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DIGITAL TRANSFORMATION STRATEGIES AND ORGANISATIONAL EFFICIENCY OF ALUMINIUM MANUFACTURING FIRMS IN ENUGU STATE

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Abstract: The study investigated the relationship between digital transformation strategies and organisational efficiency of Aluminum Manufacturing Firms in Enugu State. Specific Objectives were to: identify the relationship between digital transformation and generating of revenue; and ascertain the Relationship between digital reinforcement and reduced costs of Aluminum Manufacturing Firms in Enugu State. The area of the study was the Enugu metropolis, Enugu State. The study used the descriptive survey design approach. The primary source of data was the administration of questionnaire. Total populations of 265staff were used. The whole population was used due to small number. 214 staff returned the questionnaire and accurately filled. Data was presented and analyzed using Likert Scale and the hypotheses using t- test. The findings revealed that digital transformation had significant positive relationship with generating of revenue of Aluminum Manufacturing Firms in Enugu State, t (95, n = 214), 9.168, P. <. 05. Digital reinforcement had significant positive relationship with reduced costs of Aluminum Manufacturing Firms in Enugu State, t (95, n = 214), 6.019, P. <. 05. The study concluded that **d**igital transformation and digital reinforcement had significant positive relationship with generating of revenue, reduced costs of Aluminum Manufacturing Firms in Enugu State. The study recommended among other things that technology be put at the core of business strategy, digital transformation is required as this will increased efficiency, greater business agility and, ultimately, the unlocking of new value for employees, customers and shareholders.

Keywords: Digital transformation, Strategies, Digital reinforcement, Organisational efficiency

Introduction

1.1 Background of the Study

In today's rapidly evolving business environment, digital transformation has emerged as a critical driver of organisational efficiency and sustainability. It refers to the integration of digital technologies into all aspects of a business, fundamentally altering how organisations operate and deliver value to customers (Vial, 2019). In the manufacturing sector, particularly aluminium production, digital transformation strategies encompass the adoption of smart technologies, data analytics, automation, and cloud computing to streamline processes and enhance operational outcomes (Kamble, Gunasekaran, & Gawankar, 2018). This transition is increasingly

essential for firms striving to remain competitive and efficient in the face of rising global demands and local market pressures.

Organisational efficiency, which is the optimal use of resources to achieve desired outcomes, is a vital indicator of firm performance. In manufacturing firms, efficiency reflects how well production inputs such as labour, materials, and energy are transformed into outputs, such as finished products (Wilden, Gudergan & Lings, 2013). Digital transformation has the potential to significantly enhance this process by reducing operational costs, improving production speed, enabling predictive maintenance, and enhancing decision-making through real-time data analytics (Moeuf et al., 2020).

However, the adoption and implementation of digital transformation strategies in Nigeria's manufacturing sector, especially in aluminium firms, remains uneven and under-researched. Many firms in Enugu State continue to face challenges such as inadequate infrastructure, lack of digital skills, resistance to change, and high implementation costs (Adeleke & Bakare, 2022). Despite these challenges, firms that embrace digitalisation often report improvements in process efficiency, customer satisfaction, and overall agility (Yin, Stecke & Li, 2018). As such, understanding how digital transformation strategies influence the organisational efficiency of aluminium manufacturing firms in Enugu State is essential for improving their competitiveness and operational sustainability. This study seeks to examine the impact of specific digital transformation strategies on the efficiency of these firms.

1.2 Statement of the Problem

The digital era has redefined how manufacturing firms operate, pushing many toward adopting digital transformation strategies to stay competitive and efficient. Globally, manufacturers are leveraging digital technologies to boost operational performance, enhance revenue generation, and minimise operational costs. However, in the context of aluminium manufacturing firms in Enugu State, Nigeria, the adoption and effective integration of digital transformation strategies remain relatively limited and poorly structured. While developed economies have recorded significant progress in linking digital transformation to increased revenue, many Nigerian manufacturing firms still struggle with low digital penetration, outdated systems, and a lack of strategic investment in digital tools. This digital lag poses a major challenge to their revenue-generating capacity. The extent to which digital transformation strategies such as data analytics, enterprise resource planning, and automated systems contribute to revenue growth in these local aluminium firms remains unclear, leading to missed business opportunities and underperformance in increasingly competitive markets.

Similarly, although digital reinforcement including the consistent upgrading and support of digital systems has the potential to lower production and operational costs, its influence in the aluminium manufacturing sector in Enugu State is under-explored. Firms often incur high costs due to manual processes, inefficiencies, and system downtimes that could otherwise be mitigated through proper digital reinforcement mechanisms. The lack of empirical evidence on how digital transformation and reinforcement relate to revenue generation and cost reduction creates a critical knowledge gap. Without this understanding, firms may continue to make ineffective investments in digital technologies, missing the potential benefits of increased organisational efficiency. It is against this backdrop that this study seeks to investigate the relationship between digital transformation strategies

and organisational efficiency, specifically examining their influence on revenue generation and cost reduction in aluminium manufacturing firms in Enugu State.

1.3 Objectives of the study

The main objective of the study was to investigate the relationship between digital transformation strategies and organizational efficiency of Aluminum Manufacturing Firms in Enugu State. Specific Objectives were to:

i. Identify the relationship between digital transformation and generating of revenue of Aluminum Manufacturing Firms in Enugu State.
ii. Ascertain the Relationship between digital reinforcement and reduced costs of Aluminum Manufacturing Firms in Enugu State.

1.4 Research Questions

The following research questions guided the study.

i. What is the relationship between digital transformation and generating of revenue of Aluminum Manufacturing Firms in Enugu State?
ii. What is the Relationship between digital reinforcement and reduced costs of Aluminum Manufacturing Firms in Enugu State?

1.5 Statement of the Hypotheses

The following Hypotheses guided the study.

i. Digital transformation has significance relationship with generating of revenue of Aluminum Manufacturing Firms in Enugu State.
ii. Digital reinforcement has significance relationship with reduced costs of Aluminum Manufacturing Firms in Enugu State.

REVIEW OF THE RELATED LITERATURE

2.1 Conceptual Review

2.1.1 Digital transformation

Digital transformation entails considering how products, processes and organizations can be changed through the use of new, digital technologies (Matt, Hess and Benlian, 2015). Digital transformation is imperative for all businesses, from the small to the enterprise. Digital transformation is the integration of digital technology into all areas of a business, fundamentally changing how you operate and deliver value to customers. It's also a cultural change that requires organizations to continually challenge the status quo, experiment, and get comfortable with failure. A key element of digital transformation understands the potential of your technology. According to Deloitte, “digital transformation is all about becoming a digital enterprise an organization that uses technology to continuously evolve all aspects of its business models. Digital transformation is about evolving your business by experimenting with new tech and rethinking your current approach to common issues (Whatfix, 2023). The process of using digitized information to make established ways of working simpler and more efficient is called digitalization.

2.1.2 Digital transformation strategies

Digital transformation strategies refer to structured, organisation-wide plans aimed at leveraging digital technologies to fundamentally change business processes, models, capabilities, and customer experiences, thereby improving organisational performance and competitiveness. It is not merely the automation of existing operations, but the rethinking and redesign of core functions using digital tools and platforms (Bharadwaj et al., 2013; Westerman et al., 2014). According to Vial (2019), digital transformation strategies involve the deliberate integration of emerging technologies such as cloud computing, artificial intelligence, big data analytics, Internet of Things (IoT), and enterprise platforms into an organisation's strategic framework. These strategies allow firms to respond to market dynamics, enhance agility, and create more value for stakeholders. They also influence operational efficiency, employee collaboration, product innovation, and revenue generation (Henriette, Feki, & Boughzala, 2016).

In manufacturing contexts, including aluminium production, digital transformation strategies typically encompass the implementation of smart factory technologies, real-time data analytics, supply chain digitisation, and predictive maintenance systems. These strategic initiatives drive cost reduction, optimise production workflows, and improve decision-making processes (Schallmo, Williams, & Boardman, 2017). When properly executed, digital transformation not only boosts operational efficiency but also creates new revenue streams and competitive advantages in increasingly digital markets (Susanti et al., 2023). Moreover, the success of these strategies depends heavily on leadership commitment, employee readiness, organisational culture, and ongoing digital capability development. As such, a digital transformation strategy must align with the broader organisational vision and be supported by continuous learning and adaptability (Li, Su, Zhang, & Mao, 2018).

2.1.3 Digital Reinforcement

Nowadays, companies must cope with mass customisation and shortening development cycles that pose major challenges for smart production facilities. They must be capable to operate in highly uncertain market conditions and satisfy the increasingly challenging standards of product quality and sustainability in the shortest possible time. To meet these challenges, Germany launched the Industry 4.0 initiative in 2013 to support the development of flexible and adaptive production systems (Kagermann, Wahlster, and Helbig 2013 & Marcel Benedict, 2022)

If the industry's goal is to work closely with AI, then the consideration of reinforcement learning is one of the key factors in achieving the desired goal. As AI industries leveraging applications of reinforcement learning have advantages from manufacturing to digital marketing to maximize their return on investments. Below mentioned are a few practical examples of how industries are leveraging RL.

Product differentiation, product assembling, and product distribution are difficult jobs and require high-level qualified labor. Availability and shortage of skilled labor is the biggest concern. Manufacturing companies with heavy production schedules require automated machines that can optimize production time and production costs. Reinforcement learning can help heavy-duty machines in analyzing the best practices for building qualitative products.

A robot performing tasks with deep RL can read and develop from committed mistakes. And the more it interacts with the environment, the more it can analyze and provide optimal suggestions to advance the production process

automation. Automotive companies are taking advantage of these robots for building and assembling maximum parts of auto cars to reduce defects, (Soulpage, 2019).

2.1.4 Organisational Efficiency

Organisational efficiency refers to the capacity of a firm to utilise its resources—such as time, capital, human assets, and technology in a manner that maximises output while minimising waste and costs. It is a critical component of overall performance and indicates how well an organisation converts inputs into valuable outputs without unnecessary expenditure or delay (Dibrell, Craig, & Neubaum, 2014). Efficiency goes beyond operational streamlining; it also encompasses the effectiveness of internal systems, processes, and employee productivity in achieving strategic objectives. According to Richard et al. (2009), organisational efficiency is a metric of how economically resources are deployed in pursuit of organisational goals, often captured through indicators such as cost savings, speed of service delivery, and process optimisation.

In today's fast-paced business environment, efficiency has taken on new dimensions with the integration of digital technologies. Digital tools such as automation, artificial intelligence, and enterprise resource planning systems have significantly enhanced organisations' ability to monitor, evaluate, and adjust their operations in real-time, thereby improving efficiency levels (Schniederjans, Curado, & Khalajhedayati, 2020). Firms that consistently refine their processes to reduce redundancy and increase task accuracy are better positioned to gain competitive advantages and ensure long-term sustainability (Ghobakhloo & Fathi, 2021). Moreover, organisational efficiency must be supported by a conducive culture, robust communication networks, and strategic leadership. Leaders play a central role in fostering innovation and continuous improvement, both of which are necessary for maintaining high efficiency in dynamic markets (Amankwah-Amoah, 2018). In manufacturing settings like aluminium production, organisational efficiency includes optimising supply chains, reducing production lead times, enhancing quality control, and ensuring optimal machine and labour utilisation. These elements directly influence profitability, customer satisfaction, and overall business agility (Jermsittiparsert, Siam, Issa, Ahmed, & Pahi, 2019).

2.1.5 Generating of revenue

The essence of revenue generation is to advance the welfare of citizens of a country with focus on promoting economic growth and development through the provision of development activities. Despite remarkable growth recorded in revenue generation the physical state of the nation in terms of social amenities and infrastructure remain backward (Ogbeifun Ajetunmobi, Moronkeji and Adindu, 2019). The rationale for revenue generation in markets economy such as Nigeria stems from the government responsibilities, which include but are not restricted to stabilization of the economy, redistribution of income and provision of services in the form of public goods. Revenues generated from these various sources must be utilized efficiently in promoting through the provision of basic amenities for improved public services (Worlu and Emeka (2012). These activities are considered as sabotaging the economy and are readily presented as reasons for the underdevelopment of the country (Ogbeifun et al, 2019).

2.1.6 Reduced costs.

In reducing costs, there is need to keep a written record of what you spend; creating a budget; update subscription; save on utility costs; cheaper housing options; consolidate debts; shop for cheaper insurance; shop with a list; pay off your debts; and switch to cash only (George,2023). Reducing costs include payments to suppliers, employee wages, factory leases, and equipment depreciation. Businesses are allowed to write off tax-deductible expenses on their income tax returns to lower their taxable income and thus their tax liability; however, the Internal Revenue Service (IRS) has strict rules on which expenses businesses are allowed to claim as a deduction (Daniel, David & Timothy, 2023). One of the main goals of company management teams is to maximize profits. This is achieved by boosting revenues while keeping expenses in check. Slashing costs can help companies to make even more money from sales. However, if expenses are cut too much it could also have a detrimental effect. For example, paying less on advertising reduces costs but also lowers the company's visibility and ability to reach out to potential customers. Companies break down their revenues and expenses in their income statements. Accountants record expenses through one of two accounting methods: cash basis or accrual basis. Under cash basis accounting, expenses are recorded when they are paid. In contrast, under the accrual method, expenses are recorded when they are incurred (Daniel et al, 2023).

2.2 Theoretical Framework

2.2.1 Unified Theory of Acceptance and Use of Technology by Venkatesh, Morris, Davis and Davis, 2003

The unified theory of acceptance and use of technology (UTAUT) is a technology acceptance model formulated by Venkatesh and others in "User acceptance of information technology: Toward a unified view (Venkatesh, Morris, Davis and Davis, 2003). The theory holds that there are four key constructs: 1) performance expectancy, 2) effort expectancy, 3) social influence, and 4) facilitating conditions. The first three are direct determinants of usage intention and behavior, and the fourth is a direct determinant of user behavior. Gender, age, experience, and voluntariness of use are posited to moderate the impact of the four key constructs on usage intention and behavior.

The theory was developed through a review and consolidation of the constructs of eight models that earlier research had employed to explain information systems usage behaviour (theory of reasoned action, technology acceptance model, motivational model, theory of planned behavior, a combined theory of planned behavior/technology acceptance model, model of personal computer use, diffusion of innovations theory, and social cognitive theory). Subsequent validation by Venkatesh et al. (2003) of unified theory of acceptance and use of technology in a longitudinal study found it to account for 70% of the variance in Behavioural Intention to Use (BI) and about 50% in actual use (Venkatesh, Morris, Davis and Davis, 2003).

2.3 Empirical Review

Abubakar (2016) conducted a study on an exploratory study of social media usage and developmental outcomes by government and emerging political leaders –the Nigerian experience. The objectives of the study were; to carry out detailed literature review of the concept of new ICTs and social media and their relevance in strengthening and developing free democratic society; to assess Nigeria's current new mass media deployment within the context of ICT for development as a means of understanding the perspectives of emergence of new ICTs and

social media within the concept of e-Government; to understand factors militating against ICT use for e-governance, political participation and proffer workable solutions to relative challenges, and risks that may be associated with the use of new ICTs and social media within the set frame. The study adopted mixed method approach. The study was limited by necessity to Nigerian urban elites. Nigeria is a country of 170 million populations with 500 different ethnicities, many of who have high illiteracy rates. The finding shows that still nascent ICT and digital media threaten the virtual government monopoly on sources of information production, and therefore threaten unchecked power and extractive institutions.

Mukamanzi and Ndikubwimana (2018) conducted a study on the effects of ICT adoption on Small and Medium sized enterprises in Rwanda: A Case study of Kigali City. The purpose of the study was to investigate the effects of technology adoption by SMEs in Kigali city. The study adopted a cross-sectional approach to measure firms' responses regarding adoption of ICT. Data was collected from 250 respondents with the help of a questionnaire. A survey instrument was formulated to obtain feedback from SMEs in Rwanda, assessing their awareness, receptivity and adoption of ICT in their businesses. The study shows that perceived benefits, ICT knowledge and skills and government support were significant elements of ICT adoption. The study concluded that understanding of the internet as a medium for commercial use in the service arena, identifying the rationale for SMEs adopting or rejecting ICT. The study recommended that policymakers should emphasize policies and strategies for ICT implementation in all sectors and among SMEs as we have seen that in Rwanda SMEs form 98 per cent of the total businesses and account for 41 per cent of all private sector employment.

Mbah, Ekwo and Obi (2019) conducted a study on Technology adaptation strategies by smes in Enugu State, Nigeria. The objectives of the study was to ascertain the effect of the adaptation of mobile phone on SMEs in Nigeria, to assess the effect of the adaptation of cash tilling machines on SMEs in Nigeria, to evaluate the effect of the adaptation of institutional website on SMEs in Nigeria. The study had a population of 175 staff of Central Bank of Nigeria in Enugu state. The sample size of 122 was drawn using Freund and William's formula at 5 percent error margin. A survey design was adopted for the study. Instrument used for data collection was the questionnaire. A total of 122 copies of questionnaire were distributed while 119 were returned. Three hypotheses were tested using regression, and with aid of Statistical Package for Social Science (SPSS). The findings indicate that there is positive effect of the adaptation of mobile phone on SMEs in Nigeria, there is positive effect of the adaptation of cash tilling machines on SMEs in Nigeria, and there is positive effect of the adaptation of institutional website on SMEs in Nigeria.

Fanping, Ruiqi, Zhizhou, Grace and Liwei (2021), Conducted a study on Deep Reinforcement Learning for Digital Materials Design Designing composites has been a research topic of interest in the field of materials science. As an elegant mathematical representation for composites, the concept of digital materials (DMs) was developed to express structures with complex geometries and various material distributions. DMs have a vast design space to achieve targeted physical properties, which makes it challenging for solving inverse problems. Here, a deep reinforcement learning (DRL) scheme is utilized to automate the DM design process without the designer's prior knowledge. Based on the reward signal of structural mechanical property changes, DRL algorithms can initiate new design patterns in a self-updating process. As a demonstration example, a DM system

composed of two different materials are selected as testing environments with three different levels of design space sizes. The collaborative deep Q network (DQN) architecture is developed to comprise two cooperative agents for two types of element-level modification operations to satisfy the design constraints, such as material fraction. The quality of each composite pattern is calculated through the finite element analysis (FEA) simulation. Results show the proposed approach can effectively handle the complex state-action space problems for the digital material design process with significant computation advantages, compared with those of the genetic algorithm with a 15.9% final design quality enhancement. As such, this new class of DRL scheme could be a powerful tool to enable the autonomous discovery process for next-generation free-form DM designs.

Marcel & Benedict (2022) conducted a study on Deep reinforcement learning in production systems: a systematic literature review. Shortening product development cycles and fully customisable products pose major challenges for production systems. These not only have to cope with increased product diversity but also enable high throughputs and provide a high adaptability and robustness to process variations and unforeseen incidents. To overcome these challenges, deep Reinforcement Learning (RL) has been increasingly applied for the optimisation of production systems. Unlike other machine learning methods, deep RL operates on recently collected sensor-data in direct interaction with its environment and enables real-time responses to system changes. Although deep RL is already being deployed in production systems, a systematic review of the results has not yet been established. The main contribution of this paper is to provide researchers and practitioners an overview of applications and to motivate further implementations and research of deep RL supported production systems. Findings reveal that deep RL is applied in a variety of production domains, contributing to data-driven and flexible processes.

Kareem, Muhammad, Syed & Matrian,(2023), Conducted a study on the dual effect of digital communication reinforcement drivers on purchase intention in the social commerce environment. The paper draws on the theory of planned behavior (TPB) to investigate the dual effect of digital communication reinforcement drivers: positive (i.e., interactivity, argument quality, hedonic motivation, and perceived enjoyment online) and negative (i.e., intrusive concerns and privacy concerns) on purchase intention. This paper also examines the mediation effect of perceived usefulness and the moderation effect of habit. Using a time-lag approach, 490 responses were collected from Pakistan's social media users and then analyzed using SmartPLS v.3.2.8. Findings showed that interactivity, argument quality, and privacy concerns significantly affected purchase intention. Furthermore, perceived usefulness was partially mediated, and habit was discovered to be a significant moderator in liking perceived usefulness with enjoyment online and purchase intention. This paper advances TPB understanding and develops an integrated model for businesses to better understand customer physiology on social commerce platforms through effective contributions in theory and practice.

METHODOLOGY

The study employed descriptive survey design. Both primary and secondary sources of data were used in this study. The Study Covered Seven (7) Selected Aluminium Manufacturing Firms in Enugu Metropolis Understudy. The population of the study consists of the owners and staff of the selected Aluminium manufacturing firms in Enugu metropolis with the total population of two hundred and sixty-three (265). To determine the adequate

sample size of the study, the whole population was used due to small number. The main instrument for data collection was a structured questionnaire. Data from the questionnaire were analyzed with the aid of SPSS version 23 using simple, percentages and correlation co-efficient. Data from the questionnaire were further analyzed using simple percentages, mean and standard deviation. T- Test was used to test the hypotheses.

DATA ANALYSIS AND RESULTS PRESENTATIONS

4.1 Data Presentation

4.1.1 The relationship between digital reinforcement and reduced costs of Aluminum manufacturing firms

Table 4.1.1: The relationship between digital reinforcement and reduced costs of Aluminum manufacturing firms

		5 SA	**4 A**	**3 N**	**2 DA**	**1 SD**	**∑FX**	**- X**	**SD**	**Decision**
1	Automating manual processes improved income generation	435 87 40.7	320 80 37.4	39 13 6.1	24 12 5.6	22 22 10.3	840 214 100%	3.93	1.272	Agree
2	The reduction of errors was due to change and helps to promote gross margin	460 92 43.0	296 74 34.6	39 13 6.1	20 10 4.7	25 25 11.7	840 214 100%	3.93	1.316	Agree
3	The digital transformation added to productivity results and income generation	420 84 39.3	248 62 29.0	69 23 10.7	20 20 9.3	25 25 11.7	782 214 100%	3.75	1.368	Agree
4	Operating expenses is reduced through IT change	470 94 43.9	188 47 22.0	87 29 13.6	26 13 6.1	31 31 14.5	802 214 100%	3.75	1.438	Agree
5	The level of inefficiency is minimized with ICT	495 99 46.3	184 46 21.5	93 31 14.5	24 12 5.6	26 26 12.1	822 214 100%	3.84	1.382	Agree
	Total Grand mean and standard deviation							**3.84**	**1.3552**	

Source: Field Survey, 2023

Table 4.1.1, 167 respondents out of 214 representing 78.1 percent agreed that Automating manual processes improved income generation with mean score 3.93 and standard deviation of 1.272. The reduction of errors was due to change and helps to promote gross margin 166 respondents representing 77.6 percent agreed with mean score of 3.93 and standard deviation of 1.316. The digital transformation added to productivity results and income generation 146 respondents representing 68.2 percent agreed with mean score of 3.75 and standard deviation of 1.368. Operating expenses is reduced through IT change 141 respondents representing 65.9 percent agreed with

mean score of 3.75 and 1.438. The level of inefficiency is minimized with ICT 145 respondents representing 67.8 percent agreed with a mean score of 3.84 and standard deviation 1.382.

4.1.2 The Relationship between digital reinforcement and reduced costs of Aluminum manufacturing firms

Table 4.1.2: Responses on the Relationship between digital reinforcement and reduced costs of Aluminum manufacturing firms

		5 SA	4 A	3 N	2 DA	1 SD	∑FX	- X	SD	Decision
1	The data reinforcement drivers reveal unique purchase intentions and minimizes expenses	380 76 35.5	180 45 21.0	141 47 22.0	20 10 4.7	36 36 16.8	757 214 100%	3.54	1.439	Agree
2	Through digital change, the argument for quality and perceived enjoyment online were directly significant	380 76 35.5	264 66 30.8	75 25 11.7	42 21 9.8	26 26 12.1	787 214 100%	3.68	1.365	Agree
3	Making business more agile and adaptable in the organization was through ICT	350 70 33.7	244 61 28.5	102 34 15.9	20 10 4.7	39 39 18.2	755 214 100%	3.53	1.449	Agree
4	Digital change allows responses to quick changing market conditions	400 80 37.4	232 58 27.1	117 39 18.2	16 8 3.7	29 29 13.6	794 214 100%	3.71	1.360	Agree
5	Responding to customers need through technology has reduced operational expenses	255 51 23.8	232 58 27.1	177 59 27.6	18 9 4.2	37 37 17.3	719 214 100%	3.36	1.355	Agree
	Total Grand mean and standard deviation							**3.564**	**1.3936**	

Source: Field Survey, 2023

Table 4.1.2, 121 respondents out of 214 representing 56.5 percent agreed that The data reinforcement drivers reveal unique purchase intentions and minimizes expenses with mean score 3.54 and standard deviation of 1.439. Through digital change, the argument for quality and perceived enjoyment online were directly significant 142 respondents representing 66.9 percent agreed with mean score of 3.68 and standard deviation of 1.365. Making business more agile and adaptable in the organization was through ICT 131 respondents representing 62.2 percent agreed with mean score of 3.53 and standard deviation of 1.449. Digital change allows responses to quick changing market conditions 138 respondents representing 64.5 percent agreed with mean score of 3.71 and 1.360.

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Responding to customers need through technology has reduced operational expenses 109 respondents representing 50.9 percent agreed with a mean score of 3.36 and standard deviation 1.355.

4.2 Test of hypotheses

4.2.1 Digital transformation has significance relationship with generating of revenue of Aluminum Manufacturing Firms in Enugu State

Table 4.2.1 Shows t – test on Digital transformation has significance relationship with generating of revenue of Aluminum Manufacturing Firms in Enugu State

Contingency Table 4.2.1 of Research Question one:

S/N		SA	A	N	D	SD
1.	Automating manual processes improved income generation	87	80	13	12	22
2.	The reduction of errors was due to change and helps to promote gross margin	92	74	13	10	25
3.	The digital transformation added to productivity results and income generation	84	62	23	20	25
4.	Operating expenses is reduced through IT change	94	47	29	13	31
5	The level of inefficiency is minimized with ICT	99	46	31	12	26
	Total	**456**	**309**	**109**	**67**	**129**

Table 4.2.2 Contingency table of cumulative responses of Research Question one

Options	χ	F	Fχ	$\bar{\chi} - \chi = \chi_1$	$F(\chi_1)^2$	$\Sigma f(\chi_1)^2$
Strongly agree	5	456	2280	-1.148	456 x $(-1.148)^2$	600.964
Agree	4	**309**	1236	-.149	309 x $(-.149)^2$	6.860
Neutral	3	109	327	.851	109 x $(.851)^2$	78.937
Disagree	2	67	134	1.851	67 x $(1.851)^2$	229.555
Strongly Disagree	1	129	129	2.851	129 x $(2.851)^2$	10448.54
	15	**1066**	**4106**			**1964.854**

Mean score

$$\bar{\chi} = \frac{F\chi}{N} = \frac{4106}{1066} = 3.851$$

Variance = $(S^2) = \frac{\varepsilon f(\chi_1)^2}{N-1} = \frac{1964.854}{1065} = 1.845$

Standard deviation = $\sqrt{S^2} = \sqrt{1.845} = 1.358$

Level of confidence = 0.05

μ = Population mean = 3.0

Statistical tool used = t – test

$$t = \frac{\chi - \mu}{\frac{s}{\sqrt{n}}}$$

Where;
μ = Population mean
s = Sample standard deviation
n = Sample size 214
Level of significance: α at 5%
Degree of freedom: $\frac{K-1}{N-K} = \frac{5-1}{214-5} =$ (209, 4) = 1.96
t - Tabulated value = 1.96

Decision Rule:

If the t-calculated is greater than the t-tabulated {t-cal > t-tab} reject the null hypothesis {H_0} that the overall estimate is not significant and if otherwise conclude that the overall estimate is statistically significant.

Substituting $t = \frac{\chi - \mu}{\frac{s}{\sqrt{n}}}$

$$t = \frac{3.851-3.0}{\frac{1.358}{\sqrt{214}}}$$

$$= \frac{.851}{\frac{1.358}{14.63}}$$

$$= \frac{.851 \times 14.63}{1.358}$$

t = 9.168

The computed t = 9.168 greater than the table value of 1,96, we reject the null hypothesis. Therefore, we concluded that Digital transformation had significant positive relationship with generating of revenue of Aluminum Manufacturing Firms in Enugu State as reported in the probability value of (t = 9.168,p. > .05).

4.2.2 Digital reinforcement has significance relationship with reduced costs of Aluminum Manufacturing Firms in Enugu State

Table 4.2.3 Shows t – test on Digital reinforcement has significance relationship with reduced costs of Aluminum Manufacturing Firms in Enugu State

Contingency Table 4.2.3 of Research Question two:

S/N		SA	A	N	D	SD
1.	The data reinforcement drivers reveal unique purchase intentions and minimizes expenses	76	45	47	10	36
2.	Through digital change, the argument for quality and perceived enjoyment online were directly significant	76	66	25	21	26
3.	Making business more agile and adaptable in the organization was through ICT	70	61	34	10	39
4.	Digital change allows responses to quick changing market conditions	80	58	39	8	29

5	Responding to customers need through technology has reduced operational expenses,	51	58	59	9	37
	Total	**353**	**288**	**204**	**58**	**167**

Table 4.2.4 Contingency table of cumulative responses of Research Question two

Options	χ	**F**	Fχ	$\bar{\chi} - \chi = \chi_1$	$F(\chi_1)^2$	$\Sigma f(\chi_1)^2$
Strongly agree	5	353	1765	-1.424	353 x $(-1.424)^2$	715.805
Agree	4	**288**	1152	-.424	288 x $(-.424)^2$	51.775
Neutral	3	204	612	.576	204 x $(.576)^2$	67.682
Disagree	2	58	116	1.576	58 x $(1.576)^2$	144.059
Strongly Disagree	1	167	167	2.576	167 x $(2.576)^2$	1108.175
	15	**1066**	**3812**			**2087.496**

Mean score

$$\bar{\chi} = \frac{F\chi}{N} = \frac{3812}{1066} = 3.576$$

Variance = $(S^2) = \frac{\varepsilon f(\chi_1)^2}{N-1} = \frac{2087.496}{1065} = 1.960$

Standard deviation = $\sqrt{S^2} = \sqrt{1.960} = 1.40$

Level of confidence = 0.05

μ = Population mean = 3.0

Statistical tool used = t – test

$$t = \frac{\chi - \mu}{\frac{s}{\sqrt{n}}}$$

Where;

μ = Population mean

s = Sample standard deviation

n = Sample size 214

Level of significance: α at 5%

Degree of freedom: $\frac{K-1}{N-K} = \frac{5-1}{214-5} = (209, 4) = 1.96$

t - tabulated value = 1.96

Decision Rule:

If the t-calculated is greater than the t-tabulated {t-cal > t-tab} reject the null hypothesis {H_0} that the overall estimate is not significant and if otherwise conclude that the overall estimate is statistically significant.

Substituting $t = \frac{\chi - \mu}{\frac{s}{\sqrt{n}}}$

$$t = \frac{3.576-3.0}{\frac{1.40}{\sqrt{214}}}$$

$$= \frac{.576}{\frac{1.400}{14.63}}$$

$$= \frac{.576 \text{ x } 14.63}{1.400}$$

$$t = 6.019$$

The computed t = 6.019 greater than the table value of 1,96, we reject the null hypothesis. Therefore, we concluded that Digital reinforcement had significant positive relationship with reduced costs of Aluminum Manufacturing Firms in Enugu State, as reported in the probability value of (t = 6.019, p. > .05).

5.1 Summary of Findings

i. Digital transformation had significant positive relationship with generating of revenue of Aluminum Manufacturing Firms in Enugu State. t, (95, n = 214), 9.168, P. <. 05

ii. Digital reinforcement had significant positive relationship with reduced costs of Aluminum Manufacturing Firms in Enugu State, t (95, n = 214), 6.019, P. <. 05

5.2 Conclusion

The study concluded that Digital transformation and Digital reinforcement had significant positive relationship with generating of revenue, reduced costs of Aluminum Manufacturing Firms in Enugu State. Digitalization of business processes as a fundamental element of innovative business management leads to a qualitative transformation of the business paradigm of an individual enterprise and the modernization of entire sectors of the economy or the entire economic system. Digital transformation impacts businesses by improving the efficiency of their operations, enabling large-scale automation. Naturally, there are fewer human errors which directly lead to a decrease in operational costs. Digital Entrepreneurship, the online process of knowledge, skill, competency, and attitude development, aims to maximize the effectiveness of the entrepreneurial capacity building.

5.3 Recommendations

Based on the Findings the following recommendations were proffered.

i. To put technology at the core of business strategy, digital transformation is required as this will increased efficiency, greater business agility and, ultimately, the unlocking of new value for employees, customers and shareholders.

ii. Reinforcement is necessary for the organizations to acquire new skills, teach a replacement behavior for an interfering behavior, increase appropriate behaviors, or increase on-task behavior.

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