Xuan, T., Quach, P. H., Thinh, N. V., Hoa, T. T., & Tu, N. T. (2023). The efficiency and the performance of the logistics global supply chain activities to Vietnam exportation: An empirical case study. *International Journal of Professional Business Review*, 8(1), e01438.
- Yusof, W., Rashid, N., Shaharin, N., & Xuan, L. K. (2024). The impact of information technology towards logistics performance. *International Journal of Academic Research in Economics and Management Sciences*, 13(3), 488-503