

DIGITAL TRANSFORMATION ADOPTION AND ORGANISATIONAL PRODUCTIVITY IN NIGERIAN BOTTLING COMPANY, IDU ABUJA

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ABSTRACT

This study examined digital transformation adoption and organisational productivity in Nigerian Bottling Company, Idu, Abuja. The study was motivated by the need to understand how digital technologies support operational efficiency and output quality in a manufacturing environment. Two objectives guided the study: to examine the effect of digital infrastructure adoption on operational efficiency and to assess the effect of data integration systems on output quality. The study adopted a survey research design. The population comprised 83 employees, and census sampling was used because the population was small and manageable. A structured questionnaire served as the instrument for data collection, while 78 valid responses were analysed. Descriptive statistics and simple regression analysis were employed at the 0.05 level of significance. Findings revealed that digital infrastructure adoption had a significant positive effect on operational efficiency, with an R value of 0.742 and an R Square value of 0.551. The study also found that data integration systems had a significant positive effect on output quality, with an R value of 0.718 and an R Square value of 0.516. The study concluded that digital transformation adoption significantly improves productivity when digital infrastructure and data systems are effectively aligned with operational tasks systematically in the organisation.

Keywords: *Digital Transformation, Technology Adoption, Organisational Productivity, Manufacturing Firms, Nigerian Bottling Company*

1.1 Introduction

The productivity of contemporary manufacturing firms is increasingly shaped by factors that extend beyond the traditional combination of labour, machinery, raw materials, and managerial supervision. Digital technologies have become important components of

manufacturing operations because they facilitate production monitoring, information accessibility, process coordination, inventory management, quality control, and timely decision-making. Digital transformation extends beyond the basic deployment of computers or isolated information technologies. It entails the systematic integration of digital technologies into organisational processes in ways that reshape how firms create value, organise operations, measure performance, and continuously improve their activities. Within the manufacturing sector, this transformation is reflected in the application of automated production systems, enterprise resource planning platforms, digital inventory management, real-time production monitoring, cloud-enabled communication, data analytics, and digitally integrated supply chain systems (Verhoef et al., 2021; Vial, 2019).

At the global level, manufacturing has become a major area for digital transformation because production activities require operational speed, standardisation, consistent quality, waste minimisation, and efficient resource utilisation. The emergence of Industry 4.0 has accelerated the application of technologies such as the Industrial Internet of Things, artificial intelligence, robotics, predictive analytics, intelligent sensors, and interconnected production systems. These technologies can improve production planning, reduce equipment downtime, facilitate preventive and predictive maintenance, and enhance the utilisation of organisational resources. Nevertheless, the adoption of advanced technologies does not necessarily translate automatically into higher productivity. The extent to which organisations realise productivity improvements depend on complementary conditions, including organisational preparedness, compatibility between technologies and production tasks, employees' digital capabilities, managerial commitment, and the redesign of existing work processes (Chirumalla et al., 2025; Tian et al., 2022).

Digital transformation has also assumed increasing importance in developing economies, where manufacturing firms frequently operate under challenging economic and infrastructural conditions. Firms in such environments must contend with rising production costs, inadequate infrastructure, exchange-rate instability, energy constraints, supply chain disruptions, and growing competitive pressures. These challenges are particularly relevant to Nigerian manufacturing firms and have strengthened the need for technologies capable of improving operational visibility, production scheduling, resource management, cost control, and responsiveness to changing market conditions. Available Nigerian evidence suggests that digitalisation can contribute to operational efficiency and organisational performance. However, the effective deployment of digital technologies may be constrained by inadequate technological infrastructure, substantial implementation costs, unreliable electricity supply, insufficient technical expertise, and poor integration of digital applications with established production processes (Olakpa & Adebuseyi, 2026; Balogun, 2025; Chukwudi, 2024).

The manufacturing sector occupies an important position in Nigeria's economic development through its contribution to domestic production, employment generation, industrial diversification, and value addition. Despite this strategic importance, manufacturing productivity continues to face constraints arising from high operating costs, foreign exchange

pressures, logistics difficulties, capacity utilisation challenges, and insufficient technological upgrading. These conditions increase the relevance of digital transformation to manufacturing operations because firms require timely production information, integrated data systems, real-time inventory visibility, and effective coordination among procurement, production, distribution, and customer-related activities. Appropriate digital infrastructure and interconnected information systems can therefore provide manufacturing firms with improved capacity to coordinate operations, identify production problems promptly, and make evidence-based operational decisions.

Within this context, Nigerian Bottling Company, Idu, Abuja, provides an appropriate organisational setting for investigating the relationship between digital transformation adoption and organisational productivity. The company operates within the fast-moving consumer goods sector, where production continuity, product quality, process reliability, inventory availability, and distribution efficiency are important operational considerations. As part of a wider consumer goods production and distribution system, effective manufacturing operations increasingly require digital infrastructure, integrated information systems, automated production processes, supply chain visibility, and technology-supported quality management. Consequently, examining digital transformation within this organisational setting provides an opportunity to determine how the adoption of digital infrastructure and data integration systems relates to productivity outcomes within a manufacturing firm operating in Abuja.

Against this background, the study examined digital transformation adoption and organisational productivity in Nigerian Bottling Company, Idu, Abuja. Particular attention was given to digital infrastructure adoption and data integration systems as dimensions of digital transformation because these technologies can facilitate the flow of operational information, strengthen coordination among functional activities, and support efficient manufacturing processes.

Despite the growing adoption of digital technologies within manufacturing operations, productivity challenges continue to affect many Nigerian manufacturing firms. Production processes may still be characterised by inadequate system integration, dependence on manual documentation, delays in information transmission, limited automation, fragmented operational data, and insufficient employee capability to utilise digital technologies effectively. Such weaknesses can contribute to production delays, inefficient resource utilisation, equipment downtime, material wastage, inconsistent product quality, and increased operating costs. Consequently, acquiring digital technologies alone may not generate the expected productivity improvements when the technologies are inadequately incorporated into production processes or when the workforce lacks the necessary competence to apply them effectively (Olakpa & Adebusi, 2026; Nwamekwe et al., 2024).

The productivity challenge is particularly relevant to manufacturing organisations operating in the food and beverage industry, where production efficiency depends considerably on speed, product consistency, inventory accuracy, equipment reliability, quality control, and

supply chain responsiveness. At Nigerian Bottling Company, Idu, Abuja, digital technologies have potential applications in production planning, equipment maintenance, inventory management, logistics coordination, data management, and quality monitoring. However, the existence or acquisition of digital systems does not in itself establish that such technologies have produced measurable improvements in organisational productivity. More importantly, limited firm-specific empirical evidence appears to explain the extent to which digital infrastructure adoption and data integration systems are associated with operational efficiency and output quality within the Idu, Abuja manufacturing environment (Balogun, 2025; Chukwudi, 2024).

Furthermore, existing Nigerian literature has generally examined digitalisation in relation to broad measures of organisational or firm performance, while some studies have concentrated on sectors outside beverage manufacturing or have approached digital transformation primarily from conceptual perspectives. This leaves an important contextual and empirical issue because the productivity implications of digital transformation may differ according to industry characteristics, geographical setting, technological maturity, organisational structure, workforce capability, and the extent to which digital systems are integrated into routine operations. Findings obtained from other sectors or broader manufacturing samples may therefore not adequately explain the experience of a specific beverage manufacturing organisation operating in Abuja (Olakpa & Adebuseyi, 2026; Chukwudi, 2024; Nwamekwe et al., 2024).

The central problem addressed by this study was therefore the limited firm-level empirical understanding of how specific dimensions of digital transformation relate to productivity at Nigerian Bottling Company, Idu, Abuja. Rather than treating digital transformation as a broad technological concept, the study focused specifically on digital infrastructure adoption and data integration systems and examined their relationship with organisational productivity. Addressing this gap is important for establishing whether the integration of these digital capabilities into manufacturing operations is associated with improvements in productivity within the selected organisation.

Accordingly, the main objective of the study was to examine the effect of digital transformation adoption on organisational productivity in Nigerian Bottling Company, Idu, Abuja. Specifically, the study focused on digital infrastructure adoption and data integration systems as dimensions of digital transformation and examined their effects on organisational productivity. This focus is consistent with literature indicating that digital infrastructure and integrated data capabilities constitute important mechanisms through which manufacturing organisations can improve information flow, operational coordination, process efficiency, and productivity (Olakpa & Adebuseyi, 2026; Tian et al., 2022). The main objective is to examine digital transformation adoption and organisational productivity in Nigerian bottling company, Idu Abuja. The specific objectives are to examine the effect of digital infrastructure adoption on operational efficiency in Nigerian Bottling Company, Idu, Abuja, assess the effect of data integration systems on output quality in Nigerian Bottling Company, Idu,

Abuja, digital infrastructure adoption has no significant effect on operational efficiency in Nigerian Bottling Company, Idu, Abuja and data integration systems have no significant effect on output quality in Nigerian Bottling Company, Idu, Abuja.

2.0 Review of Related Literature

2.1 Digital Transformation

Digital transformation describes the deliberate integration of digital technologies into organisational activities to reshape operational processes, enhance value creation, improve decision-making, and strengthen organisational performance. The concept extends beyond digitisation, which primarily involves converting information from analogue to digital formats, and digitalisation, which refers to applying digital technologies to improve existing activities. Digital transformation represents a more comprehensive organisational change because it can alter work processes, organisational capabilities, structures, communication patterns, and systems for assessing performance (Verhoef et al., 2021; Vial, 2019).

Within manufacturing organisations, digital transformation involves incorporating technological applications into production and related business activities. These applications may include automated production equipment, enterprise resource planning systems, cloud technologies, digital inventory platforms, production-monitoring applications, data analytics, and integrated supply chain systems. Their effective application can enhance productivity by reducing production delays, minimising operational errors, facilitating timely decision-making, strengthening coordination, and improving the alignment between technological resources and production requirements. Within the Nigerian manufacturing environment, however, the performance benefits associated with digitalisation may depend considerably on the availability of appropriate infrastructure, employees' technological competence, and sustained managerial support (Olakpa & Adebusuyi, 2026; Chukwudi, 2024).

2.1.1 Dimensions of Digital Transformation

For the purpose of this study, digital transformation was conceptualised using two principal dimensions: digital infrastructure adoption and data integration systems. The selection of these dimensions reflects their direct relevance to manufacturing operations and organisational productivity. They can also be assessed through employees' experiences concerning the availability and utilisation of workplace technologies, interconnectedness of organisational systems, integration of work processes, and the extent to which digital applications facilitate production-related decisions (Nwamekwe et al., 2024; Tian et al., 2022).

1. Digital Infrastructure Adoption

Digital infrastructure adoption refers to the acquisition, availability, accessibility, and effective utilisation of technological facilities required to facilitate production, communication, information processing, operational monitoring, and coordination. In

manufacturing organisations, digital infrastructure may comprise computer systems, internet connectivity, automated production equipment, intelligent sensors, enterprise software, cloud-based platforms, digital dashboards, and electronic communication systems. Such infrastructure is important because it can minimise delays associated with manual processes, improve workflow, provide greater visibility into production activities, and enable employees to execute their responsibilities with increased accuracy and speed (Olakpa & Adebuisi, 2026; Chirumalla et al., 2025).

Within Nigeria's manufacturing sector, however, effective digital infrastructure adoption can be affected by several operational and environmental constraints. These include the substantial cost of acquiring and maintaining technological systems, unstable electricity supply, inadequate broadband infrastructure, limited access to specialised technical support, and weaknesses in maintenance practices. Such conditions can reduce the productivity benefits expected from technological investment because digital infrastructure is unlikely to improve organisational outcomes unless it is reliable, accessible, functional, and compatible with operational requirements. Consequently, the present study considers digital infrastructure adoption an important technological factor that may influence operational efficiency at Nigerian Bottling Company, Idu, Abuja (Balogun, 2025; Nwamekwe et al., 2024).

2. Data Integration Systems

Data integration systems refer to technological platforms and applications through which information generated across different organisational departments and operational processes is interconnected, consolidated, and made accessible for decision-making. Within manufacturing organisations, integration may involve enterprise resource planning applications, production databases, inventory management platforms, quality assurance records, logistics information systems, maintenance databases, and sales information. Effective integration reduces the fragmentation of organisational information and enables employees and managers to obtain timely and relevant data required for operational decisions (Tian et al., 2022; Verhoef et al., 2021).

Data integration is particularly important within beverage manufacturing because several interdependent activities must be continuously coordinated. Raw material availability, production schedules, quality inspections, packaging operations, inventory management, equipment maintenance, distribution, and customer demand all generate information that can affect production decisions. Where such information remains fragmented or is communicated slowly, manufacturing organisations may encounter stock shortages, excessive production, delayed responses to equipment problems, inconsistent product standards, and ineffective demand planning. Evidence from Nigerian studies suggests that stronger digital capabilities can enhance organisational decision-making and performance, although the extent of implementation continues to differ among manufacturing organisations (Olakpa & Adebuisi, 2026; Chukwudi, 2024).

2.1.2 Organisational Productivity

Organisational productivity concerns the efficiency and effectiveness with which an organisation transforms available resources into desired outputs. Within manufacturing organisations, productivity may be reflected in production speed, output per employee, equipment utilisation, cost efficiency, reduction of material waste, adherence to production schedules, and the quality of finished products. Productivity should therefore not be interpreted exclusively in terms of the quantity of products manufactured. It also encompasses the reliability, quality, timeliness, and cost-effectiveness with which production objectives are achieved.

Digital transformation can potentially strengthen organisational productivity by reducing equipment downtime, minimising operational errors, improving coordination, facilitating equipment monitoring, accelerating information exchange, and supporting quality management. Nevertheless, technological investment alone may not guarantee improved productivity. Complementary organisational capabilities, including employee training, effective leadership, redesign of work processes, reliable technological systems, and employees' willingness to utilise available technologies, are necessary if digital resources are to generate meaningful performance improvements (Chirumalla et al., 2025; Goodhue & Thompson, 1995).

Operational efficiency represents an organisation's ability to accomplish its production objectives while minimising unnecessary expenditure, waste, delays, duplicated activities, operational errors, and equipment downtime. In manufacturing, greater operational efficiency may be reflected in shorter production cycles, improved equipment utilisation, accurate inventory information, reduced human errors, effective workflow coordination, and timely completion of production activities. Digital infrastructure can contribute to these outcomes when technological facilities are sufficiently reliable and appropriately designed to support employees' assigned tasks (Olakpa & Adebisoyi, 2026; Goodhue & Thompson, 1995).

Operational efficiency is particularly important to Nigerian manufacturers because their competitiveness can be affected by high production costs, unstable energy supply, logistics difficulties, import dependence, and foreign exchange constraints. Although digital technologies cannot eliminate all these structural challenges, they can potentially reduce some operational inefficiencies through improved inventory control, equipment maintenance planning, visibility of production processes, and communication among organisational units. Achieving these benefits, however, requires continuous employee capacity development and sustained managerial commitment rather than merely acquiring technological equipment (Balogun, 2025; Nwamekwe et al., 2024).

Output quality describes the degree to which finished products conform to predetermined organisational standards, regulatory requirements, safety specifications, and customer expectations. Quality is particularly significant in beverage manufacturing because organisations are expected to maintain consistency in product content, taste, packaging,

hygiene, volume, labelling, and safety. Integrated data systems can contribute to improved output quality by connecting information relating to production, inventory, equipment maintenance, quality control, and distribution, thereby enabling organisations to identify and address quality-related problems more promptly (Chukwudi, 2024; Tian et al., 2022).

Digital transformation can further strengthen product quality through continuous monitoring, standardisation of operational records, improved product traceability, automated inspection processes, and faster identification of production defects. These potential benefits depend substantially on the accuracy, timeliness, accessibility, and appropriate utilisation of organisational data. Employees must also possess sufficient knowledge of production requirements and technological applications. Digital transformation should therefore be regarded as a socio-technical process in which technological resources and human capabilities interact to influence organisational outcomes (Goodhue & Thompson, 1995; Verhoef et al., 2021).

2.2 Theoretical Review

2.2.1 Technology Acceptance Model

The Technology Acceptance Model (TAM), developed by Davis (1989), explains individuals' acceptance and utilisation of technological systems principally through perceived usefulness and perceived ease of use. Perceived usefulness represents the extent to which an individual believes that using a particular technology will enhance job performance, whereas perceived ease of use concerns the degree to which the individual expects the technology to require minimal effort. Applied to the present study, the model suggests that employees may be more willing to utilise digital infrastructure and integrated data systems when they perceive such technologies as useful for improving their work and sufficiently straightforward to operate (Olakpa & Adebuseyi, 2026; Davis, 1989).

An important strength of TAM is its capacity to explain why the same technological application may experience different levels of acceptance among employees and organisations. Where workers consider a technological system difficult to operate, unreliable, or poorly connected to their work responsibilities, effective utilisation may remain limited even after substantial organisational investment. However, TAM primarily concentrates on individual perceptions and consequently provides comparatively limited explanations of organisational resources, environmental pressures, infrastructural conditions, and broader industry constraints that can influence digital transformation (Nwamekwe et al., 2024; Verhoef et al., 2021).

2.2.2 Technology-Organisation-Environment Framework

The Technology-Organisation-Environment (TOE) Framework developed by Tornatzky and Fleischer (1990) explains organisational technology adoption through three interconnected contexts: technological, organisational, and environmental conditions. Within the present study, the technological dimension concerns the availability, compatibility, and reliability of

digital infrastructure. The organisational dimension encompasses managerial support, employees' technological skills, organisational resources, and alignment of technologies with internal processes. The environmental dimension incorporates competitive pressures, regulatory requirements, customer expectations, industry developments, and supply chain demands. The framework is therefore valuable for explaining why the adoption of digital transformation in manufacturing is influenced by both internal organisational conditions and external environmental pressures (Chirumalla et al., 2025; Tornatzky & Fleischer, 1990).

The TOE Framework is particularly applicable to Nigerian manufacturing organisations because decisions concerning technological adoption may be affected by implementation costs, infrastructural deficiencies, market competition, organisational resources, and government policies. Nevertheless, the framework has a limitation in relation to the present study because explaining the conditions under which organisations adopt technologies does not necessarily demonstrate whether those technologies correspond adequately with specific employee tasks or ultimately enhance productivity. A complementary theoretical perspective that explicitly connects technology utilisation with work performance is therefore necessary (Balogun, 2025; Nwamekwe et al., 2024).

2.2.3 Task-Technology Fit Theory

Task-Technology Fit (TTF) Theory, associated with Goodhue and Thompson (1995), proposes that information technology is more likely to enhance individual and organisational performance when the capabilities provided by the technology correspond with the requirements of the tasks performed by users. From this perspective, possessing advanced technological resources is insufficient to produce productivity improvements unless those resources effectively support the activities employees are required to undertake. Applied to the present study, digital infrastructure and integrated data systems would be expected to contribute to productivity when their capabilities correspond with requirements relating to production, inventory management, logistics, quality assurance, equipment maintenance, and administrative operations (Olakpa & Adebuseyi, 2026; Goodhue & Thompson, 1995).

TTF Theory is especially relevant to Nigerian Bottling Company, Idu, Abuja, because productivity within a manufacturing environment requires effective correspondence between technological resources and production activities. Digital technologies that provide timely production information, minimise duplicated manual processes, strengthen quality monitoring, and facilitate coordination across operational units are more likely to contribute positively to operational efficiency and output quality. The theory therefore establishes an explicit conceptual connection between technological adoption and the productivity outcomes examined in this study (Goodhue & Thompson, 1995; Tian et al., 2022).

The present study was anchored on Task-Technology Fit Theory because it provides the most direct theoretical explanation of the relationship between the study's independent and dependent variables. Digital transformation adoption constituted the independent variable and was represented by digital infrastructure adoption and data integration systems, while

organisational productivity constituted the dependent variable and was represented by operational efficiency and output quality. Consistent with TTF Theory, the study assumed that digital transformation would contribute more effectively to productivity where technological resources correspond with operational tasks, remain reliable and accessible, and are supported by adequate employee capabilities and organisational commitment (Olakpa & Adebusi, 2026; Goodhue & Thompson, 1995).

2.3 Empirical Review

Olakpa and Adebusi (2026) examined the impact of digital transformation on staff productivity in Nigeria's manufacturing sector using a qualitative, interpretivist approach anchored on Task-Technology Fit Theory. Their findings indicated that manufacturing firms had made progress in adopting enterprise resource planning systems, robotics, and automation, with reported improvements in efficiency, quality, safety, and staff productivity. The study is relevant to the present research because it provides Nigerian manufacturing evidence on the productivity implications of digital transformation. However, the present study differs by focusing specifically on Nigerian Bottling Company, Idu, Abuja, and by quantitatively examining digital infrastructure adoption and data integration systems in relation to operational efficiency and output quality.

Chukwudi (2024) examined digitalisation and firm performance within Nigeria's manufacturing sector. The findings suggested that effective digitalisation could contribute to greater operational efficiency, improved organisational decision-making, and enhanced innovation. The study provides empirical justification for examining digital technologies within Nigerian manufacturing organisations. Nevertheless, its broader sectoral orientation creates an opportunity for firm-specific investigation. The present study responds to this limitation by concentrating on a beverage manufacturing organisation in Abuja and assessing clearly defined dimensions of digital transformation and productivity.

Nwamekwe et al. (2024) investigated smart factory adoption within Nigeria and identified inadequate infrastructure, high implementation costs, deficiencies in technical capabilities, weak institutional support, and regulatory challenges as important barriers to technological transformation. Their findings demonstrate that digital transformation within Nigerian manufacturing cannot be adequately understood without recognising the institutional, infrastructural, and organisational environment within which firms operate. The current study extends this perspective by investigating whether digital transformation adoption is associated with productivity outcomes within a selected beverage manufacturing organisation.

Tian et al. (2022) examined platform-based servitisation and business model adaptation among four established Chinese textile and apparel manufacturers. Using longitudinal and interpretive case-study methods, the authors found that manufacturers leveraged digital platforms to support digital and smart servitisation and followed different pathways of business model adaptation. The study is relevant because it demonstrates how Industry

4.0-enabled platforms can reshape manufacturing processes and organisational value creation. Its context, however, differs from the present study, which investigates digital transformation adoption and productivity within a Nigerian beverage manufacturing firm.

Chirumalla et al. (2025) investigated critical factors affecting digital transformation in manufacturing companies. The study showed that successful digital transformation depends on a combination of technological integration, organisational readiness, leadership commitment, employee capabilities, and systematic transition management. This evidence reinforces the view that digital transformation is not merely a technological investment but an organisational change process. The present study applies this perspective to Nigerian Bottling Company, Idu, Abuja, by examining whether digital infrastructure adoption and data integration systems are associated with operational efficiency and output quality.

2.4 Gaps in the Literature

The literature reviewed indicates growing scholarly attention to digital transformation in manufacturing organisations. Nevertheless, a substantial proportion of existing research has examined digital transformation in relation to broad organisational performance, innovation, financial outcomes, or general digitalisation rather than clearly specified productivity outcomes. Within Nigerian manufacturing research, relatively limited attention has been given to simultaneously examining digital infrastructure adoption and data integration systems as dimensions of digital transformation and relating them specifically to operational efficiency and output quality within beverage manufacturing. This represents an empirical gap that the present study seeks to address (Olakpa & Adebusi, 2026; Chukwudi, 2024).

A contextual gap is also evident in the geographical and organisational settings covered by previous research. Firm-level studies focusing specifically on manufacturing organisations located in Abuja appear less prominent within the literature reviewed for this study. Much of the Nigerian evidence cited in the reviewed literature addresses the manufacturing sector generally, organisations located in other major industrial centres, or broader discussions of smart manufacturing adoption. Evidence obtained from such settings may not fully explain digital transformation within Nigerian Bottling Company, Idu, Abuja, particularly given the operational characteristics of the fast-moving consumer goods sector, where production continuity, product quality, inventory management, and distribution efficiency are important competitive considerations (Balogun, 2025; Nwamekwe et al., 2024).

A methodological gap can equally be identified from the literature. Some previous studies have relied on conceptual, desk-based, or qualitative approaches, while others have examined digital transformation using broad measures that do not explicitly establish relationships between particular dimensions of digital adoption and corresponding productivity outcomes. The present study addresses this limitation through a survey-based empirical approach in which digital infrastructure adoption is examined in relation to operational efficiency, while data integration systems are examined in relation to output quality. This approach provides a more focused and empirically testable basis for understanding the relationship between

digital transformation adoption and organisational productivity at Nigerian Bottling Company, Idu, Abuja (Olakpa & Adebusuyi, 2026; Tian et al., 2022).

3.0 Methodology

This chapter presents the methodological procedures employed in conducting the study. It covers the research design, area of the study, population of the study, sample size and sampling technique. The methodological choices were guided by the objectives of the study and the need to obtain relevant primary data for examining digital transformation adoption and organisational productivity at Nigerian Bottling Company, Idu, Abuja.

3.1 Research Design

The study adopted a survey research design. The design was considered appropriate because it enabled the researcher to obtain primary data directly from employees concerning digital transformation adoption and organisational productivity at Nigerian Bottling Company, Idu, Abuja. Specifically, the survey approach facilitated the collection of information on employees' experiences and perceptions regarding digital infrastructure adoption, data integration systems, operational efficiency, and output quality. A survey design is particularly useful when a study seeks to systematically collect standardised information from a defined population through a structured research instrument and analyse relationships among organisational variables (Saunders et al., 2019).

The survey design was also suitable because the variables investigated could be operationalised through measurable questionnaire items administered to employees who interacted with the organisation's technological and operational processes. Consequently, the design provided an appropriate basis for obtaining quantitative data required to examine the relationships between the dimensions of digital transformation adoption and organisational productivity.

3.2 Area of the Study

The study was conducted at Nigerian Bottling Company, Idu, Abuja, in the Federal Capital Territory, Nigeria. The company operates within the beverage manufacturing sector, where production efficiency, product quality, process reliability, inventory management, and effective supply chain coordination are important aspects of organisational operations.

Nigerian Bottling Company, Idu, Abuja, was selected because its manufacturing activities provided an appropriate organisational setting for examining the application of digital technologies to production and related operational processes. The organisation's manufacturing environment involves activities such as production, quality control, equipment maintenance, inventory management, logistics, and administration, which require effective information exchange and coordination. The location therefore provided an appropriate context for investigating the relationship between digital transformation adoption and organisational productivity.

3.3 Population of the Study

The population of the study comprised all accessible employees of Nigerian Bottling Company, Idu, Abuja, whose responsibilities were relevant to the technological and operational activities examined in the research. The employees were drawn from production, operations, quality control, maintenance, logistics, inventory management, administration, and other related functional units.

The accessible population consisted of 78 employees. These employees constituted the population because their responsibilities and workplace experiences placed them in an appropriate position to provide information concerning the adoption and utilisation of digital technologies and their implications for organisational productivity. The population was therefore considered relevant to the objectives of the study, particularly the examination of digital infrastructure adoption, data integration systems, operational efficiency, and output quality.

3.3.1 Sample Size and Sampling Technique

Given the relatively small and manageable accessible population of 78 employees, the study adopted a census approach. Accordingly, all 78 employees constituting the accessible population were included in the study. No statistical sample size determination formula was required because the researcher intended to obtain responses from every member of the defined accessible population rather than selecting a subset.

The census approach was considered appropriate because it provided every employee within the defined population with an opportunity to participate in the study. Including the entire accessible population also eliminated sampling error arising from the selection of only a proportion of the employees and improved representation across the relevant functional units of the organisation. Consequently, 78 copies of the questionnaire were administered, corresponding to the total accessible population of the study.

Thus:

Accessible Population = 78 employees

Sample Size = 78 employees

Sampling Technique = Census approach

Thus, all the 78 employees of Nigerian Bottling Company, Idu, Abuja, constituted the sample size for the study.

3.4 Method of Data Collection

Data were collected through the administration of structured questionnaires to employees of Nigerian Bottling Company, Idu, Abuja. The researcher personally administered the questionnaire or used trained assistants where necessary, after obtaining permission from the

appropriate authority. Respondents were informed that participation was voluntary and that their responses would be treated confidentially. This procedure was appropriate because ethical data collection improves respondent trust and strengthens the quality of survey based organisational research (Creswell & Creswell, 2018; Chukwudi, 2024).

3.5 Method of Data Analysis

Data collected from the questionnaire were analysed using descriptive and inferential statistics. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarise respondents' demographic characteristics and responses to the study variables. Inferential statistics, particularly Spearman's Rank Correlation or regression analysis, were used to test the hypotheses, depending on the final structure and distribution of the data. The decision rule was to reject the null hypothesis where the probability value was less than 0.05 and accept it where the probability value was greater than 0.05 (Saunders et al., 2019; Olakpa & Adebuseyi, 2026).

4.0 Data Presentation & Analysis

4.1 Descriptive Analysis of Study Variables

The descriptive analysis was based on the four major study variables: digital infrastructure adoption, data integration systems, operational efficiency, and output quality. The interpretation was based on a five point Likert scale. A mean score of 3.00 and above was regarded as agreement, while a mean score below 3.00 was regarded as disagreement.

4.1.1 Digital Infrastructure Adoption

Table 4.1: Descriptive Analysis of Digital Infrastructure Adoption

Questionnaire Item	Mean	Standard Deviation	Decision
Digital equipment supports production monitoring in the organisation.	4.21	0.71	Agree
Internet based systems improve communication across departments.	4.05	0.78	Agree
Automated systems reduce manual delays in operational activities.	4.18	0.69	Agree
Digital tools improve the speed of task completion.	4.09	0.81	Agree
Technical support is available for the use of digital infrastructure.	4.13	0.76	Agree

Grand Mean	4.13	0.75	Agree
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Source: SPSS Version 26.0

Table 4.1 indicates that the grand mean for data integration systems was 4.06. This shows that respondents agreed that data systems were used to connect production, inventory, quality control, and decision-making processes. The result suggests that data integration helped to reduce information gaps and supported timely access to operational information.

The implication is that data integration systems enhance the capacity of the organisation to coordinate activities across departments. In a manufacturing firm, this is important because production decisions often depend on accurate information about raw materials, maintenance, quality control, inventory, and distribution requirements.

4.1.2 Operational Efficiency

Table 4.2: Descriptive Analysis of Operational Efficiency

Questionnaire Item	Mean	Standard Deviation	Decision
Digital tools reduce delays in production activities.	4.23	0.68	Agree
Digital systems improve the use of time and resources.	4.12	0.74	Agree
Automated processes reduce avoidable operational errors.	4.05	0.8	Agree
Digital infrastructure improves coordination among work units.	4.17	0.72	Agree
Technology adoption supports faster completion of assigned tasks.	4.09	0.77	Agree
Grand Mean	4.13	0.74	Agree

Source: SPSS Version 26.0

Table 4.2 shows that the grand mean for operational efficiency was 4.13. This indicates that respondents agreed that digital technology contributed to improved operational efficiency in the organisation. The result suggests that digital systems reduced delays, improved resource utilisation, minimised errors, and strengthened coordination among units.

This finding supports the argument that productivity in manufacturing firms is partly determined by the extent to which technology reduces waste, duplication, idle time, and process inefficiencies. In Nigerian Bottling Company, Idu, Abuja, digital infrastructure appears to have contributed to smoother operational activities and faster task completion.

4.1.3 Output Quality

Table 4.3 Descriptive Analysis of Output Quality

Questionnaire Item	Mean	Standard Deviation	Decision
Digital systems support consistency in product quality.	4.24	0.67	Agree
Data integration improves quality monitoring.	4.16	0.72	Agree
Digital records help to identify production faults quickly.	4.06	0.81	Agree
Integrated systems support compliance with production standards.	4.19	0.7	Agree
Digital tools improve traceability of production activities.	4.12	0.76	Agree
Grand Mean	4.15	0.73	Agree

Source: SPSS Version 26.0

Table 4.3 shows that the grand mean for output quality was 4.15. This indicates that respondents agreed that digital systems supported product quality in the organisation. The result suggests that digital tools improved quality monitoring, product consistency, compliance with production standards, and quick identification of production faults.

The finding implies that data integration systems may contribute meaningfully to output quality by improving the accuracy, accessibility, and timeliness of production information. This is important in beverage manufacturing, where quality consistency, hygiene, standardisation, and traceability are essential to organisational performance.

4.2 Test of Hypotheses

The two hypotheses were tested using simple regression analysis. The decision rule was to reject the null hypothesis where the p value was less than 0.05 and retain the null hypothesis where the p value was greater than 0.05.

4.2.1 Test of Hypothesis One

Ho1: Digital infrastructure adoption has no significant effect on operational efficiency in Nigerian Bottling Company, Idu, Abuja.

Table 4.4: Regression Result for Digital Infrastructure Adoption and Operational Efficiency

Variable	R	R Square	Adjusted R Square	F Statistic	Beta	t Value	Sig.
Digital Infrastructure Adoption	0.742	0.551	0.545	93.27	0.742	9.66	0.000

Source: SPSS Version 26.0

Table 4.4 shows that digital infrastructure adoption had a strong positive effect on operational efficiency, with an R value of 0.742. The R Square value of 0.551 indicates that digital infrastructure adoption explained 55.1 percent of the variation in operational efficiency. The F statistic of 93.27 and p value of 0.000 indicate that the model was statistically significant at the 0.05 level.

Since the p value of 0.000 is less than 0.05, the null hypothesis was rejected. Therefore, digital infrastructure adoption has a significant effect on operational efficiency in Nigerian Bottling Company, Idu, Abuja.

4.2.2 Test of Hypothesis Two

Ho2: Data integration systems have no significant effect on output quality in Nigerian Bottling Company, Idu, Abuja.

Table 4.5: Regression Result for Data Integration Systems and Output Quality

Variable	R	R Square	Adjusted R Square	F Statistic	Beta	t Value	Sig.
Data Integration Systems	0.718	0.516	0.51	81.03	0.718	9.00	0.000

Source: SPSS Version 26.0

Table 4.5 shows that data integration systems had a strong positive effect on output quality, with an R value of 0.718. The R Square value of 0.516 indicates that data integration systems explained 51.6 percent of the variation in output quality. The F statistic of 81.03 and p value of 0.000 show that the model was statistically significant.

Since the p value of 0.000 is less than 0.05, the null hypothesis was rejected. Therefore, data integration systems have a significant effect on output quality in Nigerian Bottling Company, Idu, Abuja.

4.3 Discussion of Findings

The first finding revealed that digital infrastructure adoption had a significant positive effect on operational efficiency in Nigerian Bottling Company, Idu, Abuja. This means that the availability and use of digital equipment, automated systems, internet-based communication, production monitoring platforms, and technical support contributed to improved operational processes. The implication is that digital infrastructure reduced delays, improved coordination, enhanced resource utilisation, and supported faster completion of production related tasks.

This finding agrees with the position that digital transformation improves productivity when digital tools are properly aligned with operational activities. It also supports the Task Technology Fit Theory, which argues that technology improves performance when its features correspond with the tasks users perform. In the context of Nigerian Bottling Company, Idu, Abuja, digital infrastructure appeared to fit operational needs by supporting production monitoring, communication, and workflow coordination.

The second finding showed that data integration systems had a significant positive effect on output quality. This suggests that integrated production data, inventory records, quality control information, and operational reports improved the ability of the organisation to monitor product quality and maintain production standards. The result further implies that data integration reduced information fragmentation and improved the reliability of decisions affecting output quality.

This finding is consistent with recent manufacturing literature, which suggests that data driven systems improve product consistency, traceability, defect identification, and quality assurance. In beverage manufacturing, where output quality is central to customer trust and regulatory compliance, integrated data systems are particularly important. The finding therefore suggests that digital transformation contributes not only to production speed but also to product standardisation and quality reliability.

The results indicate that digital transformation adoption contributes positively to productivity in Nigerian Bottling Company, Idu, Abuja. However, the findings also imply that the productivity benefits of digital transformation depend on the reliability of digital infrastructure, the integration of data across departments, employee competence, and managerial support. Technology alone may not produce sustainable productivity improvement unless it is embedded into daily operational routines and supported by continuous training.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study concluded that digital transformation adoption significantly influenced productivity in Nigerian Bottling Company, Idu, Abuja. The findings showed that digital infrastructure adoption improved operational efficiency by reducing delays, supporting production monitoring, improving communication, strengthening workflow coordination, and enhancing the speed of task completion. This means that manufacturing firms are more likely to achieve improved operational efficiency when digital tools are available, reliable, and properly aligned with production activities.

The study also concluded that data integration systems improved output quality in the organisation. Integrated data systems supported quality monitoring, production traceability, timely reporting, inventory coordination, and compliance with production standards. This finding suggests that output quality in beverage manufacturing depends not only on production equipment, but also on the accuracy, accessibility, and timely use of operational data across departments.

Based on the findings, the study concluded that digital transformation should not be treated as the mere acquisition of technology. Rather, it should be understood as a strategic organisational process that requires reliable infrastructure, integrated data systems, employee competence, management commitment, and proper alignment between digital tools and work processes. When these conditions are present, digital transformation can serve as a meaningful driver of productivity in manufacturing firms.

5.2 Recommendations

- i. Management should invest in reliable production monitoring systems, automated operational tools, internet-based communication platforms, and technical support systems. These digital facilities should be made available across production, maintenance, logistics, inventory, quality control, and administrative units. In addition, employees should receive regular training on the effective use of digital tools so that the organisation can reduce operational delays, improve workflow coordination, minimise avoidable errors, and enhance overall operational efficiency.
- ii. Management should ensure that data generated from different departments are digitally connected, updated in real time, and made accessible to authorised employees who need such information for decision making. This will help the organisation to improve quality monitoring, detect production faults more quickly, strengthen product traceability, reduce reporting errors, and maintain consistency in output quality.

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