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EXPLORING INVENTORY DIGITALISATION AND PRODUCT DELIVERY IN SELECTED FOOD MANUFACTURING FIRMS IN ILORIN, KWARA STATE, NIGERIA

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Abstract

The study examines how inventory digitalisation affects product delivery in selected food manufacturing firms in Ilorin, Kwara State, Nigeria. One hundred and Eighty-one181 respondents were selected, with 141 completed questionnaire were analysed which make for a 77.9% response rate. Both descriptive and inferential statistics like regression and ANOVA were used for the study. Key findings show: ANOVA shows that inventory digitalisation improves product delivery (p = 0.000, F = [redacted]

3.658). Employee digital tool training improves operational efficiency, with a mean response range of 3.93 to 4.54 and a relative importance index (RII) of 0.77 to 0.91. the study revealed that Inventory planning and inventory coordination

Keywords:
Inventory Digitalisation, Product Delivery, Manufacturing Firms, Food Industry, Internet of Things (IoT), Radio Frequency Identification (RFID), Cloud Computing.

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contributed more to product delivery in the study area. The findings also revealed that inventory digitalisation improves both operational efficiency and product delivery in a positive way. Inventory training programs are crucial for implementation of digital tools. The study concludes that regular training exercise, better inventory planning, and IoT and virtual inventory systems are good for the deployment of inventory digitalisation.

Introduction

Background to the Study

According to Asikhia (2018), manufacturing plants need a steady supply of grain and other raw materials to operate efficiently, so inventory management is crucial. Inventory control allows the flour mill to operate independently from suppliers without on-time delivery. Independence reduces the risk of supply disruptions interrupting production. Poor inventory and post-inventory management can cost companies a lot of money. Poor inventory management can lead to stockouts, which disrupt manufacturing plants' production and distribution cycles, and excess stock can drain a company's finances (William & Koffi, 2023).

Ahmed (2024) defines inventory management as the systematic sourcing, storage, and sale of raw materials and finished goods. It manages inventory and stock to ensure a company has the right items in the right quantity and time. Inventory management (IM) is crucial in all manufacturing industries. Companies face many challenges in warehouse maintenance. Operation managers must reduce inventory carrying costs and maintain stock availability. Thus, steel manufacturers can streamline their operations with effective inventory management (IMP) (Ziukov, 2015; Shenvi, 2019).

To reduce manufacturing costs, companies are implementing digital and scientific inventory management systems to boost productivity (Waters, 2017). These methods help create a strategy to improve manufacturing unit operations. Inventory management helps companies use resources efficiently and invest in inventory without tying up funds (Umry & Singhih, 2019).

Inventory management includes creating and controlling inventory levels and efficiently sourcing goods at low cost (Mgbobi, 2024). Inventory is economically valuable.

Effective inventory management frees up cash for productivity (Ghosh and Kumar, 2023). Effective inventory management boosts sales (Syed, Sweden, Suraidi, Rahman & Suhaimi, 2016). Poor inventory management threatens the long-term profitability and economic sustainability of flour mill manufacturers. Large industries must manage inventory efficiently across the value chain. When supplier requirements match company delivery, equilibrium is reached. Stock outs may make it difficult to survive in the current market (Atnafu and Balda, 2018). Inventory management is essential for corporate growth and survival (Adegbite & Ajagbe, 2023). Inventory management emphasises stock and raw material placement and amount. Companies must manage inventories to avoid material, product, and input shortages (Salahudeen & Abraham, 2018). Profit maximisation requires efficient inventory management, cost reduction, and revenue production. Thus, the need to study inventory digitalisation and product delivery in selected manufacturing firms in Ilorin, Kwara, Nigeria.

Statement of the Problem

Digitalisation affects the speed and accuracy of product deliveries in manufacturing companies, making inventory management crucial to product delivery (Nwaiwu & Ejechi, 2020). This involves carefully considering how automation, real-time data, and predictive analytics can speed up inventory processes to meet market demands. Digital technologies can boost productivity and cut costs, but manufacturing companies should consider the initial investment, ongoing maintenance, and ROI before using digital inventory systems (Colli, Madden, & Berger, 2018). However, how these technological advances are harmoniously integrated into selected manufacturing firms' inventory operational dynamics is still unclear. Thus, this study investigated how inventory digitalisation affects product delivery in manufacturing enterprises in Ilorin, Kwara State.

Research Questions

This study sets out to answer the following research questions

i. What are the adequacy and effectiveness of employees' digital tools training on product delivery in the selected manufacturing firms?

Objectives of the study

The general objective of this study is to examine the effect of inventory digitalisation on product delivery in manufacturing firms in Ilorin Kwara State. While specific objectives are to:

i. assess the adequacy and effectiveness of employees' digital tools training on product delivery in the selected manufacturing firms in the study area; and

Research Hypothesis

$H0_1$: There's no significant difference between inventory digitalisation practices and product delivery in the selected manufacturing firms in the study area.

Scope of the Study

The scope of this study focused on inventory digitalisation on product delivery within selected food manufacturing firms in Ilorin, Kwara State, Nigeria.

LITERATURE REVIEW

Concepts of Inventory Digitalisation

Inventory includes raw materials, supplies, parts, work-in-progress, and finished goods at various stages of a company's supply chain and manufacturing process (Athumani & James, 2019). Thus, inventory includes all resources used by an organisation, including work-in-progress (WIP), finished goods, and raw materials, according to Emmanuel & Tryson (2024). They add that work-in-progress issues begin when the product leaves the raw material storage space and continue until it is ready for sale and delivery.

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Inventory is often a manufacturing company's largest asset, so effective inventory control is essential for long-term profitability and efficiency. Ineffective inventory management can hurt a company's profits and market position (William & Koffi, 2023; John, Etim & Tommy, 2015). Manufacturers usually have inventory that is ready to sell. Scholars have defined inventory in many ways. Jessop (2019) defines inventory as physical property held for sale, resale, or use in production. Amira, Yuanis & Sarjono (2019) define inventory as all intangible property held for sale in the normal course of business, including goods produced for profit. Odumusor (2024) defines inventory as items kept in stockyards and storehouses for operational or manufacturing purposes, including finished goods ready for shipment. Inventory includes goods for sale and their parts. In manufacturing and retail, inventory levels affect resource allocation and financial planning after being established and become a crucial part of the budgeting system (Ahmed, 2024).

Concept of Inventory Digitalisation

Inventory digitalisation improves inventory management and control using digital technologies. This change uses cloud computing, AI, RFID, and the Internet of Things to manage inventory. These solutions improve accuracy, inventory management efficiency, and real-time data. Digitising stocks allows real-time inventory monitoring. RFID tags and IoT devices enable this. IoT sensors monitor inventory and notify of changes in real time. Live monitoring prevents overstocking and stockouts, optimising inventory levels (Ben-Day, Hassani, & Bahroun, 2017).

RFID technology enhances supply chain inventory tracking. The supply chain can automatically scan and record RFID-tagged items from manufacturing to warehousing to delivery (Su, 2024). This improves inventory records by reducing human mistake and manual inspections. Digitising inventories involves automation. Automatic inventory management systems can reorganise things, modify stock levels, and predict equipment maintenance.

When inventory dips below a specific level, automated systems order additional to refill stock without human participation (Lee, Cheng & Leung 2019).

Artificial intelligence and machine learning algorithms predict inventory needs based on past data, enhancing automation. Predictive analytics solutions optimise inventory levels by considering expected demand, seasonal patterns, and other factors. This increases inventory turnover and lowers storage costs (Ben-Day, Hassani, & Bahroun, 2017). Cloud computing is essential for inventory digitisation. Centralised storage and remote data access improve flexibility and collaboration across multiple locations with cloud-based inventory management solutions. Inventory management can be integrated with procurement, sales, and finance thanks to central data storage (Helo and Hao, 2021). Integrating data from multiple sources gives a complete supply chain view.

Companies can improve efficiency, decision-making, and supply chain visibility by adopting this comprehensive strategy. Inventory and sales data integration improves demand forecasting and inventory synchronisation (Schiavone and Sprenger, 2017). Digitalisation improves quality and traceability. Businesses can monitor inventory storage and transportation with sensors and RFID tags. This ensures product quality throughout the supply chain (Duan, Edwards, & Dwivedi, 2019). Russell and Norvig (2016) add that digital records allow firms to track the source and movement of every inventory item. Food and pharmaceutical companies need traceability due to frequent product recalls. Digitising stocks reduces costs and boosts profits. Inventory optimisation and holding expense reduction allow businesses to allocate capital to other operational needs (Soleimani, 2018). Precision and efficiency reduce costs, while demand prediction and planning boost income. Digitisation can optimise processes, reduce labour costs, and boost profitability (Duan, Edwards, and Dwivedi 2019).

Industrial growth boosts demand for banking, insurance, and other professional services. Demand boosts the service industry and accelerates its

growth. Manufacturing and service sectors interact to create a dynamic ecosystem that boosts economic growth, job prospects, and business resilience. Nigerian industry encourages technical innovation, skill development, and knowledge sharing. The industry increases productivity, competitiveness, and Nigeria's worldwide stature by adopting new processes, technology, and human resources (Cloudy & Oday, 2022). Manufacturing significantly impacts modern economies and boosts economic growth (Tochukwu, 2022). Manufacturing drives growth and underpins all economies. Manufacturing matters in mature economies. It increases productivity by stimulating import substitution and export growth, creating foreign exchange, increasing employment and per capita income, and dynamically growing consumption. It increases investment growth faster than other industries and promotes sector networking (Tochukwu, 2022).

Empirical Review

Training employees on digital inventory management technologies improves stock and delivery timetables. Boyer and Lewis (2020) state that digital inventory solutions only improve operations if staff are adequately trained. Lorenz, Benninghaus, Friedli, and Netland (2020) underlined Industry 4.0 training to maximise technology benefits. Digital system underuse due to poor training limits product delivery gains. The knowledge gap limits digital technology adoption, leading in inefficiencies and underperformance, according to Abramova and Grishchenko (2020). Digitalising inventory boosts efficiency and reduces product delivery times by 30–40%. Real-time data integration and digital system automation lowered delivery times and improved customer satisfaction, according to Colli, Madden, and Berger (2018). Digitalisation speeds market responses, enhancing delivery efficiency, says Shenvi (2019). Companies that fully digitalise inventory reduce errors and improve customer satisfaction with on-time deliveries. Asikhia (2018) and Nwaiwu and Ejechi (2020) found that digital inventory systems increase stock monitoring and product deliveries, enhancing customer satisfaction and

operational outcomes. Flour mills use AI-driven forecasting to match supply to demand. Ahmed (2018) and William and Koffi (2023) say AI-driven predictive analytics can forecast demand based on previous data, ensuring inventory levels meet future needs and preventing stockouts.

METHODOLOGY

The population for this study involves the employees of selected food manufacturing firms in Ilorin, Kwara State, Nigeria. The workforce in the Ilorin facility consists of various departments essential for smooth operations and maintaining high standards in production process. The departments typically include production, quality assurance, logistics, maintenance, human resources, finance, administration etc. The total number of permanent staff in firms selected includes approximately 332 employees, with additional support staff contributing to daily operations.

TABLE 3.1: Population Distribution of Selected Food Manufacturing Firms, Ilorin, Kwara State.

Departments	Firm A	Firm B	Population
Production/Operations Department	26	47	73
Information Technology (IT) Department	8	10	18
Supply Chain and Logistics Department	28	36	64
Quality Control/Assurance Department	27	46	73
Human Resources Department	7	9	16
Maintenance and Engineering Department	28	48	76
Finance Department	5	7	12
Total	129	203	332

Source: Field Survey, 2024

Sample and Sampling Technique for the Study: Purposive sampling is a non-probability sampling technique in which the researcher's select respondents who are relevant to the study and whose judgement is important to the study. In judgmental sampling, the researcher relies on their judgement or expertise to select participants who they believe will best serve the research purpose.

The eight departments within the organisation were given equal chances involving both top management level to lower management level. A total of 332 staff were selected from various departments. The sample size for the study was determined using the Yamane sample size formula formulated by Wang and Cheung (2011).

The formula stated in Equation (3.1) was used to estimate the sample size as follows:

$$n = \frac{N}{1+N(e)^2} \qquad (3.1)$$

where;

n = sample size, N= Total Population,

e= Acceptable error limit (0.05) and 1 is Unity (it is constant).

Substituting the 332 population size of selected firms and an acceptable error limit of 0.05 into the equation we have:

$$n = \frac{332}{1 + 332(0.05)^2}$$

$$n = \frac{332}{1.83}$$

n = 181

Therefore, the sample size considered for state government firm in order to achieve the stated objectives of this study is 181.

Method of Data Analysis: The descriptive and inferential statistics used were mean and standard deviations while Regression Analysis and Analysis of Variance (ANOVA).

RESULTS AND DISCUSSION

Response Rate of Questionnaire

Table 4.1 Response Rate of Questionnaire

Copies of Questionnaire	Respondents	
	Frequency	Percent
Quantity Distributed	181	100.0
Quantity Retrieved	149	82.3
Quantity Analysed after Data Sorting	141	77.9

Source: Field Survey, 2024

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Adequacy and Effectiveness of Employees' Digital Tool Training

The perception of respondents on the adequacy of employee's digital tool training was achieved with descriptive statistical analysis as described in table 4.2. This consists of frequency of scale-item, minimum and maximum values, standard deviation, mean, relative importance index, RII and ranking of items. The minimum (1.00) and maximum (5.00) across all the indicators of employees digital training tool indicates the respondents' wide pool of opinion on the subject matter. This is further corroborated by the standard deviation range of 0.829 -0.609 indicating the divergent choice of the respondents due to standard deviation values far away from zero (0). The mean value range 3.93-4.54 indicated the respondents' unanimous and concrete agreement that digital tool trainings offered in the study area positively contributed to their productivity.

Figures in table 4.2 shows that "the training sessions is effective in addressing any challenges or difficulties faced by employees when using digital tools for inventory management" is ranked highest with values (mean=4.54; RII=0.91). This is sequel to the submission of the respondents that "the regular staff training on digital tools used for inventory digitalisation" (mean= 4.49; RII= 0.90) is of paramount interest in the study area. This connotes that digital training offered by the firms has been helpful to the respondents in resolving inventory management difficulties encountered during daily operations. The respondents also opined that "training sessions provided are comprehensive and cover all aspects of the digital tools used for inventory management" (mean= 4.23; RII=0.85) which led to a corresponding significant improvement employees' productivity (mean= 4.23; RII=0.85). The quality of digital training was in the study area was also commended by the respondents affirmed "training provided includes hand-on practice with digital tools, thus enhances ability to apply the knowledge in real life inventory management situations" (mean= 4.17; RII= 0.83). Furthermore, digital training sessions "troubleshooting and problem-solving techniques (mean=4.11; RII= 0.82) enables employee to independently resolve issues that may arise during their

use. More so, the respondents adjudged that competence and confidence in usage of digital tools (mean=4.0; RII=0.81) is largely attributed to frequency of training sessions and regular updates with latest inventory management technological advancements (mean=4.00; RII= 0.80). These findings support previous research on training's impact on employee performance and operational outcomes. Yunusa (2021) shows how stock control practices affect firm performance, supporting the claim that digital tool training boosts productivity and reduces operational issues. The comprehensive nature of training programs matches Shen et al. (2021), who emphasise real-time learning in digital inventory management. Finally, respondent perceptions support the efficacy of digital tool training in the study area, which boosts employee productivity and competence. The findings emphasise the importance of regular, comprehensive, hands-on digital tool training for employees.

Table 4.2: Adequacy and Effectiveness of Employees' Digital Tool Training

Digital Tool Training	Min	Max	Mean	Std. Dev.	RII
The training sessions is effective in addressing any challenges or difficulties faced by employees when using digital tools for inventory management	3	5	**4.54**	.609	0.91
The regular staff training on digital tools used for inventory digitalisation is adequate	3	5	**4.49**	.672	0.90
Regular training on the use of digital tools for inventory management would significantly improve productivity	3	5	**4.23**	.721	0.85
The training sessions provided are comprehensive and cover all aspects of the digital tools used for inventory management	2	5	**4.23**	.803	0.85
The training provided includes hand-on practice with digital tools, which enhances my ability to apply the knowledge in real life inventory management situations	2	5	**4.17**	.853	0.83
The training on digital tools for inventory management includes troubleshooting and problem-solving techniques, enabling employee to independently resolve issues that may arise during their use	2	5	**4.11**	.829	0.82
The training session for the employees are integrated into daily operations	3	5	**4.10**	.713	0.82
The regular training provided helps staff to effectively learn and use the digital tools for inventory management, increasing them competence and confidence in using these system	2	5	**4.05**	.684	0.81
The frequency of training sessions on digital inventory tools is sufficient to keep employees updated with the latest technological advancements	2	5	**4.00**	.793	0.8
Regular training on digital tools for inventory management makes it comfortable for me to find them user- friendly	2	5	**3.93**	.762	0.77

Source: Field Survey, 2024

Test of Hypothesis

H_{O1}: There is no significant difference between inventory digitalisation practices and product delivery in the study area.

Table 4.3 displays the outcomes of the Analysis of Variance (ANOVA). A significance level of 95% is used, where a P-Value below 0.05 is regarded as statistically significant, however, a P-value exceeding 0.05 is considered not statistically significant. For this study, a statistically significant value of 0.000 at 95 % significance level shows that inventory digitalisation practices is significant to the model.

So, the null hypothesis is rejected. The study found a difference between inventory digitalisation and product delivery in the studied area. Research like Yukun Li (2023) found that inventory digitalisation procedures greatly affect product delivery. Li found that digital transformation in organisational processes might dramatically lower stock levels and enhance inventory management. These similarities show that digitalisation initiatives are helping enterprises in the study area cut inefficiencies, increase inventory tracking, and respond to market demands. The null hypothesis rejection shows how inventory digitalisation streamlines operations. The high P-value shows that inventory planning, optimisation, and coordination are essential to operational efficiency and directly affect product delivery. This validates past study conclusions that core practices are more important than advanced, underutilised capabilities like IoTs.

Table 4.3: Analysis of Variance (ANOVA)

ANOVAa						
Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	8.484	5	1.697	3.658	.004b
	Residual	61.697	133	.464		
	Total	70.181	138			

a. Dependent Variable: PRODUCT DELIVERY

b. Predictors: (Constant), Virtual inventory, Inventroy planning and Coordination, Inventory Optimisation, Inventory Documentation, Internet of Things (IoT)

CONCLUSION AND RECOMMENDATIONS

Conclusion

The study affirmed the adequacy and importance of employees' digital training towards improving their operational performance. The study shows that inventory digitalisation procedures significantly affect product delivery in the studied area. Key findings show that inventory planning and coordination improve product delivery and operational efficiency the most. Digital tool training is essential for solving operational issues, improving employee skills, and using digital systems effectively.

Recommendations

The following recommendations were presented:

i. To improve employee competency in using digital tools, firms should engage in regular and extensive training sessions. These sessions should include hands-on practice, troubleshooting, and tech updates.

ii. Enhance inventory planning, coordination, and optimisation methods to maximise product delivery impact. For smooth operations, firms should incorporate these principles across departments.

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