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Artificial Intelligence (AI) Integration and Business Sustainability in Enugu State: Implications for Co-operative Enterprises

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Abstract

This study examined artificial intelligence integration and business sustainability in Enugu State and its implications for co-operative enterprises. The specific objectives were to ascertain the extent the integration of artificial intelligence influence the sustainability of co-operative business enterprises and to evaluate the extent the challenges of co-operative business enterprises influence the integration of artificial intelligence. Descriptive survey research design was adopted for the study, with a population of 322, consequently adopted as the sample size owing to its manageable size. A structured questionnaire was used for data collection and validated through content and face validity. Cronbach's Alpha was used to ascertain the reliability of the instrument, with reliability coefficient of 0.84, indicating that the instrument was reliable. Data were

presented in tables and analyzed using simple percentages and means through a 5 points Likert Scale. Formulated hypotheses were tested using simple linear regression. Findings showed that the integration of artificial intelligence had significant positive influence on sustainability of co-operative business enterprises ($r^2 = 0.500$, $f = 0.206$, $p < 0.05$); challenges of co-operative business enterprises had significant positive influence on the integration of artificial intelligence ($r^2 = 0.371$, $f = 4.394$, $p < 0.05$). The study therefore concluded that the integration of artificial intelligence significantly boosts co-operative business sustainability and consequently driven by the challenges these enterprises face. Recommendations were made among others that Co-operatives should embrace AI smartly, train their teams, and use it to stay efficient long-term.

Keywords: Artificial Intelligence, Business Sustainability, Co-operative Enterprises, Enugu State

Introduction

Significant advancements in Artificial Intelligence (AI) over recent decades have revolutionized various industries, such as transportation, agriculture, healthcare, energy, and media (Enholm *et al.*, 2022) ^[9]. These advancements have opened new business opportunities (Hughes *et al.*, 2020; Shareef *et al.*, 2021) ^[12, 27]. AI simulates human intelligence through machine learning, data mining, natural language processing, and image recognition, promoting efficiency, cost savings, and improved product quality and customer service (Łapińska *et al.*, 2021) ^[18].

AI offers three key benefits: automating time-consuming tasks, extracting insights from large data sets, and addressing complex issues like the climate crisis with advanced solutions. AI redefines business practices, addressing significant societal challenges and enhancing customer service with better recommendations and cost-effective options (Payne *et al.*, 2021) ^[24].

For co-operative enterprises, especially small to medium-sized businesses, AI integration can significantly improve operational efficiency and sustainability. In Enugu State, Nigeria, AI has the potential to transform business operations, empowering local economies and fostering long-term growth through enhanced co-operative performance.

Co-operative enterprises would fully integrate AI technologies into their operations. This integration would lead to optimized supply chains, improved decision-making processes, and enhanced operational efficiency. Co-operatives would be able to allocate resources more effectively, reduce operational costs, and implement sustainable practices that contribute to economic growth and sustainable development.

Many co-operatives struggle to adopt AI technologies due to several challenges. These include shortage of capital, lack of education, training and information, shortage of skilled personnel capable of managing AI systems and technical

rationalization and innovation among others. These barriers hinder the ability of co-operatives to leverage AI for business sustainability, limiting their competitive edge and growth potential.

If these challenges are not addressed, co-operative enterprises may continue to operate below their potential. The lack of AI integration could result in inefficient operations, higher operational costs, and missed opportunities for sustainable practices. This would not only affect the economic viability of the co-operatives but also impede broader socio-economic development goals in the region.

Objectives of the Study

The broad objective of the study is to examine artificial intelligence integration and business sustainability in Enugu State and its implications for co-operative enterprises. Specifically, the objectives are to:

1. ascertain the extent the integration of artificial intelligence influence the sustainability of co-operative business enterprises;
2. evaluate the extent the challenges of co-operative business enterprises influence the integration of artificial intelligence

Statement of Hypotheses

1. Integration of artificial intelligence has no influence the sustainability of co-operative business enterprises:
2. Challenges of co-operative business enterprises have no influence on the integration of artificial intelligence

Review of Related Literature

Conceptual Review

Artificial Intelligence (AI)

Grover *et al.* (2022) ^[11] describe AI as a system's capability to gain knowledge by analyzing environmental data, allowing it to update or create new plans in response to changes. AI involves designing systems for tasks like speech recognition, visual data interpretation, and decision-making (Rai *et al.*, 2019) ^[25]. In business, AI is used for text analytics, predictive modeling, robotic automation, and virtual agents to streamline processes (Davenport & Ronanki, 2018; Sturm *et al.*, 2021) ^[7, 29].

AI also enables machines to perform tasks typically requiring human intelligence, showcasing their cognitive abilities. This includes studying how computers and algorithms solve complex problems and adapt to changes (Giuggioli & Pellegrini, 2023) ^[10]. Arakpogun *et al.* (2021) ^[3], describe AI as technologies that mimic human intelligence, enabling machines to execute cognitive functions (Rai *et al.*, 2019) ^[25].

Business sustainability involves managing an organization with a focus on economic, social, and environmental dimensions, known as the triple bottom line (Ritika & Montu, 2018) ^[26]. This approach ensures long-term viability through eco-friendly practices, ethical labor standards, and sound financial management. Integrating AI with business sustainability can transform co-operatives, enhancing operational efficiency, member engagement, and long-term viability through economic, social, and environmental sustainability.

Co-operative Enterprises

To understand "co-operative enterprises," we must first define "co-operative." As credited to the International Co-

operative Alliance (ICA, 1995) ^[14], co-operative is the autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise. Similarly, the International Labour Organization (ILO, 2003) as cited in Onyeze & Itodo (2021) ^[23], describes co-operatives as self-governed associations formed by individuals to meet their common needs via a joint and democratically managed enterprise.

Co-operative enterprises are member-owned organizations where benefits and responsibilities are shared. They are based on democratic principles, with each member having equal voting power regardless of investment (Novkovic & Miner, 2021). Unlike traditional businesses that focus on shareholder profit, co-operatives aim to fulfill members' economic, social, and cultural needs (ICA, 2020) ^[15]. They operate in various sectors, such as agriculture, retail, housing, finance, and worker co-operatives, and adhere to values like self-help, democracy, equality, equity, and solidarity (Lund, 2018) ^[19]. Members benefit from profit-sharing, access to services, or better working conditions (Birchall, 2018) ^[4].

The co-operative model supports sustainable development by prioritizing long-term community and member benefits over short-term profits, thus fostering local job creation and economic resilience (Cheney *et al.*, 2019) ^[6]. Co-operatives emphasize ethical practices, social responsibility, and environmental care, contributing positively to society and the environment (Carini & Carpita, 2020) ^[5]. Ultimately, co-operatives represent a collaborative and fair business approach that values collective well-being and sustainable growth.

Empirical Review

Juha *et al.* (2023) ^[16] examined AI adoption for sustainable business practices in major Finnish enterprises using qualitative content analysis on data from 25 companies between 2017 and 2021. They found that 20 companies used AI, with 16 integrating it into sustainable practices, highlighting AI's growing strategic importance in Finland.

Ebuka *et al.* (2023) ^[8] investigated AI's impact on sustainability for Nigerian SMEs using a descriptive design. They sampled 379 SMEs from a population of 27,546 registered with the Cooperate Affairs Commission (CAC). Data was collected through interviews and structured questionnaires, revealing that many SMEs still operate manually, limiting their AI adoption and growth potential.

Kumar *et al.* (2023) ^[17] reviewed literature on AI and e-commerce's effect on SME marketing performance. They identified AI's benefits in content development, predictive modeling, automated decision-making, real-time customer insights, and promotional strategy optimization, with e-commerce aiding market expansion and customer loyalty.

Ajayi (2023) ^[1] analyzed the economic sustainability impact of agricultural co-operatives in Ekiti State, Nigeria. Using random sampling, 175 out of 331 co-operatives were studied. Data analysis involved descriptive statistics (percentages, frequency tables) and multiple regression. Findings indicated significant effects from subsidies (0.002) and loan repayment (0.000) on rural economic sustainability.

Alnamrouti *et al.* (2022) ^[2] explored how strategic human resources and AI enhance organizational sustainability in NGOs. Using WarpPLS and PLS-SEM for analysis, they

found that organizational learning, strategic HR management, and AI significantly improve NGO sustainability through better performance and corporate social responsibility.

Mabunda (2022) ^[20] studied the sustainability challenges of co-operatives in Muyexe village, Limpopo Province, South Africa, through structured questionnaires and interviews. Findings showed that poor corporate governance, inadequate developmental programs, lack of management experience, conflict management issues, and lack of ownership contribute to co-operatives' unsustainability.

Methodology

Descriptive Survey research design was adopted for the study and was carried out in Enugu State, with a population of 322 members from selected primary registered co-operative societies within the state's metropolis. The population was adopted as the sample size, owing to its manageable. A

structured questionnaire was used for data collection and validated through content and face validity. Cronbach's Alpha was used to ascertain the reliability of the instrument and the corresponding reliability coefficient of 0.84 showed that the instrument was reliable. Data were presented in tables and analyzed using simple percentages and means through a 5 points Likert Scale. Formulated hypotheses were tested using simple linear regression.

Analysis and Results

Distribution and Return of Questionnaire

Out of the 322 copies of questionnaire distributed to the respondents, 294 copies representing 91.30% of the total number of questionnaire were successfully filled and returned while 28 copies representing 8.70% were not returned and not used for the analysis. Thus given 91.30% response rate.

Table 4.1: Respondents' Opinion on Integration of Artificial Intelligence (n = 294)

S. No	Item	SA (%)	A (%)	U (%)	D (%)	SD (%)	Mean
1	AI integration can streamline operations, reducing costs and improving resource allocation in co-operatives	93 32%	90 31%	28 9%	53 18%	30 10%	3.55
2	AI enables personalized services, enhancing member satisfaction and loyalty within co-operatives	102 34%	79 26%	33 11%	31 10%	49 19%	3.52
3	AI adoption can give co-operatives a competitive edge through data-driven decision-making and operational efficiencies	71 24%	124 41%	38 13%	27 10%	34 12%	3.58

Source: Fieldwork, 2025

Table 4.2: Respondents' Opinion on sustainability of co-operative business enterprises (n = 294)

S. No	Item	SA (%)	A (%)	U (%)	D (%)	SD (%)	Mean
4	Active member participation drives sustainable decision-making and growth	77 25%	123 41%	51 17%	27 10%	16 7%	3.74
5	Commitment to ethical practices fosters trust and sustainable operations	68 23%	102 35%	64 21%	36 12%	24 9%	3.52
6	Shared ownership leads to more stable and resilient economies	59 20%	138 46%	37 12%	42 14%	18 8%	3.60

Source: Fieldwork, 2025

Table 4.3: Respondents' Opinion on Challenges of Co-operative Business Enterprises (n = 294)

S. No	Item	SA (%)	A (%)	U (%)	D (%)	SD (%)	Mean
7	Co-operative enterprises often face challenges in raising insufficient capital for expansion	67 23%	94 32%	52 17%	55 18%	26 10%	3.41
8	Lack of professional management can hinder growth and efficiency	55 18%	89 31%	73 25%	53 17%	24 9%	3.33
9	Limited access to advanced technology and resources hinders operational capabilities	62 21%	99 33%	59 20%	47 15%	27 11%	3.42

Source: Fieldwork, 2025

Table 4.4: Respondents' Opinion on Challenges of integration of artificial intelligence (n = 294)

S. No	Item	SA (%)	A (%)	U (%)	D (%)	SD (%)	Mean
10	Limited funds may hinder AI adoption and capability development in co-operatives	96 32%	102 34%	33 11%	48 16%	15 7%	3.73
11	Co-operative values may conflict with AI's impact on decision-making and job roles	77 25%	122 41%	52 17%	16 7%	27 10%	3.70
12	Co-operatives may lack infrastructure and support systems essential for successful AI integration	54 18%	90 31%	71 25%	51 17%	28 9%	3.30

Source: Fieldwork, 2025

Table 4.1 shows that 93(32%) strongly agreed, 90(31%) agreed, 28(9%) indecisive, 53(18%) disagreed and 30(10%) strongly disagreed with a mean value of 3.55 for item 1. 102(34%) strongly agreed, 79(26%) agreed, 33(11%) indecisive, 31(10%) disagreed and 49(19%) strongly disagreed with mean value of 3.52 on item 2. The result for item 3 further indicates that 71(24%) strongly agreed, 124(41%) agreed, 38(13%) indecisive, 27 (10%) disagreed and 34(12%) strongly disagreed with mean value of 3.58.

Table 4.2 shows that 77(25%) strongly agreed, 123(41%) agreed, 51(17%) indecisive, 27(10%) disagreed and 16(7%) strongly disagreed with a mean value of 3.74 for item 4. 68(23%) strongly agreed, 102(35%) agreed, 64(21%) indecisive, 36(21%) disagreed and 24(9%) strongly disagreed with mean value of 3.52 for item 5. Result for item 6 also indicates that 59(20%) strongly agreed, 138(46%) agreed, 37(12%) indecisive, 42(14%) disagreed and 18(8%) strongly disagreed.

The response in Table 4.3 indicates that 67(23%) strongly agreed, 94(32%) agreed, 52(17%) indecisive, 55(17%) disagreed and 26 (10%) strongly disagreed with mean of 3.41 for item 7. The result for item 8 shows that 55(18%) strongly agreed, 89(31%) agreed, 73(25%) indecisive, 53(17%) disagreed and 24(9%) strongly disagreed with mean of 3.33. In addition, the result for item 9 indicates that 62(21%) strongly agreed, 99(33%) agreed, 59(20%) indecisive, 47(15%) disagreed and 27(11%) strongly disagreed with mean of 3.42.

Table 4.4 expresses that 96(32%) strongly agreed, 102(34%) agreed, 33(11%) indecisive, 48(16%) disagreed while 15(7%) strongly disagreed with mean of 3.73 on item 10. The result of the statement 11 shows that 77(25%) strongly agreed, 122(41%) agreed, 52(17%) indecisive, 16(7%) disagreed and 27(10%) strongly disagreed with mean of 3.70 on item 11. The responses also show that 54(18%) strongly agreed, 90(31%) agreed, 71(25%) indecisive, while 51(17%) disagreed and 28(9%) strongly disagreed with mean of 3.30 item 12.

Test of Hypotheses

Hypothesis H₀₁: Integration of artificial intelligence has no influence the sustainability of co-operative business enterprises

Table 4.5.1a: Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.502 ^a	.500	.500	.98362	1.966

a. Predictors: (Constant), Artificial intelligence.

b. Dependent Variable: Sustainability of co-operative business enterprises.

Table 4.5.1b: ANOVA^a

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	.096	1	.096	.206	.000 ^b
Residual	259.727	293	.463		
Total	259.822	294			

a. Dependent Variable: Sustainability of co-operative business enterprises

b. Predictors: (Constant), Artificial intelligence Artificial intelligence

Table 4.4.1c: Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	3.715	.160		23.226	.000
Artificial intelligence	1.312	.041	.502	.050	.960

a. Dependent Variable: Sustainability of co-operative business enterprises

R = 0.502

R² = 0.500

F = 0.206

T = 0.050

DW = 1.966

The model explained a significant portion of the variance in the “artificial intelligence influence on sustainability of co-operative business enterprises” (R² = 0.500, F = 0.206, p < 0.05), indicating that the model explained 50% of the variance in sustainability of co-operative business enterprises. The results showed that “artificial intelligence” predicted “sustainability of co-operative business enterprises” ($\beta = 1.312$, n = 563, t = 0.050, p, < 0.05). A 1966 Durbin-Watson statistic not exceeding 2 indicates no autocorrelation. Therefore, we reject the null hypothesis and conclude that the alternative hypothesis is true. Thus, integration of artificial intelligence has significant influence the sustainability of co-operative business.

Hypothesis H₀₂: Challenges of co-operative business enterprises have no influence on the integration of artificial intelligence

Table 4.5.2a: Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.412 ^a	.371	.371	.71705	2.102

a. Predictors: (Constant), Challenges of co-operative business enterprises

b. Dependent Variable: Integration of artificial intelligence

Table 4.5.2b: ANOVA^a

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	4.546	1	4.546	4.394	.000 ^b
Residual	580.410	293	1.035		
Total	584.956	294			

a. Dependent Variable: Integration of artificial intelligence

b. Predictors: (Constant), challenges of co-operative business enterprises

Table 4.5.2c: Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	1.945	.094	.412	20.657	.000
challenges of co-operative business enterprises	2.012	.044		.281	.778

a. Dependent Variable: Integration of artificial intelligence

R = 0.412

R² = 0.371

F = 4.394

T = 0.281

DW = 2.102

The model explains a significant portion of the variance in “challenges of co-operative business enterprises influence on integration of artificial intelligence” ($R^2 = 0.371$, $F = 4.394$, $p < 0.05$), indicating that the model explains 37.1% of the variance challenges of co-operative business. The results showed that “challenges of co-operative business” predicted “integration of artificial intelligence”, $\beta = 2.012$, $n = 563$, $t = 0.281$, $p < 0.05$. A Durbin-Watson statistic of 2102 greater than 2 indicates that there is autocorrelation. Thus, the null hypothesis is rejected and the alternative is accepted, thus, challenges of co-operative business enterprises have significant positive influence on the integration of artificial intelligence.

Discussion of Findings

Findings showed that the integration of artificial intelligence had significant positive influence on sustainability of co-operative business enterprises. This aligns with earlier works by Juha *et al.* (2023) ^[16] and Alnamrouti *et al.* (2022) ^[2], both of whom highlighted the rising importance of AI in building more sustainable organizations. Juha's study showed that out of 20 Finnish companies surveyed, 16 had already woven AI into their sustainability strategies, reflecting a growing trend toward tech-enabled environmental and operational practices. Alnamrouti and colleagues found that combining AI with organizational learning and strategic human resource management led to stronger NGO sustainability, largely through improved performance and alignment with corporate social responsibility goals. Unlike previous studies that focused mainly on large corporations, NGOs, or government bodies, this research offers a fresh perspective by looking at the often-overlooked grassroots co-operative sector. The findings point to a meaningful shift, co-operatives are beginning to see AI not just as a tech upgrade, but as a necessary tool for staying resilient and efficient in the long run. One reason for this shift might be that AI helps these organizations make smarter decisions, better manage limited resources, and plan more effectively for the future. With the rise of user-friendly AI tools, even smaller co-operatives, traditionally slow to adopt tech, are finding it easier to engage. What's emerging is a growing recognition of how AI can strengthen transparency, accountability, and responsiveness in their daily operations.

It was also revealed that and that the challenges of co-operative business enterprises had significant positive influence on the integration of artificial intelligence. This also supports the findings of Ajayi (2023) ^[1] and Mabunda (2022) ^[20]. Ajayi showed that financial constraints like reduced subsidies and high loan defaults significantly impacted rural economic stability, prompting many to seek innovative responses. In the same vein, Mabunda outlined several critical issues like poor leadership, lack of structured development programs, and weak conflict resolution, that have historically undermined co-operative sustainability. While past studies have mostly looked at how these challenges affect performance, this research goes a step further: it suggests that these persistent problems might actually be pushing co-operatives toward embracing digital tools like AI. In other words, the need to survive in tough conditions may be sparking innovation. For many co-operatives, especially those operating on tight margins, AI offers a practical way to adapt, streamline operations, and meet rising demands for transparency from funders and

regulators. What once hindered progress is now becoming a reason to transform.

Conclusion and Recommendations

The study therefore concludes that the integration of artificial intelligence significantly boosts co-operative business sustainability and consequently driven by the challenges these enterprises face. In line with the findings, the study recommends that co-operatives should embrace AI smartly, train their teams, and use it to stay efficient long-term and that Co-operatives must act early to tackle poor funding and weak management that risk their future.

Contribution to Knowledge

The study highlighted artificial intelligence role in enhancing co-operative enterprises' sustainability amidst challenges and contributing to business literature and practice.

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