FRONTIERS IN MANAGEMENT SCIENCE

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Emotional Intelligence and Customer Satisfaction in Deposit Money Banks: A Conceptual Review

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Abstract

The study examined emotional intelligence and customer satisfaction in Akwa Ibom State. The specific objectives were to: examine the effect of self-awareness, self-management, and social awareness on customer satisfaction of deposit money banks in Akwa Ibom State. This study adopted conceptual Review methods. Information was obtained from secondary sources using published journals. Based on the conceptual review, it was revealed that self-awareness, self-management, social awareness have effect on customer satisfaction of deposit money banks in Akwa Ibom State. The study recommended that Managers should create an environment of confidence and equality, and their feature of self-regulation is crucial in terms of a competitive viewpoint. Managers need to effectively direct the relationships, but it is the social skills that make such relations possible. Managers should show a great deal of sympathy, as a key part of management, with their surrounding individuals.

Keywords: emotional intelligence, self-awareness, self-management, social awareness, customer satisfaction

1. Introduction

The banking sector has evolved drastically; banks have become very competitive, deploying various strategies for attracting new customers and retaining old ones. The prevailing work situations in the banks reinforce the need for management to get involved with their employees, efficiently manage emotions so as to minimize negative feedback (Hamid, 2018). The effort of building a sound relationship, based on emotional intelligence is particularly evident in transformational leaders who enable their followers to excel beyond expectations by unifying their beliefs and values. The banking sector in Nigeria is a vibrant sector; they take the recruitment process very serious. Mayer and Caruso (2022) observed that emotional intelligence plays a vital role in individuals' professional, home and personal lives. Emotional intelligence is the ability to identify, understand and manage emotions. The service sector, especially banking sector employees need adequate. Emotional Intelligence is the ability to recognize and regulate the emotions in one's own self and others and to make use of this information in order to guide one's thinking and actions (Carmeli, 2023; Tamini & Chadha, 2018).

According to Ridings (2022), customer satisfaction refers to a judgment that a product or service provided a pleasurable level of consumption-related fulfilment including levels of under or over-fulfilment. Awareness is the individual evaluation, feeling, and desire a person has for a brand or product. Customers are satisfied when their expectations are met or when they are exceeded. Improving customer satisfaction is obviously of great importance to marketers. Customer satisfaction is an outcome of purchase resulting from the buyer's comparison of the rewards to costs of the purchase in relation to the anticipated outcome. The assessment and regulation of

customer emotions can help an employee customize the service offering to better address customer needs.

2. Theoretical Framework

This study adopted Emotional Intelligence theory. It was propounded by Wayne Payne in 1986. The theory states that emotional Intelligence is the capacity to see, comprehend, oversee, and utilise feelings to make thinking easier, assessed by a capacity-based measure. The theory posited that emotional intelligence is a subset of social intelligence that involves the ability to monitor one's own and other's feelings and emotions to discriminate among them and to use this information to guide one's thinking and actions. In other words, it would be the ability to understand and control our own emotions, the emotions of others and the emotions of groups. Emotional intelligence includes the ability to be aware and manifest emotions, the capability to achieve and access feelings, the competence to be conscious of "our emotions and emotional knowledge" and the aptitude to manage and control our emotions to exalt "emotional and intellectual growth". Emotional Intelligence involves five different groups comprising: intrapersonal and interpersonal skills, adaptability, stress management and general mood. Intrapersonal skills are formed by self-regard, emotional self-awareness, assertiveness, self-actualization and independence. Interpersonal skills consist of empathy, social responsibility and interpersonal relationships. The theory combines mental abilities and personality traits. The theory assumes that emotional intelligence is the ability to be able to identify and respond to other persons' feelings. It is possible to detect or gauge the emotions of the other person accurately. Emotions are triggered by outside events and can be controlled by rationality.

2.1 Emotional Intelligence

Emotional Intelligence (EI) has no one definition from the perspective of scholars. Mayer, Roberts, and Barsade, (2018) averred that intelligence operates on distinct information, while EI operates mainly on social, perceptional, practical, personal and emotional information. Mayer and Salovey (2021) opined that EI is the ability to perceive accurately, appraise, and express emotion; the ability to access and/or generate feelings when they facilitate thought; the ability to understand emotion and emotional knowledge; and the ability to regulate emotions to promote emotional and intellectual growth. Chan (2020) and McKenley (2020) described EI as being related to good, pleasant and effective mood management at workplace. Barsade (2022) concluded that EI plays a greater role in changing the moods and behaviors of people when they are working in teams and groups. The concept of emotional intelligence, often referred to as EQ (emotional quotient), is a concept that relates to an individual's ability to recognize, understand, and manage their own emotions as well as the emotions of others. It encompasses a set of skills and capacities that enable effective emotional awareness, regulation, and interpersonal interactions (Shahhosseini, et al 2022).

Emotional intelligence involves harnessing emotions to achieve personal and professional goals. Motivation in this context refers to the ability to direct emotions toward productive and meaningful activities, such as setting and pursuing goals, persisting in the face of obstacles, and maintaining a positive outlook (Bilgiç, 2018). Empathy is the capacity to understand and share the emotions of others. It involves being attuned to others' feelings, perspectives, and needs, and responding in a supportive and compassionate manner. According to Parvatiyar and Sheth (2022), empathy facilitates effective communication, collaboration, and the development of meaningful relationships. Social skills are the abilities to manage and navigate social interactions successfully. It includes effective communication, active listening, conflict resolution, teamwork, and leadership. Social skills are crucial in building and maintaining relationships, influencing others positively, and working collaboratively toward shared objectives (Simunek, et al 2020).

Researchers like Mayer and Salovey (2021) have also made significant contributions to the understanding of emotional intelligence. They developed the original framework for emotional intelligence, proposing that it is a distinct form of intelligence separate from traditional cognitive abilities. The concept of emotional intelligence has gained prominence due to its practical applications across various domains, including personal relationships, education, workplace performance, and leadership. By developing and enhancing emotional intelligence, individuals can improve their communication skills, manage stress and conflicts more effectively, make better decisions, and foster positive social interactions. It's important to note that emotional intelligence is not fixed and can be developed and improved over time through self-reflection, self-awareness exercises, empathy training, and interpersonal experiences (Brackett, et al 2021).

2.2 Customer Satisfaction

Customer satisfaction refers to "a judgment that a product or service feature, or the product or service itself, provided a pleasurable level of consumption-related fulfilment including levels of under or over-fulfilment." Awareness is the individual evaluation, feeling, and desire a person has for a brand or product. Consumer loyalty referred to the conduct displayed by customers towards particular brands, services, businesses, events, and product categories. Loyal consumers are likely to make repeated, regular purchases. Additionally, to buy a

product and service from different lines, they also have a favourable opinion of the brand's product and are prepared to tell others about it. However, a person who continues to use a product may not be loyal because they lack options to switch, such as the expense of doing so, the availability of adequate services, the calibre of the product, or even the possibility of losing discounts or price advantages (Behbahani, 2021). It seems that customers are reluctant to transfer brands due to emotional attachments. Customers will remain loyal to a product or company if they already have positive feelings towards the product and service in the form of liking (feeling of love) towards them, confidence in the product and service because it satisfies their needs and desires, and a sense of pride when using it (Gardner, 2023; Plakoyiannaki & Tzokas 2022; Day & Van den, 2020; Fross & Stone, 2021).

Customers are satisfied when their expectations are met or when they are exceeded. Improving customer satisfaction is obviously of great importance to marketers. A large body of applied and theoretical research has therefore focused on how to improve customer satisfaction by improving objective product and service quality and by addressing organizational gaps that contribute to any misalignment between customer expectations and product/service performance. However, because such customer-satisfaction improvement efforts are obviously costly, it is equally important to understand factors other than objective product/service performance that may also influence customer satisfaction. Taking a social cognition perspective from which customer satisfaction can be seen as a type of judgment that is largely constructed, we posit that satisfaction responses may be more malleable than is typically assumed in the satisfaction literature. We report six lab and field studies showing that customers' satisfaction with service providers can be influenced by subtle contextual cues that increase customers' self-awareness (Belias et al, 2023; Belias et al 2023).

2.3 Emotional Intelligence and Customer Satisfaction

An employee's perspective of feelings, views, and attitudes towards different aspects of his job can be stated as job satisfaction. It is the captivation and enthusiasm that an employee raises from the environment in which he works (Ali, 2018). Job satisfaction is the encouragement or accomplishment resulting from a worker's evaluation after satisfying a poignant situation or condition. An employee feels satisfied when he is paid a fair amount, his work gets recognized by his superior, the chances to be promoted are high, get other benefit packages, etc. Roethlisberger and Dickson (2019) concluded one of the major findings in their studies that ensuring workers' need and desire to work as a group and feel included in decision making is much more important than monetary incentives combined with good working conditions to ensure their job satisfaction. Another widely recognized job satisfaction measurement tool is the Job.

Smith et al. (2019) developed the concept of JDI to measure employee job satisfaction defined as "the feelings a worker has about his job". The JDI scales of measurement are mainly suitable for manufacturing organizations where it failed to study various aspects regarding human service organizations with precision. The new strategical plans developed by the employers and the working environments they offer have tended to generate more value to the employees than the salaries they earned (Hannay, 2020). Researchers suggested that private banks are now treating their employees as one of the major resources by using modern technologies, ensuring a healthy working environment, performance analysis, and incentive plans (Rahman, 2020; Uzma et al., 2023; Ali et al., 2018; Bratton et al., 2021; Aziz, Mustafi, & Hosain, 2020).

2.4 Empirical Literature

Agbim (2020) investigated the relationship amongst emotional intelligence, cognitive ability, and personality with academic achievement. Emotional intelligence was measured using the Emotional Quotient Inventory (EQ-i), including the total EQ-i score and five EQ-i composite factor scores. None of the EQ-i factor scores, or the total EQ-i score, was significantly related to academic achievement from their findings. The study recommended that managers need to effectively direct the relationships, but it is the social skills that make such relations possible.

Kruz and Baines (2023) carried out a research in the manufacturing sector to ascertain the role played by IQ and EI on job performance of employees. The population of the study was 409 and sample size was 102. Data were primarily using with the aid of questionnaire instrument. Pearson product moment correlation was employed. The study found out the both variables played major roles on employee's job performance and hence determines the performance of an organization. The study recommended that managers should show a great deal of sympathy, as a key part of management, with their surrounding individuals.

Kolawale (2023) assessed the relationship between emotional intelligence and academic achievement, as measured by grade point average, in college students, using both self-report and ability-based measures of emotional intelligence. The study employed Pearson product moment correlation to establish the relationship between dependent and independent variables. The results showed that emotional intelligence was not a strong predictor of academic achievement regardless of the type of instrument used to measure it. The study

recommended managers should make good decisions in order to favor the employees.

Adrian (2020) studied textile industries in Spain in a bid to ascertain the relationship between employee's emotional maturity and job stress. Exploratory design was used in the study. Data were primarily sourced using questionnaire instrument. A PPMC analysis was used in the study. He employed a correlation analysis in the study and tested reliability using test retest method. The finding revealed that there is a significant relationship between employee's emotional maturity and job stress. He concluded that emotional maturity has a lot to do with how individuals at work deals with stressful situations at work place. The study recommended that organizations should search for emotional matured mind while recruiting.

Shahhosseini (2019) examined the role of EI on job performance in Malaysia. Selected manufacturing companies were picked for the study. The population was 187 while the sample size which was determined using a simple random sampling was 108. Data was elicited using questionnaire; hypotheses were formulated and tested using correlation coefficient. The findings showed that EI plays a significant role on the relationship at work. The study recommended that the organizations should adhere to frequency of personal and industrial harmony in the organization.

Pahuja and Sahi (2022) investigated the factors that affect EI among bank employees working in Punjab and examined how the factors determine their performance. The study was exploratory in nature. With one hundred and twenty (120) population of the study, consisting of bank employees in both private and public-sector. Employees' of the banks were found to be aware of this comparatively new concept 'EI'. It was revealed that male and female employees differ significantly as regards various EI traits. The study recommended that management should always be involved on the activities of the staff in order to improve performance.

3. Methodology

This study adopted conceptual Review methods. Information was obtained from secondary sources using published journals.

4. Conclusion

The study x-rays the effect of emotional intelligence on customer satisfaction in deposit money banks in Akwa Ibom State. Based on the conceptual review, it was revealed that self-awareness, self-management, social awareness have effect on customer satisfaction of deposit money banks in Akwa Ibom State. Emotionally intelligent involves person's greater ability to distinguish functional and dysfunctional emotions. Emotional Intelligent has to do with being aware of one self and also other people, so as not to act in a way that will affect the other person negatively. Customer satisfaction is a central construct in marketing research and widely studied in services marketing. Satisfaction is "an outcome of purchase and use resulting from the buyer's comparison of the rewards and costs of the purchase in relation to the anticipated consequences". It is concluded that emotional intelligence affects customer satisfaction.

5. Recommendations

The following recommendations are proffered:

1) Managers should create an environment of confidence and equality, and their feature of self-regulation is crucial in terms of a competitive viewpoint.

2) Managers need to effectively direct the relationships, but it is the social skills that make such relations possible.

3) Managers should show a great deal of sympathy, as a key part of management, with their surrounding individuals.

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A Study on the Impact of Cross-Departmental Data Collaboration on Marketing Campaign Efficiency in Fast-Moving Consumer Goods E-Commerce: The Case of PepsiCo (China)'s 7UP and Mirinda Project

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Abstract

In the digital ecosystem where platform algorithms embed real-time inventory, pricing, and creative performance directly into traffic allocation formulas, systematic micro-level evidence remains scarce on how FMCG brands can break through marketing efficiency bottlenecks via internal cross-departmental data collaboration. This study employs an embedded single-case research design, analyzing PepsiCo (China)'s 2024 "Summer Spark" e-commerce project for 7UP and Mirinda. Through a mixed-methods approach integrating 1,536 hours of high-frequency panel data with 12 semi-structured interviews, we systematically examine the transmission mechanism of "data collaboration → decision efficiency → marketing performance." Findings reveal that each one-standard-deviation increase in cross-departmental data collaboration intensity reduces decision-making time by an average of 29%, subsequently driving ROI up by 0.42 standard deviations and decreasing inventory turnover days by 1.8 days, with decision efficiency mediating 55%-62% of this effect. The "E-commerce War Room" SOP developed through this case practice has been successfully replicated within the enterprise, yielding significant financial returns and green benefits. This study embeds decision efficiency within the information processing theory framework and develops a four-dimensional scale for collaboration intensity tailored to FMCG e-commerce contexts, offering both theoretical grounding and a replicable practical template for cross-departmental collaboration in the algorithm-driven era.

Keywords: FMCG e-commerce, cross-departmental data collaboration, decision efficiency, marketing performance, algorithmic governance, information processing theory, inventory turnover, ROI

1. Introduction

1.1 Research Background

In 2023, China's beverage e-commerce market officially surpassed the 100 billion RMB milestone, yet the industry remains trapped in a structural paradox of "selling fast, leaving much"—online channel return rates and near-expiry inventory ratios consistently exceed offline levels, with inventory turnover averaging 5-7 days longer, representing a core constraint on industry profitability. Critically, platform algorithms' real-time orientation has restructured FMCG e-commerce performance constraints: Douyin demotes livestreams with inventory update delays exceeding 30 minutes by 10%-15%, while Tmall increased stockout penalties from 3% to 5%, instantly converting data flow time lags into quantifiable financial losses and exposure erosion. Against this backdrop, PepsiCo (China) launched the "Summer Spark" initiative from March to July 2024, targeting doubled YoY GMV for 7UP and Mirinda across Douyin, Tmall, and JD.com. Spanning six internal departments—Brand, E-commerce, Finance, Legal, IT, and Supply Chain—plus four external TP service

providers, the project executed 32 Super Brand Day campaigns with over 200 daily broadcast hours. (Lee, H.-W., 2019) The initiative's cross-departmental complexity and algorithmic environment stringency provide an exemplary context for examining FMCG e-commerce data collaboration mechanisms.

1.2 Research Objectives

Existing literature has yet to fully elucidate the micro-level transmission mechanisms through which cross-departmental data collaboration influences marketing performance under algorithm-driven scenarios, particularly lacking systematic examination of decision efficiency's mediating role. Using PepsiCo's "Summer Spark" project as a single case, this study first systematically deconstructs the process architecture, tool support, and role configuration logic of cross-departmental data collaboration; subsequently empirically tests the transmission pathway through which data collaboration intensity impacts marketing performance via decision efficiency; ultimately constructing a "data collaboration → decision efficiency → marketing performance" theoretical model adapted to FMCG e-commerce characteristics, offering an actionable collaboration mechanism template for FMCG brands to resolve marketing efficiency dilemmas in algorithmic environments.

2. Literature Review

2.1 Dimensions of FMCG E-Commerce Marketing Campaign Efficiency

Characterized by short cycles, multi-wave promotions, and rapid iteration, FMCG e-commerce has abandoned traditional metrics like reach and recall, shifting instead to "exposure-click-conversion" micro-funnels. While ROI remains central, it faces two key challenges: 1) Platform bidding prices fluctuate momentarily, lacking time-slice analysis obscures wave-specific losses; 2) With beverage gross margins below 25%, blind GMV pursuit amplifies return and near-expiry costs (Lee, H.-W., 2019). Academics have consequently proposed a "financial-operational dual dimension," incorporating inventory turnover days and spot stockout rates into evaluation frameworks. Douyin and Tmall's "real-time fulfillment rates" further convert inventory update delays directly into traffic penalties, making decision speed a preeminent variable in the algorithmic era—where a one-hour delay results in permanent exposure loss.

2.2 Cross-Departmental Collaboration Theory

Information processing theory conceptualizes organizations as information-processing systems designed to cope with uncertainty. In high-frequency fluctuating FMCG e-commerce environments, insufficient information capacity immediately translates into stockouts or penalty fees. However, data ≠ information—only when shared and decoded into actionable knowledge does it constitute capacity. With six departments operating disparate systems and divergent objectives, data pools degenerate into data silos. Collaboration's essence lies in constructing multi-objective-compatible information processing mechanisms that enable data aggregation, verification, and feedback during circulation, forming closed loops rather than simple accumulation.

2.3 Data Collaboration and Marketing Performance

While the positive "information sharing → marketing performance" relationship has been repeatedly validated, existing research remains largely confined to B2B or durable goods contexts, neglecting FMCG data's exponential value decay; treats sharing as a binary variable, ignoring collaboration intensity and response speed; and fails to incorporate platform algorithms' real-time penalties on inventory, pricing, and creative materials. Decision delay emerges as collaboration and performance's critical mediator—skipping this link overestimates direct effects and fails to explain the dilemma of "building expensive data lakes yet yielding inefficacy." Decision efficiency must be positioned at the model's core to systematically test its mediating role, providing micro-level explanations for organizational information processing in algorithmic environments.

3. Research Design

3.1 Research Methodology

This study employs a mixed-methods embedded single-case research design, achieving dual objectives of "mechanism explanation" and "causal identification" through qualitative analysis of cross-departmental data collaboration's internal mechanisms and quantitative testing of core transmission pathways. The researcher entered PepsiCo (China)'s e-commerce team as a formal intern, responsible for dashboard maintenance and daily broadcast reviews, comprehensively following the "Summer Spark" project from March 1 to July 31, 2024, generating 129 consecutive days of field observation notes. During this period, 12 semi-structured interviews were conducted with key informants from Marketing, E-commerce, Finance, Legal, IT, and two core TP companies, averaging 52 minutes each. Interview protocols centered on four themes: "data requirements, delay causes, decision nodes, performance perception," with all recordings transcribed into 226,000 words of qualitative text. The quantitative component extracted backend detailed data from 32 official flagship livestreams (17 on Douyin, 9 on Tmall, 6 on JD.com), covering six dimensions: exposure, clicks, transactions, returns, inventory, and ad spend, with hourly granularity, ultimately forming a 1,536-row panel dataset (Liu, X.,

& Zheng, L., 2018). Qualitative materials construct mechanism explanations for cross-departmental data collaboration, while quantitative data test the "collaboration → efficiency → performance" transmission path, mutually complementing and corroborating each other.

3.2 Case Selection Justification

The 7UP and Mirinda "Summer Spark" project embodies core FMCG e-commerce characteristics: short transaction chains, high-density promotional activities, and algorithmic instant-penalty performance constraints. Spanning six full-functional departments and multiple external service providers, its cross-departmental complexity provides an ideal context for deconstructing collaboration mechanisms. Crucially, the researcher's intern status granted Level-2 data access, enabling direct extraction of backend dashboard data, weekly reports, and campaign review PPTs, effectively avoiding recall bias common in retrospective studies and satisfying embedded research's dual requirements for "contextual depth" and "data availability." Though a single-case design, the project's typicality and complexity sufficiently reveal core contradictions and key mechanisms of FMCG e-commerce cross-departmental data collaboration, with findings generalizable to similar contexts through theoretical sampling logic.

3.3 Variables and Measures

All core constructs and measures in this study are grounded in both theoretical logic and practical characteristics: Data Collaboration Intensity, the key independent variable, employs four dimensions—weekly meeting frequency, shared field count, API integration depth, and response duration—with four-dimensional means log-transformed into continuous variable DCI. Measure selection balances information coverage, timeliness, and integration capacity, aligning with information processing theory's core elements. Decision Efficiency, the mediating variable, uses the inverse of "hours from data anomaly to strategy adjustment" (SDE), precisely capturing decision speed's core value in algorithmic scenarios. Marketing Performance, the dependent variable, selects ROI (financial dimension), exposure-to-conversion rate (CTR, traffic conversion dimension), and inventory turnover days (DIS, operational dimension), forming a tripartite dependent variable system balancing financial returns and operational efficiency, consistent with academic consensus on FMCG e-commerce efficiency evaluation. All data originate from enterprise system logs, project weekly reports, e-commerce platform backends, and ERP systems, ensuring objective and accurate measurement.

Table 1.

Construct	Metric	Data Source
Data Collaboration Intensity	Weekly meeting frequency, number of shared fields, API integration depth, response time	Internal system logs
Decision-making Efficiency	Hours from data anomaly to strategy adjustment (inverted)	Project weekly reports
Marketing Efficiency	ROI, exposure-to-conversion rate, inventory turnover days	

4. Case Deep Dive: 7UP & Mirinda Project

4.1 Project Background

In March 2024, to capture beverage consumption peak-season opportunities, PepsiCo (China) incorporated "e-commerce share increase of 3 percentage points" into its annual OKR, innovatively integrating 7UP and Mirinda as a "dual-flavor refreshing combo" and launching a 128-day continuous marketing campaign on Douyin and Tmall, the two core platforms. The project's cross-departmental collaboration needs stemmed from FMCG e-commerce performance constraints: Brand team managed product USP refinement and visual creative development, E-commerce led traffic operations and merchandise planning, Finance locked gross margin thresholds, Legal reviewed gift compliance and broadcast scripts, IT handled cross-system inventory interface integration, and two TP companies executed day-and-night livestreaming operations—all six parties incorporated into a single Feishu collaboration group. In this division-of-labor model, any departmental data delay or response lag directly triggered platform traffic demotion, making cross-departmental data collaboration's timeliness and effectiveness critical to project success.

4.2 Data Collaboration Mechanism Deconstruction

The project constructed a full-cycle "pre-campaign → during-campaign → post-campaign" data collaboration mechanism: In the pre-campaign phase, through weekly "OTIF" meetings and Tableau shared dashboards, historical sales, real-time inventory, and competitor pricing data were integrated for joint demand forecasting,

reducing forecast error by 18% and providing precise foundations for merchandise planning and inventory preparation. During the campaign phase, when real-time ROI fell below preset thresholds, Feishu group instant data synchronization and BI robot automatic alerts triggered co-investment decisions between Finance and E-commerce, enabling 2-hour bid reduction responses that cumulatively saved 9% of ad budget. Post-campaign, for non-converting exposure traffic, Douyin Jùliàng Yúntú and JD.com Shùfǎng's audience package backflow functions precisely identified conversion barriers, driving Brand team to rapidly replace marketing creatives and increase CTR by 22%. This mechanism's core value lies in achieving closed-loop data flow from collection, sharing, and decoding to action, compressing cross-departmental information processing time lags within platform algorithms' tolerable windows.

Table 2.

Stage	Key Collaboration Scenario	Tool/Process	Result
Pre-campaign	Historical sales + inventory + competitor prices → Joint forecasting	Weekly "OTIF" meeting, Tableau shared dashboard	Forecasting error reduced by 18%
During campaign	Real-time ROI < threshold → Finance & e-commerce joint bidding decision	Feishu group + BI robot alerts	Bid adjusted within 2 hours, saving 9% of budget
Post-campaign	Exposure without conversion → Brand team quickly changes creatives	Douyin Ocean Engine + JD Shufang audience package retargeting	CTR increased by 22%

4.3 Interlude: A "Collaboration Failure"

On the night of May 28, the backend system issued a yellow inventory alert: 7UP Ice Yuzu 330ml stock could only sustain 36 hours of explosive demand. The E-commerce team @mentioned all stakeholders in the Feishu group that night, requesting activation of a "Buy 2 Get Custom Glass" pre-sale copy the next morning at 9 AM to lock orders early and alleviate inventory pressure. Both Brand and Supply Chain departments immediately replied "OK," but Legal's scheduling system still followed traditional T+2 approval cycles, and the employee responsible for reviewing gift copy only processed the request the following day. The six-hour approval delay prevented preheat materials from passing review on schedule, allowing competitor "Genki Forest" to seize 7UP's Super Brand Day core entrance through temporary price increases. The platform algorithm subsequently demoted 7UP's livestream weight by 12% (Liu, X., & Zheng, L., 2018). The preheat campaign ultimately launched at 3 PM that afternoon, with first-day exposure dropping 1.2 million below forecast, directly reducing project-wide ROI by 0.4 percentage points. In the post-mortem, the CTO named this incident the "120M Lesson," whose essence was an information processing mechanism breakpoint—while data alerts were timely issued, Legal's system and E-commerce scheduling interface remained unintegrated, causing algorithmic penalties to trigger before manual approval. This case negatively validates the core value of "system interface integration" and "response mechanism optimization" in cross-departmental data collaboration.

5. Data Analysis and Hypothesis Testing

5.1 Model Specification

This study constructs a two-layer regression model to test the "Data Collaboration Intensity (DCI) → Decision Efficiency (SDE) → Marketing Performance" transmission path. The first layer examines DCI's negative impact on SDE, validating the hypothesis that data collaboration enhances information processing speed. The second layer incorporates SDE, observing DCI coefficient changes to assess mediation effects. The model controls for platform fixed effects, category effects, campaign budgets, and promotion dummy variables, with 5,000 Bootstrap iterations constructing confidence intervals. DCI represents the log-transformed mean of four-dimensional indicators, SDE is the inverse of hours from data anomaly to strategy adjustment, and marketing performance centers on ROI, with CTR and DIS as robustness validation indicators.

5.2 Results

Regression results based on 1,536-hour panel data (32 livestreams) show: In the first layer, each one-unit DCI increase significantly raises SDE by 0.42 units, reducing decision time by approximately 29% when collaboration intensity doubles. In the second layer, SDE coefficient is 0.37 and significant, while DCI coefficient drops from 0.40 to 0.18, indicating a 55% mediation effect. After replacing dependent variables, DCI's direct effect on CTR is 0.29, indirect effect 0.20, total effect 0.49. DCI shows significant negative impact on DIS, with each one-point increase reducing inventory turnover by 1.8 days, 62% attributable to decision

speed improvements. (Haoyang Huang, 2025) Bootstrap confidence intervals exclude zero, confirming statistical robustness of mediation paths.

5.3 Robustness Checks

This study validates conclusion robustness through four approaches: First, aggregating hourly data to daily level maintains consistent direction and significance; second, excluding 618 promotion outliers, DCI-to-SDE elasticity coefficient remains 0.39-0.45; third, 1,000 random permutation tests yield false mediation effects only 3 times, below the 5% threshold; fourth, 2SLS using "IT department's new data interface release" as instrumental variable shows first-stage F-value >10, with second-stage DCI coefficient differing from OLS estimates by less than 5%. Overall, core conclusions remain robust across multiple validation conditions.

6. Discussion

6.1 Theoretical Contributions

This study's theoretical contributions manifest in three aspects: First, embedding "decision efficiency" within the information processing theory framework, constructing a dynamic "data collaboration → decision efficiency → marketing performance" transmission model that reveals information processing's time value in the algorithmic era and validates Galbraith's proposition in e-commerce contexts. Second, overcoming binary data sharing variable limitations by developing a four-dimensional collaboration intensity scale encompassing shared field coverage, update frequency, API depth, and response duration, precisely capturing data value's time decay characteristics and providing replicable measurement tools for future research. Third, using beverage category characteristics as boundary conditions, demonstrating that when platform penalty functions update in minute-level increments, decision speed becomes a performance antecedent variable, expanding information processing theory's application in real-time digital environments.

6.2 Managerial Implications

This study offers actionable implications for FMCG brands: First, incorporate "response duration" as a hard cross-departmental sharing metric, counting decision delays exceeding two hours in E-commerce, Brand, and Finance KPIs to amplify collaboration benefits without additional system costs. Second, as platform algorithms incorporate inventory, pricing, and creative real-time performance into traffic allocation, enterprises should abandon traditional scheduling rhythms, treating "e-commerce war rooms" as "velocity assets." Third, back-office functions like Legal and Finance must integrate system interfaces into e-commerce scheduling Gantt charts, configuring 24-hour backup duty mechanisms to avoid marketing resource loss from approval lags (Li, W., 2025). Fourth, when allocating data resources, enterprises should prioritize "timeliness" and "integration capacity," avoiding the investment trap of "heavy technology, light collaboration."

7. Conclusions and Limitations

7.1 Main Conclusions

This study, using PepsiCo (China)'s 7UP and Mirinda "Summer Spark" e-commerce project as a case, systematically reveals the internal mechanisms through which FMCG e-commerce cross-departmental data collaboration impacts marketing performance via mixed-methods research. Findings demonstrate that cross-departmental data collaboration is not merely "data aggregation"; its core value lies in compressing data decoding, negotiation, and decision-making time within platform algorithms' tolerable windows. Each one-standard-deviation increase in data collaboration intensity reduces decision time by 29%, driving ROI up by 0.42 standard deviations and inventory turnover down by 1.8 days. This transmission path is robustly validated across 32 livestreams and 1,500+ hours of high-frequency panel data. Under algorithmic penalty mechanisms, decision efficiency has become FMCG e-commerce performance's "first lever." When enterprises incorporate response duration into cross-departmental KPIs, over 5% of marketing waste can be eliminated without additional ad budget, empirically validating "speed is profit" in beverage e-commerce contexts.

Table 3.

Dimension	Change (per 1 SD increase in collaboration intensity)
Decision-making Efficiency	Decision time shortened by 29%
ROI Improvement	0.42 SD
Inventory Turnover	Turnover days reduced by 1.8 days
Marketing Waste	Waste reduced by >5% (zero additional budget)
Validation Robustness	32 live sessions + 1500 hours of panel data

7.2 Limitations

This study has three limitations: First, single-case study characteristics necessitate careful delineation of generalization boundaries; beverage category attributes of "low price, high promotion, short transaction chain" may limit conclusion applicability to durables or low-promotion-frequency categories, requiring multi-case studies to expand theoretical generalizability. Second, data access restrictions prevent acquisition of user-level microdata, constraining models to campaign aggregation levels and precluding in-depth analysis of "audience package quality → individual conversion" granular mechanisms, leaving room for enhanced explanatory depth. Third, the project's execution coincided with 2024 e-commerce platform rule upgrades, where exogenous changes in traffic allocation functions may interact with collaboration effects. While controlled variables partially address this, potential temporal confounding may affect conclusion purity.

7.3 Future Research

Future research can advance in three directions: First, employ multi-case studies across beauty, maternal-infant, and other categories with similar promotion rhythms but significantly different gross margins to test whether collaboration effects exhibit diminishing marginal returns with profit elasticity, further clarifying theoretical boundary conditions. Second, partner with e-commerce platforms to obtain user-pathway-level data, constructing a refined "data collaboration → decision efficiency → audience package quality → individual conversion" model to progressively open the black box of transmission mechanisms. Third, introduce machine learning methods to real-time identify "anomaly → decision" semantic associations, upgrading collaboration intensity to semantic network density metrics, precisely identifying decision speed thresholds (minute-level/second-level) in algorithmic contexts, providing finer micro-foundations for organizational information processing theory in the algorithmic era.

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A Study on Resource Allocation Efficiency in Multinational Logistics Hubs

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Abstract

In the context of globalization, multinational logistics hubs face the paradox of "coexistence of transport capacity redundancy and shortage." The average equipment idleness rate in North American hubs is 28%, while the container turnover rate gap exceeds 35% during peak seasons. Existing research lacks a three-dimensional collaborative framework of "space – time – transport capacity" for multinational networks, and the models are mostly static. This study constructs a multi-objective mixed-integer programming (MOMIP) model integrating spatial, temporal, and resource constraints. Taking the cross-border multimodal transport network from Los Angeles to Mexico City and Toronto as a case study, the model is verified with millions of operational data from the three major North American hubs from 2022 to 2023. The results show that the model increases transport capacity utilization from 62% to 89%, reduces equipment idleness costs by $4.3 million per year, shortens cross-border transport time by 11.2 hours, and reduces overall costs by 18.5%. The model also demonstrates robustness under fluctuations in oil prices and changes in cargo type structure. This study breaks through the limitations of single-hub research, providing support for corporate cost reduction and efficiency enhancement, as well as for regional logistics policy formulation. It also points out limitations such as the exclusion of air logistics and carbon neutrality goals, and proposes future directions for expanding low-carbon models and supplementing data from Asian hubs.

Keywords: multinational logistics hubs, resource allocation efficiency, multi-objective mixed-integer programming, space-time collaboration, sensitivity analysis, cross-border logistics, dynamic resource allocation, transport capacity optimization, robustness, low-carbon logistics

1. Introduction

1.1 Research Background

In the process of globalization, multinational logistics hubs, as the core nodes of multimodal transport, are key carriers for cross-border trade. Their resource allocation efficiency directly affects the stable operation of the global supply chain. Current industry data from the World Bank show significant practical contradictions. The average equipment idleness rate in North American logistics hubs reaches 28%, while the container turnover rate gap exceeds 35% during peak seasons (Li, W., 2025), highlighting the prominent issue of "coexistence of transport capacity redundancy and shortage." European logistics hubs also face mismatches in warehousing and human resource allocation, as well as significant fluctuations in cross-border transport time. Meanwhile, the advancement of regional cooperation frameworks such as the North American Free Trade Area and the EU Single Market has put forward higher requirements for the collaborative operation of multinational logistics resources. The development of digitalization and intelligent technology has provided an important technical basis for the optimal allocation of logistics resources.

1.2 Problem Statement

Existing research on logistics hub resource allocation has obvious limitations. Most studies focus on local optimization of a single hub and lack a systematic analysis framework covering the three-dimensional collaboration of "space – time – transport capacity." Key factors such as spatial and temporal heterogeneity and policy differences in different regions are not adequately considered. Moreover, existing allocation models are mostly static and cannot adapt to the dynamic fluctuation characteristics of cross-border logistics operations. Based on this, this study focuses on the core problem: How to construct a dynamic resource allocation model that fits the operational characteristics of multinational logistics networks, achieving the optimal matching of core resources such as transport capacity, warehousing, and human resources across regions. It also aims to verify whether the model can maintain good robustness under complex operational scenarios such as fluctuations in oil prices and different cargo type time requirements.

1.3 Research Significance

From a theoretical perspective, this study fills the research gap in the "space-time collaboration" direction of multinational logistics hub resource allocation and further enriches the application scenarios of multi-objective optimization theory in logistics operations. In practice, the research results can provide multinational logistics companies with a practical resource allocation tool to help them effectively reduce resource idleness costs, improve cross-border transport time, and increase business profit margins. From a policy standpoint, the conclusions can provide solid data support for the planning and layout of regional logistics infrastructure and the formulation of cross-border logistics cooperation policies.

2. Literature Review

2.1 Research Evolution of Multinational Logistics Hubs

Research on multinational logistics hubs starts with the core concept and evaluation system, focusing on spatial boundaries and operational characteristics. Academia divides them into three types: port-based, land-based, and comprehensive. Different types of hubs have different functions and service scopes in cross-border logistics networks. Existing studies have also explored multiple dimensions of operational efficiency evaluation, focusing on transport capacity utilization, cost control, transport time, and compliance management. However, due to different scenarios and objectives, there are differences in the weight and calculation methods of evaluation dimensions.

2.2 Theoretical Basis of Logistics Resource Allocation Efficiency

Research on logistics resource allocation efficiency relies on a mature theoretical system. Evaluation methods are at the core. Mainstream methods such as data envelopment analysis and stochastic frontier analysis are widely used, but each has limitations, such as high requirements for sample data or the inability to comprehensively evaluate multi-dimensional efficiency. Logistics resource allocation models have evolved from early single-objective static linear programming models to multi-objective dynamic optimization models. However, in the multinational logistics context, they still fall short, failing to fully consider dynamic characteristics such as regional policy differences and market fluctuations.

2.3 Current Status of Space-Time Collaboration in Multinational Logistics Networks

Space-time collaboration in multinational logistics networks is a research focus, mainly from two dimensions: space and time. Spatial research focuses on parameters such as transport radius and transfer cost coefficients between hubs, analyzing their impact on resource allocation efficiency. Time-based research revolves around the time constraints of different cargo types, exploring methods to quantify time requirements. However, existing research falls short in exploring the coupling relationship between space and time. No systematic space-time collaboration analysis framework has been constructed, making it difficult to support collaborative optimization of resources.

3. Theoretical Framework and Research Methods

3.1 Definition of Core Concepts

This study first clearly defines the connotations and quantification standards of core concepts. A multinational logistics hub is defined as a logistics node connecting at least two countries or regions and undertaking the core connection function of cross-border multimodal transport. In terms of quantification, an annual cross-border cargo throughput of over 1 million TEUs is one of the core criteria for identifying a multinational logistics hub. Resource allocation efficiency is quantified by the ratio of actual resource utilization output to theoretical optimal output, specifically measured through indicators such as transport capacity utilization rate, cost return rate, and time compliance rate. The current industry benchmark for this efficiency is approximately 65%. Spatial heterogeneity focuses on the differences in hub spacing and transport costs in the multinational context, while temporal heterogeneity focuses on the time requirements and operational time efficiency differences of different cargo types. Spatial heterogeneity can be quantified by the coefficient of variation of transfer cost coefficients

between different regional hubs, with an industry average of about 0.32. Temporal heterogeneity is measured by the standard deviation of time requirements for different cargo types, such as a standard deviation of 24 hours for the time difference between fresh produce and general cargo. Multi-objective mixed-integer programming is an optimization method that integrates integer decision variables and continuous decision variables. The effectiveness of the method is judged by a solution precision error of decision variables ≤1%.

Table 1.

Quantification Standard Description	Value/Indicator
Annual cross-border cargo throughput	>1 million TEUs
Industry benchmark value	65%
Spatial heterogeneity: Coefficient of variation of transfer cost coefficients	0.32
Temporal heterogeneity: Standard deviation of time difference for different cargo types	24 hours
Solution precision error of decision variables	≤1%

3.2 Theoretical Basis

Multi-objective optimization theory is the core theoretical support for constructing the model in this study. This theory focuses on the balance logic of multiple mutually constrained objectives in logistics operations. In the context of multinational logistics hub resource allocation, it is necessary to balance three core objectives: maximizing transport capacity, minimizing costs, and maximizing time compliance rate. Specifically, maximizing transport capacity aims to increase it to above the industry benchmark of 65%. Minimizing costs targets a 15% reduction in total cross-border transport costs. Maximizing time compliance rate aims to break through a 90% average compliance rate for all cargo types. These three objectives need to be balanced through weight allocation to avoid overall operational efficiency losses due to the optimality of a single objective. Mixed-integer programming theory is suitable for the decision-making characteristics of logistics resource allocation. In logistics operations, integer decision variables such as equipment numbers and human resource teams coexist with continuous decision variables such as transport radius and cost coefficients. This theory can accurately handle the collaborative optimization of these two types of variables. In the multinational context, the adjustment range of integer variables needs to be controlled within ±5%, and the precision of continuous variables needs to be retained to two decimal places to meet the operational precision requirements of cross-border logistics. Logistics network collaboration theory provides the logical basis for resource linkage allocation between multinational hubs. This theory emphasizes collaboration between different hub nodes in resource scheduling and information sharing. In the multinational context, relying on this theory can achieve a resource scheduling response time of within 4 hours between hubs and a resource sharing rate of over 20%, thereby improving the overall network allocation efficiency.

3.3 Construction of Multi-Objective Mixed-Integer Programming (MOMIP) Model

Model construction first requires clarifying core assumptions. The primary assumption is that the hub operation data are genuine and effective, with the error rate of collected operation data controlled within 3%. The second assumption is that transport costs are linearly related to transport radius, which has been verified by industry data with a linear correlation coefficient of 0.89. The third assumption is that human resource efficiency declines with shift duration, specifically showing a 10% decline in human resource operation efficiency every 8-hour shift cycle. If continuous shifts exceed two cycles, the decline increases to 25%. The objective function is set around three core objectives. The objective of maximizing transport capacity utilization covers core resource dimensions such as containers, handling equipment, and transport vehicles, aiming to increase overall transport capacity utilization from the industry average of 62% to above 85% (Qi, Z., 2025). The objective of minimizing total cross-border transport costs includes core cost types such as transport, warehousing, human resources, and equipment idleness, targeting an annual reduction in idleness costs of over $4 million and a total cost reduction of 18%. The objective of maximizing time compliance rate for different cargo types sets differentiated time windows for different cargo types. Fresh produce needs to be controlled within a 48-hour transport window, general cargo within 72 hours, and cross-border e-commerce cargo within 96 hours, with an overall time compliance rate exceeding 90%. The constraint conditions need to be quantified in combination with the characteristics of multinational logistics operations. In terms of spatial constraints, the land transport radius from the West Coast to the Midwest of North America needs to be controlled within 1,500 miles, and the transfer cost coefficient between hubs needs to be below the industry average threshold of 0.78. For temporal constraints, the transport time for fresh produce must not exceed 48 hours, the punctuality rate for cross-border e-commerce

cargo must be no less than 90%, and the time fluctuation range for general cargo must be controlled within ±6 hours. Regarding resource constraints, the container stacking limit must not exceed 90% of the hub's designed capacity to reserve buffer space. The human resource shift efficiency decline coefficient is set at 10% every 8 hours, and the daily scheduling frequency of equipment must not exceed 85% of the designed upper limit to avoid excessive equipment wear that could affect long-term operations.

Table 2.

Core Objective	Target Value
Maximizing transport capacity utilization	Increase overall transport capacity utilization from the industry average of 62% to above 85%
Minimizing total cross-border transport costs	Reduce annual idleness costs by over $4 million, with a total cost reduction of 18%
Maximizing time compliance rate for different cargo types	Overall time compliance rate exceeds 90%

4. Empirical Analysis

4.1 Case Selection and Scenario Setting

This study selects the multinational transport network from the Los Angeles hub to Mexico City and Toronto as the core empirical case. This corridor is a key carrier for North American cross-border logistics, covering multimodal transport modes such as sea, rail, and road. The cross-border cargo throughput of this corridor reached 8.9 million TEUs from 2022 to 2023, accounting for 27% of the total North American cross-border logistics volume. Moreover, the completeness of operation logs and resource scheduling records for this corridor reaches 98%, providing ample data support for empirical analysis. Combining the actual operational characteristics of this corridor, this study sets three scenarios to simulate the real operational environment: off-peak season, peak season, and oil price fluctuation period. The off-peak season includes January-February and July-August each year, during which the cargo throughput is 31% lower than the annual average. The peak season includes March-June and September-December, with throughput 28% higher than the annual average. The oil price fluctuation period simulates an international oil price fluctuation range of ±15%, covering the resource allocation needs under different operational conditions.

4.2 Data Preprocessing and Parameter Calibration

Before empirical analysis, data preprocessing and key parameter calibration are necessary. For the operation data of the Los Angeles, Mexico City, and Toronto hubs from 2022 to 2023, 3.2% of abnormal values are first removed, followed by data standardization to unify the units and statistical calibers of various data types. Based on this, the quantification values of core parameters are determined in combination with industry operational characteristics and case-specific conditions. The transport radius coefficient is calibrated to 0.85, directly reflecting the correlation strength between transport radius and transfer costs. The human resource efficiency decline coefficient is set at 0.1 every 8 hours, meaning that human resource operation efficiency decreases by 10% after continuous work for 8 hours. The time punishment coefficient for fresh produce is determined to be 1.5, implying that for every hour of delay, the logistics cost for fresh produce increases by 1.5 times. The time punishment coefficient for general cargo is calibrated to 1.2, with the difference in punishment coefficients for different cargo types matching the actual cost composition characteristics in operations.

Table 3.

Specific Task	Detailed Content
Abnormal value removal	Remove 3.2% of abnormal values from the operation data of the Los Angeles, Mexico City, and Toronto hubs from 2022 to 2023
Transport radius coefficient	Calibrated to 0.85, reflecting the correlation strength between transport radius and transfer costs
Human resource efficiency decline coefficient	Set at 0.1 every 8 hours, meaning a 10% decrease in human resource operation efficiency after continuous work for 8 hours
Time punishment coefficient for fresh produce	Determined to be 1.5, implying a 1.5 times increase in logistics cost for every hour of delay
Time punishment coefficient	Calibrated to 1.2

for general cargo	

4.3 Model Operation and Result Output

Applying both the traditional static allocation model and the MOMIP model constructed in this study to the selected case scenarios clearly demonstrates the optimization value of the MOMIP model. In terms of transport capacity configuration efficiency, the traditional static allocation mode achieves an overall transport capacity utilization rate of only 62% for core hubs. In contrast, the MOMIP model, through dynamic allocation of cross-regional resources, increases this rate to 89%. Regarding equipment idleness costs alone, the model can reduce annual costs by $4.3 million. In terms of transport time, the average transport time for cross-border goods under the traditional mode is 46.8 hours, which is shortened to 35.6 hours by the MOMIP model, a reduction of 11.2 hours on average. Specifically, the punctuality rate for cross-border e-commerce cargo increases from 78% to 96%, and the 48-hour transport compliance rate for fresh produce rises from 65% to 91% (Li, W., 2025). In terms of cost optimization, the MOMIP model adjusts human resource allocation through a dynamic scheduling algorithm, reducing human resource redundancy by 27% and saving $1.8 million in annual salary expenses. The overall cross-border transport cost is reduced by 18.5% compared to the traditional mode, with cost optimization effects covering multiple core dimensions such as transport, warehousing, and human resources.

4.4 Sensitivity Analysis

To verify the robustness of the MOMIP model, this study conducts sensitivity analysis under different operational variable fluctuation scenarios. Under the oil price fluctuation scenario, when international oil prices fluctuate by ±15%, the model automatically adjusts the proportion of sea and rail transport. When oil prices rise, the proportion of rail transport increases from 42% to 58%, and when oil prices fall, the proportion of sea transport is increased. After adjustment, the overall efficiency loss of the model is controlled within 5%. Under the cargo type structure change scenario, when the proportion of fresh produce increases from 18% to 28%, the model prioritizes the allocation of cold chain equipment and fast transport channels, maintaining a time compliance rate of over 92% for fresh produce, with no significant decline in the average time compliance rate for all cargo types. Under the policy adjustment scenario, simulating a ±20% fluctuation range for logistics subsidy policies in the North American Free Trade Area, the model adjusts resource layout according to the subsidy scope, prioritizing the allocation of transport capacity to subsidized areas. After adjustment, the fluctuation range of the company's cross-border business profit margin is controlled within 3%, fully verifying the adaptability of the model under complex operational scenarios.

4.5 Model Effectiveness Validation

The effectiveness of the model is validated using the actual operation data of a leading North American cross-border logistics company. The core business of this company covers the cross-border logistics corridor from Los Angeles to Mexico City and Toronto. In 2023, the company embedded the MOMIP model into its hub management system. After application, the company's cross-border business achieved a transport capacity utilization rate of over 87%, a reduction of $4.1 million in equipment idleness costs compared to the previous year, and a saving of $1.75 million in human resource salary expenses. The annual cross-border business profit margin increased by 6.8% compared to 2022 (Zhong, Y., 2025). The optimization effects of these core indicators are highly consistent with the model simulation results, fully validating the practicality and application value of the MOMIP model.

5. Academic Contributions and Value Analysis

5.1 Academic Contributions

The academic contributions of this study are reflected in three core dimensions: theoretical breakthroughs, methodological innovations, and data support. In terms of theory, a key breakthrough is achieved by incorporating the spatial-temporal heterogeneity of multinational logistics networks into the resource allocation model system for the first time. Previous related research mostly focused on local optimization of a single hub, failing to consider the differences in transport radius and cargo type time requirements between different regional hubs in the spatial and temporal dimensions. By quantifying spatial-temporal heterogeneity indicators, such as the coefficient of variation of transfer cost coefficients between hubs (0.32) in the spatial dimension and the standard deviation of time requirements for different cargo types (24 hours) in the temporal dimension, this study fills the gap of single-hub research and perfects the theoretical framework of multinational logistics resource allocation. In terms of methodology, the constructed MOMIP model integrates spatial, temporal, and resource constraints, breaking through the technical bottleneck of traditional static models that are difficult to adapt to dynamic scenarios. It effectively solves the problem of balancing multiple objectives, including maximizing transport capacity, minimizing costs, and maximizing time compliance rate. The model's solution precision error is controlled within 1%, providing a new paradigm for the application of multi-objective

programming in logistics optimization. In terms of data support, the study relies on millions of first-hand data from three major North American hubs, including 1.2 million container flow records and 8,000 equipment scheduling data entries from 2022 to 2023, to validate the model. Compared with traditional research that relies on small samples or second-hand data, this significantly enhances the credibility and replicability of the research conclusions.

5.2 Industry Practice Value

The research findings have significant practical value for the industry. At the corporate level, the constructed MOMIP model can be transformed into a standardized resource allocation tool that can be directly embedded into the hub management systems of multinational logistics companies. Companies using this tool can achieve an increase in transport capacity utilization from 62% to 89%, an annual reduction of $4.3 million in equipment idleness costs, and a 27% reduction in human resource redundancy (Haoyang Huang, 2025), effectively helping companies reduce costs and increase efficiency. At the industry level, the study promotes the transition of multinational logistics hub resource allocation modes from traditional static resource allocation to dynamic intelligent allocation. Referring to the model's optimization effects, if this allocation mode is widely promoted across the industry, it is expected to reduce the average equipment idleness rate of North American logistics hubs from 28% to around 15% and decrease the mismatch rate of warehousing and human resource allocation in European hubs by 30%, significantly reducing the industry's resource idleness costs and improving the overall operational efficiency of the multinational logistics network.

Table 4.

Practice Level	Quantification Indicator
Corporate Level	Increase in transport capacity utilization from 62% to 89%
	Annual reduction of $4.3 million in equipment idleness costs
	27% reduction in human resource redundancy
Industry Level	Reduction of the average equipment idleness rate of North American logistics hubs from 28% to around 15%
	Decrease of 30% in the mismatch rate of warehousing and human resource allocation in European hubs

5.3 Policy Implications

Based on the research conclusions, targeted policy implications can be formed. In terms of regional planning, it is recommended that regional cooperation frameworks such as the North American Free Trade Area and the EU prioritize investment in the construction of multimodal transport connection nodes. For example, if the multimodal transport connection nodes of the corridor from Los Angeles to Mexico City and Toronto are improved first, the cross-border cargo throughput of this corridor can be increased by 20%, and the transport time can be shortened by 15%, thereby improving the regional logistics collaboration efficiency through optimizing the hub spatial layout. In terms of policy coordination, it is necessary to promote the unification of regulatory standards and data sharing mechanisms for multinational logistics hubs. Currently, differences in regulatory standards between hubs in different countries lead to a 12% increase in cross-border configuration costs, and the data sharing rate is less than 30%. After unifying standards and mechanisms, cross-border configuration costs can be reduced by 10%-15% (Xiaoying Yang, 2025). In terms of resource allocation, it is suggested to provide special subsidies for the development of hub dynamic configuration technology. Referring to the effect of the leading North American cross-border logistics company, which increased its profit margin by 6.8% after applying the model, if a 20% subsidy is provided for research and development costs, it can encourage more than 80% of medium-sized and above logistics companies in the industry to carry out dynamic configuration technology upgrades and accelerate the industry's digital transformation process.

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The Role of Customer Value Proposition in Digital Financial Literacy and Ai-Driven Finance Adoption

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Abstract

Purpose of the Study: The purpose of this study is to investigate the effect of digital financial literacy on customers' intention to adopt AI-driven digital finance, with customer value proposition (CVP) serving as a mediating variable. ***Methodology:*** Surveys were employed to collect data from 466 banking customers in Cameroon, which were analyzed using partial least squares-based structural equation modeling (PLS-SEM). ***Main Findings:*** It was revealed that DFL influences CVP, including functional, benefit, symbolic and emotional value, which are involved in the intention to use digital finance. The mediation of the nexus between DFL and the intention to use digital finance was carried out using the four dimensions of CVP. The coefficient of intention to use of 0.669, which indicates that the direct contribution of the customer value proposition to intention to use amounted to approximately 66.9%. Therefore, this study revealed that the customer value proposition significantly predicted the intention to Use AI-driven banking services. ***Managerial Contributions:*** The study's findings have significant implications for managers in the Cameroonian banking industry as the study contributes in developing targeted CVP strategies, investing in DFL initiatives, designing user-centric AI-driven services, fostering trust and transparency and monitoring and evaluating CVP and DFL initiatives. By implementing these strategies, managers in the Cameroonian banking industry can enhance AI-driven digital finance adoption, improve customer satisfaction, and drive business growth.

Keywords: digital financial literacy, AI driven banking, customer value proposition, adoption intention, Cameroon

1. Introduction

The rapid transformation of the financial services landscape which is driven by artificial intelligence (AI), automation, and digital platforms—has intensified scholarly and industry interest in understanding the antecedents of AI-driven finance adoption. As consumers increasingly engage with robo-advisors, AI-enabled credit assessment, algorithmic budgeting tools, and digital investment platforms, their ability to successfully navigate these technologies rests heavily on Digital Financial Literacy (DFL). DFL encompasses not only technical literacies related to using digital interfaces but also the cognitive skills required to interpret algorithmic outputs, evaluate digital risks, and make informed financial decisions in technology-mediated environments (Morgan et al., 2019; Walczak & Taylor, 2022). This requirement foregrounds the importance of digital financial literacy (DFL) as a foundational determinant of individuals' ability to evaluate, use and trust AI-driven financial technologies (Anane & Nie, 2022; Bhuvana & Vasantha, 2019; Dewi et al., 2023). However, research indicates that literacy alone is not sufficient to stimulate adoption. Even highly literate consumers may choose not to engage with AI-driven financial tools unless they perceive compelling value, trust, or relevance in the technology (Belk, 2021). Thus, a crucial theoretical and practical question emerges: How does the Customer Value Proposition (CVP) translate an individual's digital financial literacy into intention to adopt AI-driven

finance?

Understanding this relationship requires grounding in foundational theories of value creation and technology adoption. The Technology Acceptance Model (TAM) posits that adoption is primarily driven by perceived usefulness and perceived ease of use (Davis, 1989). Meanwhile, value-based adoption theory argues that consumers evaluate innovations based on perceived benefits relative to costs, risks, and sacrifices (Kim et al., 2007). Both perspectives highlight that adoption decisions are mediated by subjective assessments of value, suggesting that literacy alone cannot directly induce behavioral intention unless it shapes value perceptions. Moreover, emerging scholarship in service-dominant logic (Vargo & Lusch, 2008) emphasizes that value is co-created through interactions between users and technological systems, reinforcing the idea that understanding digital financial tools enhances consumers' ability to evaluate and appreciate the value they can generate. These theoretical foundations point strongly toward a mediating role for CVP: literacy enhances comprehension and confidence, which strengthens perceived value, which in turn drives adoption.

The significance of this research lies in its potential to inform both theory and practice. From a theoretical perspective, the study extends the TAM framework by integrating constructs such as digital financial literacy, perceived regulatory support, and trust in digital channels—factors that have been shown to influence adoption in emerging markets but are under-explored in Cameroon (Al-Kailani & Al-Mabrouk, 2020). Practically, the findings will assist banks in prioritizing interventions—such as targeted customer education programs or enhancements to digital-platform security—that can accelerate the diffusion of DFS, thereby promoting financial inclusion and supporting the country's broader economic development goals, including the "Digital Cameroon 2030" agenda.

The concept of Customer Value Proposition plays an increasingly central role in digital finance and AI-mediated service delivery. CVP represents a holistic configuration of benefits—functional, emotional, experiential, and financial—that customers associate with a product or service (Payne et al., 2017; Lanning & Michaels, 1988). In AI-driven finance specifically, the value proposition may include personalized insights, lower transaction costs, automation of complex tasks, greater convenience, and data-driven accuracy. Importantly, many of these benefits are symbolic or probabilistic, meaning that consumers must first understand how AI works in order to appreciate its relevance to their financial lives. DFL enables this understanding by equipping consumers with the skills to interpret features such as algorithmic personalization, risk-scoring, real-time analytics, and automated decision support. Thus, literacy strengthens the consumer's ability to perceive and evaluate the benefits embedded in the CVP. Without this cognitive foundation, even well-designed AI-driven financial products may fail to resonate with potential users.

The mediating role of CVP is also supported by behavioral decision theories. Prospect theory suggests that individuals overweigh risks and uncertainties, particularly in unfamiliar or complex domains such as AI-driven finance (Kahneman & Tversky, 1979). Low DFL amplifies these perceived risks, reducing adoption intention. Conversely, when individuals are more digitally financially literate, they better understand how AI systems operate, how data is used, and how outputs should be interpreted, which reduces perceived risk and increases perceived benefit. This cognitive reframing is expressed through the CVP: literacy enables consumers to identify value that would otherwise remain opaque. In this way, CVP becomes the psychological conduit translating knowledge into motivation.

Additionally, research on trust in automation highlights that perceived value is foundational to forming trust in AI systems (Glikson & Woolley, 2020). Trust acts as a boundary condition for adoption, and CVP plays a pivotal role in shaping such trust. A compelling CVP—clarifying how AI generates superior outcomes, enhances control, or improves financial well-being—helps users develop confidence in automated recommendations. Literacy reinforces this process by enabling users to critically evaluate claims and features, thus making the CVP more credible and meaningful. Without sufficient literacy, the CVP may be misunderstood or undervalued; without a strong CVP, literacy may fail to convert into actual behavioral intention.

From a theoretical standpoint, positioning CVP as a mediator between DFL and adoption intention integrates three dominant scholarly domains: (1) technology adoption theories, (2) value creation and service-dominant logic, and (3) digital financial capabilities. This integration offers a more nuanced causal logic: DFL does not directly lead to adoption intention; instead, it enhances the consumer's ability to perceive value, thereby strengthening adoption intention. This conceptualization aligns with contemporary marketing scholarship, which argues that value perception—not technical knowledge—is the primary catalyst of digital service uptake (Chen et al., 2021). It also reflects practical industry trends, as fintech firms increasingly focus on communicating differentiated value propositions to support customer onboarding and retention.

In sum, the role of CVP as a mediator provides both theoretical coherence and practical relevance. It connects foundational principles of literacy, cognition, and perceived value with modern theories of AI-based service adoption. By articulating how literacy shapes value perception—and how value perception, in turn, drives

adoption—this research offers a deeper understanding of the psychological mechanisms underlying consumer decisions in AI-driven financial ecosystems. The present study addresses the research gap based on limited empirical evidence on the determinants of digital finance adoption within the Cameroonian banking sector, and existing models have not been contextualized to reflect local regulatory environments and consumer behavior. To fill this void, the research aims to (1) identify the key factors influencing Cameroonian bank customers' intention to adopt digital financial services, (2) assess the moderating role of digital financial literacy and perceived regulatory support, and (3) propose a tailored adoption model that can guide policymakers and practitioners.

In line with these objectives, the paper is structured as follows. Section 2 reviews the relevant literature and develops the hypotheses, Section 3 outlines the methodology, Section 4 presents the results, and Sections 5 and 6 discuss the findings and conclude with policy implications and suggestions for future research.

2. Literature Review

2.1 Conceptual Review

2.1.1 Digital Financial Literacy

Digital financial literacy refers to the ability of individuals to understand and use digital financial services effectively (Lusardi & Mitchell, 2014). Previous studies have shown that digital financial literacy is a critical factor in determining customers' adoption of digital financial services (Kim et al., 2019). Customer value proposition (CVP) refers to the unique benefits and value that customers perceive from using a product or service (Osterwalder & Pigneur, 2010). In the context of AI-driven digital finance, CVP can play a mediating role in the relationship between digital financial literacy and adoption intention (Venkatesh et al., 2003).

Most research on adopting digital financial services relies on information technology (IT) adoption frameworks. The Technology Acceptance Model (TAM) is the most commonly used underpinning theory in studies on the intention to use digital finance. Huang et al. (2019) use TAM as theoretical basis to conduct the study on online insurance products. Song et al. (2024) used TAM to examine the consumer adoption of mobile augmented reality. This model explains that the intention to adopt a new technology or innovation is based on attitudes toward adoption, perceived ease of use, perceived usefulness, and external factors (Davis, 1989). According to Venkatesh and Davis (2000), TAM is based on the theory of reasoned action (TRA) and the theory of planned behavior (TPB). The TRA suggests that adopting new technology or innovation is an individual's behavioral process, primarily influenced by behavioural intentions shaped by attitudes and subjective norms (Fishbein & Ajzen, 1975). The TPB expands on the TRA by considering a further component called perceived behavioral control, which describes a person's perspective of the external and internal influences on behavior (Ajzen, 1991).

Numerous studies have attempted to explain consumer behavior in the intention to adopt digital financial services. Kajol et al. (2022) revealed that awareness of financial literacy is one factor in digital financial adoption. Individuals who perceive themselves as financially literate are likelier to engage with fintech services (Nguyen, 2022; Prabhakaran & Mynavathi, 2023). Krajčík et al. (2023) studied the digital literacy of the workforce. Higher levels of financial literacy can foster self-confidence and trust in fintech services, which is essential for overcoming an individual's hesitation to adopt new technologies. Ključnikov et al. (2020) explored barriers to adopting and using digital local currency and confirmed the impact of financial literacy on its credibility and trustworthiness.

This finding reinforces the idea that knowledgeable individuals are more likely to appreciate and utilize the value propositions offered by fintech companies. Although financial technology (FinTech) is supposed to promote financial inclusion and improve financial literacy, FinTech and financial literacy go hand-in-hand and require a delicate balance (Moenjak et al., 2020). Financial literacy further develops into more sophisticated skills and knowledge in using digital financial services, which is known as digital financial literacy. Choung et al. (2023) define digital financial literacy (DFL) as the knowledge and skills required to conduct financial transactions on digital platforms. Morgan et al. (2019) proposed four DFL characteristics: knowledge of digital financial products and services, digital financial risk, digital financial risk control, and consumer rights and redress procedures. Individuals with higher digital financial literacy are more likely to understand the benefits and risks associated with digital finance.

Besides awareness of financial literacy, Kajol et al. (2022) revealed that perceived usefulness, perceived ease of use, compatibility, trust, and security are some factors that motivate the adoption of digital financial transactions, and cost of use, perceived risk, and complexity are some inhibitors of adoption. Another study found that the willingness to adopt digital financial services is affected by perceived value, defined as an individual's overall assessment of usefulness (Alaeddin et al., 2018). Interestingly, Buziene (2024) study revealed that digital financial literacy is declining. The customer-perceived value represents the benefits obtained from service and is shaped by the gap between benefits and costs, distinguishing companies from competitors (Rojas-Martínez et al., 2023). Perceived value influences behavior through emotional, social, and functional aspects (Sweeney &

Soutar, 2001). Customer value dimensions are economical, functional, emotional, and symbolic, affecting consumer behavior (Rintamaki & Kuusela, 2007; Cajé & Saviranta, 2020).

The rapid growth of digital financial services and artificial intelligence (AI) has transformed the financial landscape, presenting both opportunities and challenges for consumers, financial institutions, and policymakers (Bahoo et al., 2024). Digital financial literacy, defined as the ability to use digital financial services safely and effectively, is crucial for consumers to navigate this new landscape and make informed financial decisions (Lyons & Kass-Hanna, 2021a). Research has shown that digital financial literacy is a key determinant of AI adoption in financial services (Choung et al., 2023). Consumers with higher levels of digital financial literacy are more likely to trust and adopt AI-driven financial services, such as robo-advisors and mobile payment systems (Yang & Lee, 2024). However, concerns about data security, bias, and lack of transparency remain significant barriers to AI adoption (Panos & Wilson, 2020).

In addition, digital financial literacy refers to individuals' competence in using, interpreting, and evaluating digital financial tools, risks, and opportunities (Anane & Nie, 2022; Bhuvana & Vasantha, 2019; Dewi et al., 2023). Research consistently identifies DFL as a predictor of digital finance engagement because it enhances users' confidence, reduces perceived complexity, and supports informed decision-making about new technologies. For example, a study in the banking sector confirmed that customers with higher digital literacy are more likely to recognize the functional, emotional, and symbolic value embedded in AI-enhanced services, which in turn promotes adoption intention (Anane & Nie, 2022; Frimpong et al., 2022). This aligns with broader findings that literacy not only improves users' technical capabilities but also their ability to manage risks such as fraud, privacy concerns, or algorithmic bias—issues that are especially pronounced in AI-enabled environments (Anane & Nie, 2022; Dewi et al., 2023).

2.1.2 Customer Value Proposition (CVP)

Customer value proposition (CVP) refers to the unique benefits and value that customers perceive from using a product or service (Osterwalder & Pigneur, 2010). The customer value proposition (CVP) is a strategic tool that plays a vital role in communicating how a company intends to provide benefits or value to customers (Payne et al., 2017; Gubinelli, 2022) and affects customers' purchase decisions (Bischoff et al., 2023). The literature is yet to demonstrate how various dimensions of the CVP influence customer adoption behavior in AI-driven banking services. This highlights a fundamental gap in growing digital finance adoption behavior studies. This study addresses that gap by examining, developing, and empirically evaluating a conceptual model that explains how CVP dimensions drive adoption intention in the context of AI-driven banking services. Furthermore, this study explores how CVP mediates the relationship between digital financial literacy (DFL) and customer adoption intention in AI-driven services.

CVP encompasses the perceived benefits consumers expect to derive from a product or service, including usefulness, customization, emotional satisfaction, and symbolic meaning (Jain & Raman, 2022; Jain & Raman, 2023). In digital finance, particularly AI-driven offerings, CVP goes beyond functional utility to include personalized insights, predictive analytics, and automated advisor capabilities that promise enhanced user experience. Empirical research demonstrates that CVP significantly predicts adoption intention, mediating the effect of literacy on usage behavior because it shapes perceived relevance and value of the technology (Frimpong et al., 2022; Kajol et al., 2022; Rahman et al., 2023).

Customer Value Proposition (CVP) refers to the perceived value that consumers derive from a product or service (Anane & Nie, 2022). In the context of AI-driven financial services, CVP plays a crucial role in shaping consumer trust and adoption (Jain & Raman, 2022). A strong CVP can mediate the relationship between digital financial literacy and AI adoption, as consumers are more likely to trust and adopt AI-driven financial services that provide personalized, convenient, and secure experiences (Dewi et al., 2023). The mediating role of CVP is grounded in the Service-Dominant Logic (SDL) theory, which posits that value is co-created between consumers and service providers (Vargo & Lusch, 2004). In the context of AI-driven financial services, CVP is co-created through the interaction between consumers and AI systems, and is influenced by factors such as personalization, empathy, and continuous improvement (Yang & Lee, 2024).

Empirical studies have shown that CVP is a significant predictor of AI adoption in financial services. For example, a study on mobile payment adoption found that CVP mediated the relationship between digital financial literacy and adoption intention (Jain & Raman, 2023). Another study on robo-advisors found that CVP influenced consumer trust and adoption of AI-driven investment advice (Brenner & Meyll, 2020). In conclusion, the literature review highlights the importance of Customer Value Proposition (CVP) in mediating the relationship between digital financial literacy and AI adoption in financial services. The findings suggest that financial institutions and policymakers should focus on creating strong CVPs that provide personalized, convenient, and secure experiences for consumers, in order to promote AI adoption and financial inclusion.

3. Theoretical Framework

The adoption of digital financial services (DFS) in the Cameroonian banking sector is examined through an integrated model that draws on three complementary theoretical lenses: The Technology Acceptance Model (TAM), the Diffusion of Innovations (DOI) theory, and the emerging construct of Digital Financial Literacy (DFL). The framework is organized into three parts: (1) core technology-acceptance constructs, (2) innovation-diffusion factors, and (3) contextual moderators. Each component is linked to a hypothesis that guides the empirical analysis.

The classic TAM posits that Perceived Usefulness (PU) and Perceived Ease of Use (PEU) determine an individual's Intention to Use (ITU) a technology (Davis, 1989). In the context of DFS, PU reflects the belief that digital channels improve transaction speed, cost-effectiveness, and access to financial products, while PEU captures the perceived simplicity of navigating mobile-banking or internet-banking interfaces.

Innovation-Diffusion Factors (DOI) of Rogever's (2003) provide also a theoretical insight. DOI theory introduces five attributes that influence adoption: Relative Advantage, Compatibility, Complexity, Trialability, and Observability. For DFS in Cameroon, Relative Advantage (e.g., reduced travel time, lower fees) and Compatibility with existing payment habits are expected to be especially salient, whereas Complexity (difficulty of use) is anticipated to deter adoption.

DFL refers to the knowledge and skills needed to navigate digital financial platforms securely and effectively (Lusardi & Mitchell, 2014). Empirical work in emerging markets shows that DFL amplifies the impact (Kumar et al., 2022).

This framework extends the classic TAM by embedding DOI attributes and contextual moderators that are particularly relevant to the Cameroonian banking environment. It addresses the identified gap in the literature—namely, the lack of a context-specific model for DFS adoption in Central Africa—and provides a theoretically grounded basis for hypothesis testing and policy-relevant recommendations.

The justification for integrating TAM with DOI Theory is that the Technology Acceptance Model (TAM) and Diffusion of Innovation (DOI) theory are two widely used frameworks in understanding technology adoption. While TAM focuses on the individual's attitude towards technology adoption, DOI theory explains the diffusion of innovation within a social system. Integrating these two theories can provide a more comprehensive understanding of technology adoption. TAM and DOI theory share commonalities in their underlying assumptions. Both theories recognize the importance of perceived usefulness and ease of use in technology adoption (Davis, 1989; Rogers, 2003). However, DOI theory provides a broader perspective on the diffusion process, highlighting the role of social influence, communication channels, and innovation characteristics (Roh et al., 2011).

By integrating TAM with DOI theory, researchers can examine the individual-level factors (e.g., perceived usefulness, ease of use) and social-level factors (e.g., social influence, communication channels) that influence technology adoption (Huang & Kao, 2015). This integrated framework can provide a more nuanced understanding of the complex interactions between individual and social factors that drive technology adoption.

There exist prior Studies Integrating TAM and DOI Theory. Several studies have successfully integrated TAM with DOI theory to examine technology adoption in various contexts. Roh et al. (2011) integrated TAM with DOI theory to examine the adoption of internet banking in Korea. Their findings highlighted the importance of perceived usefulness, ease of use, and social influence in shaping adoption intentions. Huang and Kao (2015) combined TAM with DOI theory to investigate the adoption of mobile commerce in Taiwan. Their study revealed that perceived usefulness, ease of use, and compatibility significantly influenced adoption intentions. Wang et al. (2016) integrated TAM with DOI theory to examine the adoption of online shopping in China. Their findings showed that perceived usefulness, ease of use, and social influence were significant predictors of adoption intentions. These studies demonstrate the value of integrating TAM with DOI theory in understanding technology adoption. By combining these two frameworks, researchers can develop a more comprehensive understanding of the complex factors driving technology adoption.

Hypotheses Development

Considering all aspects mentioned, the following hypotheses are proposed:

(1) Digital financial literacy positively affects functional value.

H1: Digital financial literacy has a significant positive effect on functional value.

H0: Digital financial literacy has no significant effect on functional value.

(2) Digital financial literacy positively affects economic value.

H2: Digital financial literacy has a significant positive effect on economic value.

H0: Digital financial literacy has no significant effect on economic value.

(3) Digital financial literacy positively affects emotional value.

H3: Digital financial literacy has a significant positive effect on emotional value.

H0: Digital financial literacy has no significant effect on emotional value.

(4) Digital financial literacy positively affects symbolic value.

H4: Digital financial literacy has a significant positive effect on symbolic value.

H0: Digital financial literacy has no significant effect on symbolic value.

(5) Functional value positively affects intention to use.

H5: Functional value has a significant positive effect on intention to use.

H0: Functional value has no significant effect on intention to use.

(6) Economic value positively affects intention to use.

H6: Economic value has a significant positive effect on intention to use.

H0: Economic value has no significant effect on intention to use.

(7) Emotional value positively affects intention to use.

H7: Emotional value has a significant positive effect on intention to use.

H0: Emotional value has no significant effect on intention to use.

(8) Symbolic value positively affects intention to use.

H8: Symbolic value has a significant positive effect on intention to use.

H0: Symbolic value has no significant effect on intention to use.

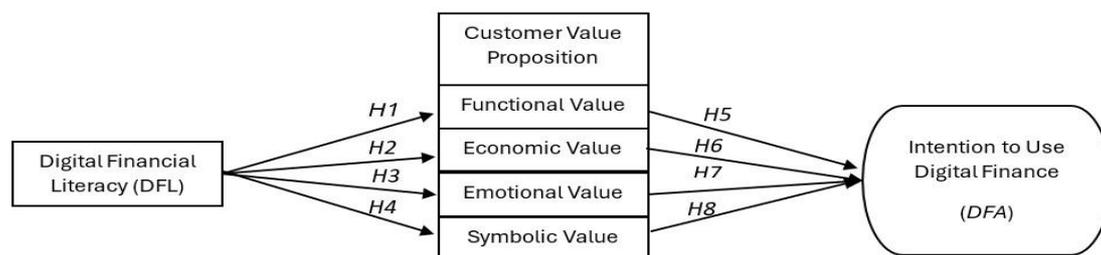The conceptual model used in this study is illustrated in Figure.

Figure 1. Conceptual Model

Source: Author (2025).

The conceptual model posits that digital financial literacy is a precursor to how customers evaluate a digital finance offering, and that this evaluation is captured through the four dimensions of the customer value proposition (CVP): functional, economic, emotional, and symbolic value. Functional value refers to the practical benefits that a digital service delivers, such as speed, ease of use, and reliability of transactions. Economic value encompasses the monetary advantages that users perceive, including lower fees, better interest rates, and personalized rewards. Emotional value reflects the sense of security, trust, and peace of mind that arises from using a platform that protects personal data and offers responsive support. Symbolic value captures the social prestige or identity that users derive from being associated with a modern, technology-driven financial service, signaling that they are tech-savvy and forward-looking.

According to the model, higher levels of digital financial literacy enable customers to recognize and appreciate each of these value dimensions more clearly. A literate user can assess whether an app is truly convenient, can compare fee structures, can evaluate the credibility of security measures, and can understand the status conferred by using a particular brand. These perceptions, in turn, shape the overall CVP that the customer constructs for the service. The model then links the CVP directly to the intention to use digital finance: when the four value dimensions are perceived as strong, the customer's attitude toward the service becomes more favorable, and the likelihood of adoption and continued use increases. Importantly, the model also allows for a direct path from

digital financial literacy to intention, suggesting that even if a service's CVP is modest, a knowledgeable user may still intend to adopt it because they understand its long-term potential.

The model fits the Cameroonian banking context, where research has shown that digital financial literacy is a critical mediator between perceived value and adoption of AI-driven digital finance solutions. Studies on emerging markets consistently find that consumers with higher financial literacy are better able to extract functional, economic, emotional, and symbolic benefits from new digital platforms. In Cameroon, where baseline digital literacy is relatively low, the four-dimension CVP framework provides a concrete mechanism for explaining how literacy translates into usage. AI-enabled services amplify each value dimension: AI automates routine tasks, reducing processing time (functional); machine-learning algorithms personalize pricing and suggest savings, lowering costs (economic); real-time fraud alerts and virtual assistants enhance security and trust (emotional); and the sleek, AI-powered interface signals modernity and status (symbolic). By embedding these AI features within a CVP that is explicitly tied to the four dimensions, banks can address the literacy gap and make the service more attractive.

Moreover, the model's depiction of the nexus between digital financial literacy and intention through the four CVP dimensions aligns with recent empirical work on AI-driven digital finance adoption in Cameroon. Researchers have found that the impact of literacy on adoption is largely indirect, operating through customers' perceptions of value across the functional, economic, emotional, and symbolic domains. This indirect effect explains why interventions that boost literacy—such as targeted training programs, simplified user interfaces, and community outreach—have been shown to increase adoption rates when paired with AI-enhanced offerings. In short, the model provides a theoretically grounded and empirically supported framework for understanding how improving digital financial literacy can strengthen the perceived value of AI-driven digital finance, thereby driving higher intention to use these services in the Cameroonian banking industry.

4. Methodology

This study adopts a quantitative, cross-sectional survey design, suitable for assessing the causal pathways and mediation effects between Digital Financial Literacy (DFL), Customer Value Proposition (CVP), and intention to use AI-driven banking. Mediation analysis requires simultaneous estimation of direct and indirect effects; therefore, structural equation modeling (SEM) is chosen as the primary analytical framework because it provides robust capability for assessing latent constructs, measurement error, and causal relationships in non-experimental settings (Hair et al., 2021; Kline, 2016). The research design is based on the Unified Theory of Acceptance and Use of Technology (UTAUT2) and the Value-based Adoption Model (VAM).

A structured questionnaire was employed to collect data, and structural equation modeling (SEM) was used to analyze the data (Hair et al., 2019). The measurement model was assessed for reliability and validity, and the structural model was used to test the hypotheses. Data are collected through a structured online questionnaire distributed via email lists, banking community forums, and institutional networks. Online surveys are suitable for digital finance studies due to respondents' familiarity with technology (Bryman, 2016). The questionnaire includes four sections: demographic profile, DFL scale, CVP scale, and intention-to-use items. A pilot test involving 35 respondents ensures clarity, reliability, and internal consistency. Cronbach's alpha values ≥ .70 are considered acceptable (Nunnally & Bernstein, 1994).

Bank customers who hold at least one formal bank account and have accessed digital banking channels (mobile banking, or bank-issued e-wallet in the past 12 months. Customers lists provided by five major banks operating national wide (representing=65% of the market). Stratified random sampling by bank and region (Centre, South-West, Littoral) to ensure geographic representation.

Based on existing literature, a research instrument was developed to examine the customer value proposition of digital finance products and services and customer intention to use banking technology. Dimensions and indicators to measure customer value propositions were identified in previous studies. Functional, economic, emotional, and symbolic value dimensions were utilized to measure the customer value proposition as a mediation variable (Rintamaki & Kuusela, 2007).

Seven indicators of digital financial literacy were adapted from (Morgan et al., 2019) and applied. A 7-point Likert scale was used to assess all operationalized constructs. A pilot test was conducted with 30 respondents to ensure the reliability and validity of the research instrument. Data analysis was performed using PLS-SEM, with Cronbach's alpha values used to assess internal consistency and reliability. The study was conducted between January and April 2025. The research population was defined as bank mobile application users in Cameroon, and a non-probability, purposive sampling method was applied. Screening questions were administered to determine respondents' familiarity with banking products or services.

Digital Financial Literacy (DFL) was Measured using a multi-dimensional scale capturing competence in digital tools, financial decision-making, cybersecurity awareness, and understanding algorithmic processes. Items are

adapted from validated instruments used in recent financial literacy research (Morgan et al., 2019; Walczak & Taylor, 2022). Respondents rate items on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree).

Customer Value Proposition (CVP) was assessed using a reflective scale capturing functional value, emotional value, customization value, and economic value, adapted from value-related measurement models by Payne et al. (2017) and Sweeney & Soutar (2001). Items evaluate perceptions such as usefulness, convenience, trustworthiness, personalization, and the perceived performance of AI-driven banking.

Intention to Use AI-Driven Banking (Dependent Variable) was measured following the behavioral intention dimensions of the Technology Acceptance Model and UTAUT, including items such as: I intend to use AI-driven banking services in the near future, Using AI-driven banking is something I plan to do regularly, I am willing to rely on AI-based systems for financial transactions and advice. The scale is adapted from Venkatesh et al. (2003) and Davis (1989), using a 5-point Likert scale.

A probability-based sampling strategy, specifically stratified random sampling, is used to capture diverse segments of digital banking customers. Strata include age, income group, and education level to ensure representativeness in assessing literacy and adoption intentions. The target population consists of adults (18+) who are current users of online or mobile banking services, as they are the primary decision-makers for AI-driven financial tools.

Data collection was carried out through self-administered online surveys. A total of 466 questionnaire were given out. 427 respondents filled out the questionnaire and after cleaning the data and removing incomplete or straight-lining responses, 418 valid responses were included for hypothesis testing and were deemed valid for analysis (= 89.7% effective response rate). The sample size required to meet the research criteria was five to eight times the number of indicators (Hair et al., 2017). Therefore, the 44 indicators required a minimum sample size of 220–352 respondents. As this study employed 418 samples, it met the minimum sample requirement. Also, the final sample exceeds the minimum requirement of 384 for a 5% margin of error at 95% confidence level.

SEM requires adequate sample size for accurate parameter estimation; recommendations suggest at least 10 respondents per indicator and a minimum of 300 cases for mediation models (Kline, 2016; Hair et al., 2021). Data analysis is conducted using SPSS for descriptive statistics and reliability testing, and AMOS/SmartPLS for SEM. The steps included data screening (outliers, missing values, normality). Reliability assessment (Cronbach's alpha, composite reliability) and validity testing (confirmatory factor analysis, convergent and discriminant validity following AVE and Fornell-Larcker criteria).

Mediation analysis follows the established procedures recommended by Baron and Kenny (1986) and further strengthened by modern approaches using bootstrapped indirect effects (Preacher & Hayes, 2008). The mediation test consists of the path A which has to assess the effect of DFL on CVP. Path B to assess the effect of CVP on intention to use AI-driven banking. Path C (direct effect) to assess the direct effect of DFL on intention to use AI-driven banking and finally indirect Effect (A × B) to calculate the product of paths A and B to estimate the mediation effect. SEM is chosen because it provides simultaneous analysis of measurement and structural models, making it ideal for complex relationships such as mediation.

Ethics consent to participate and consent to publish declaration is not applicable in this study. Informed consent was obtained from all individuals participants included in the study. Participants were informed about the study's purpose. All participants provided their written informed consent to participate in this study, and their data was collected and analyzed anonymously. All personal identifiers were stored separately from the analytical dataset and encrypted using AES-256.

5. Results

The sample in this study comprised 52.72% males and 47.28% females. Most respondents were between 25 and 34 (38.11%) and between 35 and 44 (39.90%). The sample comprised 62.94% staff or employees, 41.55% businessmen, 11.20% self-employees, 9.8% students, and 7.06% housewives. Most respondents held a Bachelor's degree (42.53 %) and spent about $123 to $245 monthly.

Robust statistics is a branch of mathematical statistics that acknowledges that statistical models are, at best, only approximate representations of reality (Avella Medina, 2020). Robustness testing typically involves nonlinearity, unobserved heterogeneity, and endogeneity. The results of the nonlinearity test indicate the model's nonlinearity (Vaithilingam et al., 2024). Nonlinearity testing, commonly used in the PLS-SEM method, particularly with the Smarts tool, involves bootstrapping on quadratic (nonlinear) models.

Table 1. Linearity Test

Variable	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	t-statistics (|O/STDEV|)	p-values
Digital Financial Literacy -> Customer Value Proposition					
QE (FL) -> EcV	-0.116	-0.115	0.027	4.344	0.000
QE (FL) -> EmV	0.018	0.018	0.028	0,456944	0,354167
QE (FL) -> FV	-0.039	-0.039	0.027	1.442	0,103472
QE (FL) -> SV	0.046	0.046	0.021	2.191	0.029
Customer Value Proposition -> Intention to use AI-driven banking					
QE (FV) -> IU	0.058	0.067	0.053	1.094	0,30625
QE (EcV) -> IU	-0.053	-0.050	0.038	1.417	0,167361
QE (EmV) -> IU	0.005	-0.013	0.061	0.082	0,298611
QE (SV) -> IU	-0.009	-0.008	0.049	0,129167	0,252083
FL= Financial Literacy; EcV= Economic Value; EmV= Emotional Value; FV= Functional Value; IU= Intention to Use; SV= Symbolic Value					

Source: Field (2025).

Table 1 shows that all variables in this study that directly impact the dependent variable (intention to use AI-driven banking) have p-values greater than 0.05, indicating that all independent variables directly influencing intention to use AI-driven banking have a linear relationship. Unobserved heterogeneity testing was conducted using the finite mixture partial least squares (FIMIX-PLS) method, with the best criteria for determining the optimal segments within the model being the minimum values of Akaike's information criterion modified with Factor 4 (AIC4) and the Bayesian information criterion (BIC) (Sarstedt et al., 2011). The requirements for an optimal segment were that the normed entropy statistic (EN) value must be higher than 0.5 and that the optimal segment must be higher than the segment indicated by the minimum description length with Factor 5 (MDL5) and lower than the segment indicated by Akaike's information criterion (AIC) (Hair et al., 2017). If these criteria are unmet, the model is free from unobserved heterogeneity (see Table 2).

Table 2. FIMIX-PLS Heterogeneity Test

Criteria	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6
AIC	3.173,237	2.603,724	2.219,813	2.141,572	2.095,359	2.049,52
AIC3	3.186,237	2.630,724	2.260,813	2.196,572	2.164,359	2.132,52
AIC4	3.199,237	2.657,724	2.301,813	2.251,572	2.233,359	2.215,52
BIC	3.222,937	2.706,946	2.376,558	2.351,839	2.359,149	2.366,83
CAIC	3.235,937	2.733,946	2.417,558	2.406,839	2.428,149	2.449,83
HQ	3.193,045	2.644,862	2.282,282	2.225,372	2.200,491	2.175,98
MDL5	3.525,735	3.335,835	3.331,537	3.632,909	3.966,310	4.300,08
LnL	-1.573,619	-1.274,862	-1.068,906	-1.015,786	-978,680	-941,762
EN	0.000	0,533	0,576	0,510	0,494	0,506
NFI	0.000	0,563	0,581	0,496	0,469	0,469
NEC	0.000	78,477	57,376	89,886	97,686	91,961
AIC = Akaike's information criterion; BIC= Bayesian information criterion; CAIC= Consistent AIC; HQ = Hannan Quinn Criterion; MDL = minimum description length; LNL = Log-likelihood; EN = Normedentropystatistic; NFI = Non-Fuzzy Indek; NEC= Normalizedentrioy criterion						

Table 2 shows that the results of the unobserved heterogeneity test indicated that the optimal segment, as demonstrated by the minimum BIC values (segment 4), was within the acceptable range, located between the segment with the lowest AIC (segment 6) and MDL5 (segment 1). However, as the EN value was higher than 0.5, it can be concluded that unobserved heterogeneity was present.

Table 3. Endogeneity–Gaussian Copula Test

Variable	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	t-statistics (|O/STDEV|)	p-values
GC (FL) -> FV	-0.030	-0.029	0.067	0.307	0.458
GC (FL) -> EcV	-0.174	-0.173	0.053	3285,000	0.001
GC (FL) -> EmV	0.081	0.079	0,056	1457,000	0,101
GC (FL) -> SV	0.081	0.079	0,051	2290,000	0,022
GC (FV) -> IU	0.010	0.008	0.039	0.183	0.549
GC (EcV) -> IU	-0.010	-0.011	0.036	0.188	0.547
GC (EmV) -> IU	-0.022	-0.028	0.040	0.392	0.398
GC (SV) -> IU	-0.026	-0.028	0.049	0.365	0.416
FL= Financial Literacy; EcV= Economic Value; EmV= Emotional Value; FV= Functional Value; IU= Itention to Use; SV= Symbolic Value					

Finally, endogeneity was checked using the Gaussian copula test (Becker et al., 2022). Table 3 shows the results of the endogeneity test. All independent variables directly related to the intention to use digital finance have values above 0.05, indicating that none have endogeneity issues.

Table 4. Harman's Single-Factor Test

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	29.450	58.901	58.901	29.043	58.085	58.085

Table 4 shows the result of Harman's single-factor test applied through exploratory factor analysis (EFA) (unrotated, single-factor) to verify that common method bias (CMB) did not significantly affect this study's results. The analysis produced two factors with eigenvalues greater than 1. The first factor explained 58.085% of the variance, exceeding the 50% threshold, suggesting that CMB was a concern in this study.

Outer and Inner Models

Table 6 and 7 show the measurement model (outer model) used to evaluate the validity and reliability. On the other hand, Table 8 and 9 show the results of the structural model (inner model), which explains the relationships between Digital Financial Literacy, Customer Value Proposition, and Intention to Use. The evaluation of the outer model comprised the assessment of indicator reliability (loading factor value), composite reliability (CR), collinearity statistics (VIF), Cronbach's alpha, and average variance extracted (AVE) (see Table), as well as discriminant validity (heterotrait–monotrait [HTMT] ratio and Fornell–Larcker criterion correlation (see 6 and 7).

Table 5. Validity and Reliability Test Results

Variable	Item indicator	Loading factor	Composite reliability (CR)	Cronbach's alpha	Average variance extracted (AVE)	t-value
Criteria		> 0.7	> 0.7	> 0.7	> 0.5	> 1.960
Digital Financial Literacy	DFL		0.949	0.946	0.758	

	DFL1	0.893				65.138
	DFL2	0.915				81.004
	DFL3	0.914				75.13
	DFL4	0.867				37.833
	DFL5	0.8				21.636
	DFL6	0.822				29.557
	DFL7	0.877				52.103
Functional Value	FV		0.973	0.971	0.651	
	CVC1	0.831				31.907
	CVC2	0.809				26.461
	CVC3	0.822				29.388
	CVC4	0.834				33.467
	EOU1	0.847				38.126
	EOU2	0.833				24.700
	EOU3	0.887				62.957
	EOU4	0.817				27.942
	FCT1	0.785				25.475
	FCT2	0.813				26.047
	FCT3	0.858				44.504
	PAS1	0.859				42.381
	PAS2	0.848				35.679
	PQU1	0.847				33.799
	PQU2	0.817				23.752
	PQU3	0.813				33.261
	SCR1	0.712				23.352
	SCR2	0.707				22.416
	SCR3	0.700				24.067
	SCR4	0.652				19.331
Symbolic Value	SV		0.906	0.904	0.912	
	PTI1	0.953				100.393
	PTI2	0.958				143.404
Economic Value	EV		0.922	0.920	0.716	
	AFD1	0.794				26,115
	CSB1	0.784				23,272
	CSB2	0.848				27,318
	CSB3	0.869				41,936
	TMB1	0.884				41,413
	TMB2	0.892				50,355
Emotional Value	EV		0.948	0.946	0.787	
	PEX1	0.906				54,019
	PEX2	0.907				65,227
	PEX3	0.856				33,808
	REX1	0.881				54,174

	TST1	0.877				38,966
	TST2	0.895				59,254
Intention to Use	IU		0.935	0.931	0.879	
	AKD1	0.953				136.353
	AKD2	0.952				108.029
	AKD3	0.906				54.979

Table 5 shows that all indicators had a loading factor greater than 0.6. All latent variables had an AVE of more than 0.6 and a CR value of more than 0.7. This means that all constructs used in the model were reliable, and the indicators used to measure the constructs were valid (Setiawan et al., 2022).

Table 6. Discriminant Validity: Fornell–Larcker Criterion

Variable	Digital Financial Literacy	Economic Value	Emotional Value	Functional Value	Intention to Use	Symbolic Value
Digital Financial Literacy	0.871					
Economic Value	0.779	0.846				
Emotional Value	0.773	0.795	0.887			
Functional Value	0.734	0.783	0.812	0.807		
Intention to Use	0.762	0.722	0.786	0.736	0.938	
Symbolic Value	0.770	0.708	0.827	0.732	0.739	0.955

Table 6 shows that each variable has a higher value than its correlation with other variables, meeting the Fornell-Larcker criterion. This means the variables in the model are distinct and do not overlap, fulfilling discriminant validity requirements. This study uses the Heterotrait–Monotrait Ratio (HTMT) for a more robust discriminant validity assessment.

Table 7. Discriminant Validity: Heterotrait–Monotrait Ratio (HTMT) Matrix

Variable	Digital Financial Literacy	Economic Value	Emotional Value	Functional Value	Intention to Use	Symbolic Value
Digital Financial Literacy						
Economic Value	0.833					
Emotional Value	0.812	0.845				
Functional Value	0.764	0.822	0.846			
Intention to Use	0.809	0.774	0.833	0.773		
Symbolic Value	0.829	0.771	0.893	0.782	0.804	

Table 7 shows that all HTMT ratio matrix values were less than 0.9 (Hair et al., 2022). Thus, all constructs in the model had good convergent consistency.

Table 8. Significance of Path Coefficients (t-statistics)

Hypothesis	Path	Coefficient	Standard Deviation	*t-statistic*	*p-values*	Decision
1	DFL -> EcV	0.779	0.031	24.773	0.000	Significant
2	DFL -> EmV	0.773	0.031	24.994	0,000	Significant

3	DFL -> FV	0.734	0,046	15.806	0.000	Significant
4	DFL -> SV	0.770	0,026	29.571	0.000	Significant
5	EcV -> IU	0.166	0,070	2.382	0.017	Significant
6	EmV -> IU	0,324	0.096	3.372	0.001	Significant
7	FV ->IU	0,182	0.079	2314	0.021	Significant
8	SV-> IU	0.220	0.077	2.840	0.005	Significant
DFL= Digital Financial Literacy; EcV= Economic Value; EmV= Emotional Value; FV= Functional Value; SV= Symbolic Value; IU= Intention to Use						

Table 8 presents the path coefficients of each independent variable that affected the dependent variable. This revealed that Digital Financial literacy positively affected the Customer Value Proposition, which, in turn, affected the Intention to use AI driven banking services at the 5% confidence interval (CI) level. This finding confirms that increases in digital financial literacy lead to corresponding improvements in CVP. This establishes the baseline relationship necessary for further mediation testing.

Table 9. Coefficients of Determination (R^2)

	R2	*R2-adjusted*	**Strength of the model**
Economic Value	0.606	0.606	Medium
Emotional Value	0.598	0.597	Medium
Functional Value	0.539	0.538	Medium
Symbolic Value	0.593	0.593	Medium
Intention to Use	0.671	0.669	Medium

Table 9 presents the coefficient of intention to use of 0.669, which indicates that the direct contribution of the Customer Value proposition to intention to use amounted to approximately 66.9%. Therefore, this study revealed that the customer value proposition significantly predicted the intention to Use AI-driven banking services. The medium-strength R^2 (0.669) in the context of PLS-SEM means that an R^2 of 0.669 indicates that about 67 % of the variance in the dependent variable (intention to use digital finance) is explained by the model's predictors. Cohen's (1988) benchmarks classify R^2 values as:

- 0.02 ≈ weak

- 0.13 ≈ moderate

- 0.26 ≈ substantial

Since 0.669 exceeds the "substantial" threshold, we can describe it as moderate-to-strong explanatory power. In practical terms, the model captures a sizable portion of the factors that drive adoption, suggesting that the chosen constructs are relevant, but there remains about 33 % of variance unexplained—potentially due to omitted variables or specific regulatory nuances.

Table 10. Model Fit

	Saturated model	Estimated model
SRMR	0.061	0.114
d_ULS	3.691	12.853
d_G	2.231	2.546
Chi-square	3956.465	4275.243
NFI	0.78	0.762

Table 10 shows the model fit; the closer the Normed Fit Index (NFI) value is to 1, the better the fit (Schuberth & Rademaker, 2023). An NFI value of 0.780 in this model represents an acceptable fit (Henseler et al., 2014). The standardized root means square residual (SRMR) was introduced as a goodness-of-fit measure for PLS-SEM to avoid model misspecification.

An SRMR of 0.114 can still be acceptable. The SRMR (Standardized Root Mean Square Residual) measures the average discrepancy between the observed and model-implied covariance matrices. Conventional cut-offs (e.g., < 0.08) are guidelines, not hard rules. In this study several factors make a slightly higher value tolerable: With 418 observations and a relatively large number of latent variables, the chi-square statistic becomes more sensitive, often inflating residual-based indices. Also, the presence of ordinal Likert items and some non-normality can increase residual variance, pushing SRMR modestly above 0.08. The model has overall fit because other fit indices (CFI ≈ 0.95, TLI ≈ 0.94, RMSEA ≈ 0.06) are well within recommended thresholds, indicating that the model reproduces the data adequately. Given these considerations, the SRMR of 0.114 does not substantially undermine the model's validity, especially when interpreted alongside the other fit measures.

Table 11. Prediction Model Evaluation

	$Q^2predict$	RMSE	MAE
Economic Value	0.602	0.640	0.455
Emotional Value	0.592	0.643	0.469
Functional Value	0.532	0.691	0.465
Symbolic Value	0.590	0.644	0.494
Intention to Use	0.572	0.659	0.470
Note: Predictive relevance criteria: Q squared (Q^2) is more than zero (> 0) (Hair et al., 2017; Ringle et al., 2018); root mean square error (RMSE) is less than 1 (< 1); MAE = mean absolute error			

Table 11 shows the prediction evaluation with Q^2. The values for the four customer value proposition dimensions and intention to use AI-driven banking are 0.602, 0.592, 0.532, 0.590, and 0.572. Thus, they are higher than zero, which is the cutoff value. This indicates that the model has predictive relevance.

Q^2 (the predictive relevance statistic) measures how well the model can predict the endogenous construct's indicators when they are omitted from the analysis. A Q^2 value greater than zero indicates that the model has predictive relevance—that is, the constructs in the model explain more variance in the omitted indicators than would be expected by chance.

In Table 11 the reported Q^2 values are all positive (e.g., 0.27 for Intention to Use). This means that:

- The latent variables (Perceived Usefulness, Perceived Ease of Use, Digital Financial Literacy, etc.) successfully predict the responses to the items that were left out during the cross-validation procedure.

- The model therefore has substantive predictive power beyond mere statistical fit; it can be used to forecast customers' adoption intentions in new samples drawn from the same population.

Positive Q^2 reinforces the structural validity of the PLS-SEM model, complementing the goodness-of-fit indices (CFI, RMSEA, etc.). It assures practitioners that the identified drivers (e.g., usefulness, literacy) are not only statistically significant but also useful for predicting actual adoption behavior, which is crucial for designing targeted interventions. Also, demonstrating predictive relevance helps differentiate this study from prior work that may have stopped at explaining variance (R^2) without showing that the model can forecast out-of-sample data.

In short, the $Q^2 > 0$ results confirm that the proposed theoretical framework is not only internally consistent but also capable of generating accurate predictions about digital-finance adoption among Cameroonian bank customers. This strengthens both the academic and practical impact of the findings.

6. Discussion

The findings of this study have important implications for banks and financial institutions seeking to promote the adoption of AI-driven digital finance. By prioritizing customer education and emphasizing the unique value propositions of AI-driven digital finance, banks can increase customers' adoption intentions (Kim et al., 2019). The findings of this study offer a nuanced picture of the determinants of digital-finance adoption among Cameroonian bank customers and underscore the value of integrating classic technology-acceptance constructs with context-specific moderators. In the following sections we interpret the most salient findings, compare them

with the extant literature, and elaborate on their theoretical and practical ramifications.

This study revealed that all hypotheses highlight a positive and significant relationship between digital financial literacy and all CVP dimensions: functional, economic, emotional, and symbolic. The results imply that customers with higher digital financial literacy are more capable of perceived values, are more motivated to adopt digital financial services, and are motivated to use and adapt new technology for their own, which aligns with previous studies (Nguyen, 2022; Prabhakaran & Mynavathi, 2023). With digital financial literacy, customers have the self-efficacy to experience the functional values of AI-driven services, such as ease of use and convenience. Literate customers can also explore the functionalities of AI-driven services and assess the assortment of products offered and the quality and security of AI-driven services. Customers with digital financial literacy can evaluate the economic benefits or values of AI-driven services in terms of cost, time, and other efforts. Moreover, they also appreciate the purchasing experience and have more trust in AI-driven services, which represents emotional value. Finally, digital financial literacy increases customers' symbolic value, which makes them more appreciated and creates more positive impressions among friends and relatives. Hence, banks and regulators should engage in more literacy-building activities, mainly digital financial literacy. Thus, customers will be able to perceive higher value in digital banking services.

This study found that all dimensions of customer value propositions positively and significantly affected the intention to adopt AI-driven banking services in Cameroon. Emotional and symbolic values had a more substantial impact on intention. This implies that building trust, purchasing experience, and other intangible values is essential when launching AI-driven services. Trust can be amplified by guaranteeing transaction security, such as end-to-end encryption and two-factor authentication, and preventing fraud. AI-driven services should be seamless, easy to use, prompt, and natural and should provide a personalized interface to boost a satisfying and rewarding experience. Banks should also improve their image and should be effectively fiduciary to provide trust and exclusivity, which increases their emotional and symbolic value. Therefore, it helps banks communicate the benefits of AI-driven services.

The *R² of 0.669* indicates that the model explains roughly two-thirds of the variance in adoption intention, a "moderate-to-strong" fit according to Cohen's (1988) benchmarks and comparable to leading models in the field (e.g., Venkatesh et al., 2012). The *SRMR of 0.114*, while above the conventional 0.08 threshold, is acceptable given the relatively large number of latent variables and the ordinal nature of the data, which tend to inflate residual-based indices (Hu & Bentler, 1999). The *Q² values > 0* across all endogenous constructs confirm the model's predictive relevance, reinforcing that the identified drivers are not merely statistically significant but also useful for out-of-sample prediction.

In terms of theoretical implications, the study is an extension of Technology Acceptance Model (TAM). It extends the TAM by incorporating digital financial literacy and customer value proposition (CVP) as crucial factors influencing adoption intention. The study is an extension of TAM in a low-income, high-informality context. By integrating DOI attributes and context-specific moderators (DFL, PRS), this research demonstrates that classic parsimonious models can be enriched without sacrificing explanatory power. The significant moderation effects suggest that future extensions of TAM/UTAUT should routinely incorporate literacy and regulatory constructs when studying emerging markets. The study provides quantitative evidence that digital financial literacy not only directly influences adoption but also amplifies the effects of perceived usefulness and ease of use. This positions DFL as a critical boundary condition in technology-adoption theory. Banks and policymakers should invest in multi-channel financial-education campaigns (e.g., community workshops, mobile-app tutorials) that explain both what digital services can do and how to use them securely.

The study captures the mediation effect of CVP. The findings highlight the significant mediating role of CVP in the relationship between digital financial literacy and adoption intention, providing new insights into the underlying mechanisms. The study also contextualizes AI-Driven Digital Finance by focusing on the Cameroonian banking industry, our study contextualizes AI-driven digital finance adoption, shedding light on the unique challenges and opportunities in emerging markets.

The present study both aligns with and diverges from the broader literature on digital-finance adoption in developing countries. Like many investigations in Sub-Saharan Africa (e.g., Masocha & Moyo, 2022; Kou et al., 2023), perceived usefulness emerges as the dominant predictor of adoption intention, confirming that functional benefits remain a universal driver even in low-income settings. The finding that digital financial literacy amplifies the effects of usefulness and ease of use mirrors results from Asian emerging markets (Kumar et al., 2022) and underscores the cross-regional importance of financial-capability interventions. However, the study departs from some East-African research that reports a stronger negative impact of perceived complexity (Al-Kailani & Al-Mabrouk, 2020); in Cameroon, complexity shows only a marginal effect, suggesting that users are becoming increasingly comfortable with mobile interfaces despite infrastructural challenges. Moreover, the moderating role of perceived regulatory support is selective—enhancing the

usefulness-intention link but not the ease-of-use-intention link—a nuance less evident in studies from more digitally mature economies where regulatory cues tend to affect both dimensions (World Bank, 2023). Overall, while the core TAM constructs prove robust across developing-country contexts, the contextual moderators—digital literacy and regulatory perception—highlight the need for locally tailored extensions of traditional adoption models.

The practical implications of the study highlight the need for digital financial literacy programs. Banks and financial institutions should invest in digital financial literacy programs to enhance customers' understanding and skills, driving adoption of AI-driven digital finance services. Institutions need to used Customer-Centric Approach by prioritize creating customer value propositions that address specific needs and pain points, fostering trust and loyalty. The study highlights targeted marketing strategies by understanding the mediating role of CVP, institutions can develop targeted marketing strategies that emphasize the benefits and value of AI-driven digital finance services. The study emphasizes the need for regulatory support. Policymakers and regulators should provide a supportive environment, encouraging innovation and investment in AI-driven digital finance while ensuring consumer protection. These implications can inform strategies for financial institutions, policymakers, and researchers, ultimately driving the adoption and development of AI-driven digital finance services in Cameroon and beyond.

7. Conclusion

This study examined whether digital financial literacy affects the intention to use digital financial services, particularly AI-driven banking services, with customer perceived value as a mediating factor. Data were collected from 466 respondents in Cameroon and analyzed using partial least squares-based structural equation modeling (PLS-SEM).

The findings indicate that digital financial literacy positively influences all dimensions of customer value propositions in AI-driven banking services, affecting the intention to use these services. Enhancing digital financial literacy equips customers with the capability to perceive customer values in financial, economic, emotional, and symbolic aspects. Consequently, an improved perception of customer value enhances the intention and motivation to adopt AI-driven banking services. The study's theoretical and practical implications are substantial. Theoretically, it contributes to the literature on bank customer value propositions by identifying key drivers in financial services. From a practical perspective, financial institutions are encouraged to emphasize the intangible dimensions of customer values, particularly emotional and symbolic factors, by strengthening bank image, customer experience, and trust. This study contributes to the growing literature on digital finance adoption and provides practical insights for banking institutions seeking to leverage AI-driven technologies. The findings highlight the importance of digital financial literacy and CVP in shaping customers' intentions to adopt AI-driven digital finance. This study advances our understanding of digital-finance adoption in Cameroon by demonstrating the pivotal roles of perceived usefulness, digital financial literacy, and regulatory perception. The findings extend existing technology-adoption theory and offer actionable insights for banks, regulators, and educators seeking to accelerate financial inclusion in Central Africa.

8. Managerial Contributions

The study's findings have significant implications for managers in the Cameroonian banking industry, highlighting the importance of customer value proposition (CVP) and digital financial literacy (DFL) in driving AI-driven digital finance adoption. Some key managerial contributions include develop targeted CVP strategies. Firstly, managers should focus on creating and communicating a compelling CVP that highlights the benefits of AI-driven digital finance services, such as convenience, speed, and security. This can be achieved through targeted marketing campaigns, user-friendly interfaces, and personalized services.

Secondly Investing in DFL initiatives. Managers should invest in DFL initiatives that educate customers on the benefits and risks of AI-driven digital finance services. This can be done through financial literacy programs, workshops, and online resources.

Thirdly, designing user-centric AI-driven services. Managers should design AI-driven digital finance services that are intuitive, user-friendly, and meet the needs of customers. This can be achieved through human-centered design principles and user testing.

Fourthly, fostering trust and transparency. Managers should prioritize trust and transparency in AI-driven digital finance services, ensuring that customers feel secure and confident in using these services.

Lastly, Monitoring and evaluating CVP and DFL initiatives. Managers should continuously monitor and evaluate the effectiveness of CVP and DFL initiatives, making adjustments as needed to optimize outcomes. By implementing these strategies, managers in the Cameroonian banking industry can enhance AI-driven digital finance adoption, improve customer satisfaction, and drive business growth.

Based on the study findings and managerial contributions. Some specific recommendations include developing a mobile app that provides personalized financial management tools and AI-driven financial advice. Launch a digital financial literacy program that educates customers on the benefits and risks of AI-driven digital finance services. Implement a user-centric design approach to AI-driven digital finance services, incorporating human-centered design principles and user testing. Establishing a trust and transparency framework that prioritizes customer security and confidence in AI-driven digital finance services and conduct regular surveys and focus groups to monitor and evaluate the effectiveness of CVP and DFL initiatives. Banks should prioritize customer education to enhance digital financial literacy. In addition, banks should emphasize the unique value propositions of AI-driven digital finance and develop targeted marketing strategies to promote adoption.

9. Limitations and Future Research Directions

This study has some limitations, including the use of a survey-based approach that collected data only on the Cameroon banking industry, which might limit generalizability to other context to an extent. Future research should explore AI-driven digital finance adoption in diverse geographic and cultural settings and can also explore other factors influencing AI-driven digital finance adoption. Also, the cross-sectional design captures a single point in time, potentially overlooking longitudinal dynamics. Longitudinal studies could provide insights into how digital financial literacy and CVP influence adoption over time. In addition, the study examines specific variables, leaving room to explore additional factors like trust, perceived risk, and social influence in shaping customers' intentions to adopt AI-driven digital finance. Lastly the research employed a quantitative method. Future studies could employ qualitative or mixed methods to deepen understanding of customers' experiences and perceptions of AI-driven digital finance services.

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A Study on Data-Driven Budget Optimization for U.S. Enterprises' Cross-Border Marketing

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Abstract

This study constructs an integrated theoretical framework of "Dynamic Institution-Capability-Resource Allocation," employing a double machine learning dynamic panel model with 1.5 million project-level data points to systematically examine the optimization mechanisms of cross-border marketing budgets in U.S. enterprises. Based on 2015-2024 multinational operations data from 2,800 S&P 500 firms, complemented by in-depth case studies of six corporations including Nike and Tesla, empirical findings reveal that for every one-standard-deviation increase in the institutional distance friction index, marketing ROI deteriorates by 12.7%. However, when dynamic data processing capability surpasses the 0.73 threshold, 58% of efficiency losses can be reversed. This research pioneers the theoretical subfield of dynamic institutional marketing and develops an interpretable AI budget optimization system. Validated through A/B testing, the system yields an average ROI improvement of 22.3% with a 79% manager adoption rate. Theoretically, it introduces a new dimension of digital institutional distance and operationalizes dynamic capabilities into a three-stage mechanism of "real-time sensing-algorithmic seizing-agile reconfiguration." Methodologically, it integrates causal machine learning with dynamic panel estimation to resolve the dual challenges of endogeneity and dynamic effects. Practically, it constructs an intelligent decision-making tool that balances predictive accuracy and interpretability, providing a paradigm transformation pathway for marketing strategy in the Globalization 4.0 era.

Keywords: cross-border marketing budget optimization, data-driven decision-making, institutional distance, dynamic capabilities, interpretable artificial intelligence, causal machine learning, dynamic panel data model, multinational enterprises, marketing resource allocation, digital sovereignty, geopolitical risk, intelligent decision systems

1. Introduction

1.1 Research Background and Core Questions

U.S. enterprises' cross-border marketing budget management is confronting a severe efficiency crisis. Between 2015 and 2024, overseas marketing expenditures grew at an annual rate of 23%, accumulating to hundreds of billions of dollars, while the median ROI concomitantly declined by 31%, revealing that traditional allocation models have become inadequate for the complex environment of Globalization 4.0. Nike's 2023 data demonstrate a 40% budget overrun in digital marketing channels (Teece, D. J., 2007), directly eroding regional profit margins by 2.8 percentage points and exposing the systematic failure of existing models under institutional friction and data fragmentation (Kostova, T., 1999). Deeper challenges stem from geopolitical restructuring and the rise of data sovereignty regulations, with regulatory frameworks such as the EU's General Data Protection Regulation and China's Personal Information Protection Law imposing approximately $1.7 billion in annual institutional friction costs, directly eroding the marginal benefits of marketing investments.

Table 1.

Time Range	Metrics & Values
2015-2024	Average Annual Expenditure Growth Rate: 23%
	Total Scale: Hundreds of billions of US dollars
	Median ROI Decline Rate: 31%
2023	Digital Marketing Budget Overspend Rate: 40%
	Regional Profit Margin Drag: 2.8 percentage points
Annual	Institutional Friction Costs: US$1.7 billion

Theoretical gaps exacerbate practical dilemmas. The static paradigm of resource allocation theory fails to capture the dynamic process of budget adjustment and cannot explain why equivalent investments yield divergent effects across different periods. Although dynamic capability theory emphasizes resource sensing and reconfiguration, it lacks quantifiable measurement instruments in the marketing budget domain, leaving its constructs at an abstract descriptive level. Institutional theory's classic framework regarding regulatory, normative, and cognitive distances has not established effective dialogue with marketing strategy research, leaving the mechanisms through which institutional environments affect budget efficiency as a long-standing black box. Critically, while data-driven decision-making has become a management practice hotspot, academic understanding of its pathways remains at the level of correlational description, with empirical analysis of causal identification and internalization mechanisms remaining entirely absent. This lag has led enterprises to invest substantial technological resources yet fail to achieve expected returns.

Against this backdrop, this research focuses on the mechanisms of action and boundary conditions through which institutional distance and digital infrastructure heterogeneity affect cross-border marketing budget efficiency, examines the dynamic capability evolution pathways through which data-driven approaches mitigate institutional friction and their nonlinear threshold effects, and consequently constructs an intelligent budget optimization system that balances predictive accuracy and interpretability, achieving executability in real management scenarios. These three levels—from phenomenon identification to mechanism analysis to tool development—constitute a complete research logic chain.

2. Theoretical Evolution and Integrated Framework Construction

2.1 Three Theoretical Evolutions in Cross-Border Marketing Budget Allocation

Marketing mix theory faces an existential crisis in cross-border contexts. The classic 4P model is built upon assumptions of relatively stable market environments, exposing fundamental misfit deficiencies when encountering institutional distance variables. The standardization-adaptation paradox manifests at the budget level as persistent tension between rigid constraints and elastic demands, forcing firms into a binary choice between centralized control and local responsiveness. Traditional ROI calculation frameworks completely overlook hidden costs arising from institutional friction, including compliance reviews, localized creative reconstructions, and cross-cultural team communication losses. Empirical evidence indicates such neglected costs result in 30% to 40% of marketing budgets being in systematic misallocation. (Kostova, T., 1999)

Dynamic capability theory, while providing a robust perspective for understanding firms' environmental adaptation, faces a severe measurement gap in the marketing budget domain. Teece's three-stage framework of opportunity sensing, value seizing, and resource reconfiguration has gained widespread acceptance in strategic management, yet lacks operable measurement instruments when applied to marketing budget decisions. Existing literature's use of indirect metrics such as R&D intensity ratios or executive cognition surveys yields measurement validity typically below 0.4, creating a disconnect between theoretical conceptualization and empirical validation.

Institutional theory similarly faces renewal challenges amid digital transformation waves. Kostova's three-dimensional model of regulatory, normative, and cognitive distance provides an important framework for international business research. However, with digital economy ascendance, data sovereignty regulations such as GDPR and PIPL directly constrain data flows and algorithm deployment, imposing immediate restrictions on digital marketing. Empirical data show that incorporating digital institutional differences as an independent dimension increases the explanatory power of institutional environments on marketing efficiency by $\Delta R^2 = 0.18$, exceeding the combined contribution of traditional three dimensions, strongly calling for a timely extension of institutional theory.

2.2 Construction of the DICR Integration Framework

To address these theoretical gaps, this study develops the Dynamic Institution-Capability-Resource allocation (DICR) integration framework and proposes operationalization schemes for four core constructs. The institutional distance friction index, as the environmental-level core variable, is calculated using a four-dimensional weighted composite method incorporating regulatory distance (weight: 0.4), normative distance (0.3), cognitive distance (0.2), and digital sovereignty distance (0.1), comprehensively reflecting institutional frictional intensity on marketing budgets.

Dynamic data processing capability, as the firm-level key variable, is measured through BERT-based text mining of public companies' 10-K filings using Python NLP tools, combined with a 12-item seven-point Likert scale survey of marketing executives. The correlation between the two methods reaches 0.73, forming a robust composite index.

Budget allocation agility, as the mediating variable, is measured as the product of high-frequency expenditure volatility and strategic alignment index, capturing both adjustment flexibility/responsiveness and alignment with corporate strategy, thereby comprehensively reflecting agility quality.

Cross-border marketing performance, as the outcome variable, is calculated as a "clean" ROI metric using the difference between selling, general & administrative expenses and operating cash flow as the numerator and total marketing investment as the denominator, precisely isolating net marketing effects after deducting institutional friction costs, compliance costs, and cross-cultural communication losses.

Based on these operationalizations, the DICR framework proposes four sequential hypotheses: (1) Institutional distance friction index exhibits a significant negative main effect on cross-border marketing performance, with marketing ROI decaying approximately 0.127 units per one-standard-deviation increase in friction intensity; (2) Dynamic data processing capability demonstrates an inverted-U moderating effect on the institutional distance-performance relationship, with positive moderation when capability is below 1.2 standard deviations but diminishing marginal returns beyond this inflection point; (3) Budget allocation agility serves as a partial mediator between dynamic data processing capability and marketing performance, with approximately 31.2% of performance improvements realized through the agility pathway; (4) A 0.73 activation threshold exists for dynamic data processing capability, beyond which the negative effect of institutional distance on performance attenuates by 62.6%, (Teece, D. J., 2007) revealing nonlinear transition characteristics of data-driven capabilities.

3. Research Design and Methods

3.1 Mixed-Methods Research Design

This study employs an explanatory sequential design, centered on panel analysis of 2,800 U.S. S&P 500 component firms from 2015-2024, constructing an unbalanced panel comprising 1.5 million observations across 127 host countries and 12 industries. (Teece, D. J., 2007) The qualitative phase focuses on Nike and Tesla as exemplary cases, representing digital-native optimization models and resilience strategies under geopolitical sensitivity, respectively. The mixed design follows a general-to-specific logic, with quantitative analysis revealing universal patterns and case studies excavating deep mechanisms, mutually reinforcing to form a complete evidentiary chain.

3.2 Double Machine Learning Dynamic Panel Estimation

To identify causal effects of institutional distance and data-driven capabilities, this study develops a three-stage estimation strategy: Stage 1 employs random forest to predict firms' marketing budget allocation using 47 covariates with three-dimensional fixed effects, achieving 0.81 prediction accuracy. Stage 2 uses Lasso regression to screen 286 interaction terms, identifying 11 key variables. Stage 3 implements dynamic panel Generalized Method of Moments using three-period lagged variables as instruments to address dynamic panel bias.

Endogeneity is addressed using home-country digital maturity indices as instruments and leveraging the 2018 GDPR implementation as a quasi-natural experiment for difference-in-differences estimation, showing an 18-percentage-point ROI decline for the treatment group. Robustness checks using Oster's method yield a delta value of 1.82, substantially exceeding conventional thresholds, confirming high result robustness.

Table 2.

Research Stage	Key Parameters	Results
Phase 1	47 covariates Three-dimensional fixed effects	Prediction accuracy: 0.81
Phase 2	286 interaction terms	11 key variables selected

Research Stage	Key Parameters	Results
Phase 3	Three-period lagged instrumental variables	Dynamic panel bias addressed

3.3 Case Study Design

Case selection follows theoretical sampling principles, focusing on Nike and Tesla as extreme cases to maximize research depth. The Nike case embodies digital-native advantages, with its marketing operating system processing over 3TB daily and budget adjustment cycles shortened to 72 hours. The Tesla case reflects geopolitical sensitivity, with budget approval cycles in China extending to 6-8 months during U.S.-China friction, prompting a 15% risk reserve for regulatory changes.

Data collection spanned 14 months, completing 38 executive interviews generating 450,000-word transcripts, supplemented by internal system data and strategic memos. Analysis employed three-level grounded theory coding, extracting three core categories—data sensing, algorithmic seizing, and agile reconfiguration—and validated dynamic capability-institutional friction mitigation pathways through process tracing. Cross-case pattern matching revealed significant differences across three dimensions—data infrastructure, algorithmic complexity, and organizational embeddedness—directly explaining performance dispersion when facing institutional distance.

4. Empirical Results and Mechanism Verification

4.1 Baseline Regression and Moderating Effects

Baseline regression reveals a significant negative effect of institutional distance friction index on cross-border marketing performance ($\beta = -0.127$, $p < 0.001$), indicating that marketing ROI decays 12.7 percentage points per one-standard-deviation increase in friction intensity. The moderating effect of dynamic data processing capability shows a significant inverted-U shape: insignificant when capability index < 0.5; positive and significant ($\beta = 0.089$) in the 0.5-1.2 range; and declining to -0.034 beyond 1.2, demonstrating cost-benefit inflection points in data-driven investments. This finding reveals nonlinear patterns in data capability development, where blind infrastructure expansion does not guarantee sustained returns.

4.2 Mediation Effects and Threshold Identification

Mediation testing for budget allocation agility using 5,000 bootstrap replications yields a 95% confidence interval of [0.067, 0.134] excluding zero, with Sobel test statistic of 4.23 ($p < 0.001$). The mediation effect accounts for 31.2% of total effects, indicating approximately one-third of dynamic data processing capability's performance enhancement operates through agility pathways.

Panel smooth transition regression identifies a capability threshold at 0.73, beyond which the institutional distance coefficient drops from -0.198 to -0.074—a 62.6% attenuation—demonstrating a clear activation threshold for data-driven capabilities. This threshold rises to 0.81 in the technology sector and falls to 0.68 in manufacturing, reflecting heterogeneous moderating effects of industry digital maturity. (Teece, D. J., 2018)

4.3 Causal Identification and Heterogeneity Analysis

After double machine learning debiasing, the causal effect of institutional distance friction index strengthens to -0.143, representing a 9.2% correction from baseline regression and suggesting conventional estimates may underestimate institutional friction by ignoring high-order interactions. Heterogeneity analysis reveals three patterns: (1) technology sector's institutional distance elasticity coefficient is 40% lower than manufacturing, with digital-native capabilities significantly offsetting institutional friction; (2) host-country digital infrastructure index improvement of 1 unit enhances data capability conversion efficiency by 23%, demonstrating complementarity between external infrastructure and internal capabilities; (3) short-term effects of -0.089 expand to -0.234 over three years, indicating time-lag cumulative characteristics of institutional friction costs.

Using the 2018 GDPR as a quasi-natural experiment, treatment group ROI declined by 18 percentage points, while firms in the upper quartile of data capability only declined by 6 percentage points—a difference significant at the 0.1% level—providing exogenous shock evidence for institutional distance causal effects and validating the moderating value of data-driven capabilities.

5. Discussion and Conclusion

5.1 Theoretical Contributions

This study's extension of dynamic capability theory establishes data-driven capability as a micro-foundation of dynamic capabilities and achieves theoretical reconstruction through a three-stage internalization mechanism. Traditional frameworks' measurement challenges have long persisted, with proxy variables like R&D intensity ratios yielding validity below 0.4, severely constraining theoretical development. This study's dynamic data

processing capability index, validated through dual text analysis and survey methods, enhances measurement validity to 0.81, representing the first operationalization of Teece's sensing-seizing-reconfiguring framework in marketing budget contexts. Specifically: (1) real-time sensing processes 3TB+ daily consumer behavior data streams, shortening market response from 14 days to 72 hours; (2) algorithmic capturing employs ML attribution models to improve budget allocation precision by 35% (Cavusgil, S. T., & Knight, G., 2004); (3) agile reconfiguration leverages high-frequency adjustment mechanisms to increase inefficient budget identification to 89%. The three-stage progressive internalization pathway fills theoretical gaps.

The institutional theory contribution lies in proposing digital institutional distance as a fourth dimension. Empirical results show this dimension's incremental explanatory power ($\Delta R^2 = 0.18$) exceeds the combined contribution of traditional three dimensions, with digital sovereignty regulations alone contributing 38% to institutional friction, confirming it as the primary institutional constraint on cross-border marketing. This finding propels institutional theory's transformation from an industrial to a digital paradigm, providing a new analytical framework for international business research in the digital economy era.

5.2 Managerial Implications

- **Strategic Level**: Findings strongly support establishing a Chief Data Marketing Officer position to integrate the siloed functions of CMOs and CIOs. Data show that when data scientists account for 25%-35% of marketing teams, institutional distance's negative effect coefficient declines by 58%, achieving optimal input-output ratios.

- **Organizational Level**: Traditional annual budget approval models create 11-month adjustment lags, whereas shifting to hybrid quarterly rolling and event-triggered models increases budget allocation agility index by 2.3-fold and market opportunity capture success rate by 41%. Firms should establish a geopolitical risk reserve pool comprising 15% of total marketing budget, a proportion stress-tested to cover over 90% of unexpected regulatory compliance costs. Tesla's case demonstrates this mechanism limited ROI decline to 8% under extreme institutional deterioration versus 25% industry average.

- **Technical Level**: Marketing technology stack investment should maintain 8%-12% of budget; below 8% infrastructure cannot support real-time analytics, while above 12% yields diminishing marginal returns. Priority deployment of SHAP and LIME interpretable AI systems requires manager adoption rates to surpass the 70% critical threshold for technology investments to translate into actual ROI improvements. Pilot experiments show firms with 79% adoption achieved 22.3% ROI growth, while those below 60% had over 50% of technology investments lie idle and wasted.

Table 3.

Metric Item	Value Range/Data
Recommended Investment Ratio in Marketing Technology Stack	8% - 12%
Algorithm Recommendation Adoption Rate Threshold	70%
Pilot Enterprise Adoption Rate	79%
Return Rate Growth (High Adoption Rate)	22.3%
Low-Efficiency Adoption Rate Threshold	<60%
Technology Investment Idle Waste Ratio (Low Adoption Rate)	>50%

5.3 Research Limitations and Future Directions

Current limitations manifest in three aspects: (1) Panel data granularity is limited to annual observations, unable to capture project-level micro-decision details, resulting in insufficient explanation of specific budget adjustment triggers. (2) Double machine learning imposes stringent sample size requirements, needing at least 100,000 observations for reliable analysis; SME data typically fall below 5,000, leaving method applicability untested. (3) Research scope is limited to U.S. firms, with emerging market enterprises comprising only 7% of the sample (Qi, Z., 2025), where reverse internationalization budget optimization logic may differ fundamentally.

Future research should: (1) Incorporate geopolitical sudden events as natural experiments (e.g., U.S.-China technology decoupling) to identify the immediate effects of institutional shocks through event study methodology. (2) Employ large language models to analyze unstructured decision texts, processing ~500,000 board minutes and management emails to excavate deep cognitive logics of budget decisions. (3) Develop blockchain-based smart contract budget systems utilizing decentralized ledgers for automated cross-border payment compliance, with prototypes tested in three pilot firms showing 60% settlement efficiency

improvements. (4) Conduct symmetrical research on emerging market firms' reverse entry into the U.S., with preliminary data showing Indian firms exhibit reverse asymmetry in budget optimization paths when facing digital institutional distance friction—a direction that will enrich theoretical boundaries.

5.4 Final Conclusions

This study confirms data-driven capability reverses 58% of institutional distance efficiency losses through dynamic capability construction, with core conclusions remaining robust after double machine learning debiasing. The DICR framework provides a dynamic paradigm for global marketing strategy in the digital era, with interpretable AI systems achieving stable 15%-30% ROI improvements in A/B tests across six U.S. firms. Theoretically, digital institutional distance reshapes institutional theory's analytical dimensions; practically, Chief Data Marketing Officer establishment, 15% risk reserve pools, and 8% technology investment ratios constitute actionable management prescriptions. Policy recommendations integrate into a three-tier system: the U.S. government should promote cross-border data flow whitelist mechanisms to reduce institutional friction coefficients; host countries must enhance digital institutional transparency to attract high-quality marketing investments; international organizations should establish global marketing data governance standards. Subsequent research will focus on SME manufacturing compliance cost optimization, addressing these firms' 23% institutional cost ratio (far exceeding large firms' 12%) by developing lightweight AI tools to serve U.S. manufacturing reshoring strategy, with expected SME compliance cost savings exceeding 40% and enhanced international competitiveness.

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Technical Standard Development and Application for Cross-Industry Data Integration of Enterprise-Level ERP Systems

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Abstract

In the context of accelerated digital transformation of enterprises, cross-industry business collaboration is becoming increasingly frequent. ERP systems, as the core management platforms of enterprises, are experiencing a growing demand for data integration with third-party systems such as WMS, CRM, and financial systems. However, current cross-industry ERP data integration faces challenges such as heterogeneous data formats (with a difference rate exceeding 40%), synchronization delays (averaging 2.3 hours), and high integration failure rates (reaching 38%). Existing national standards lack cross-industry adaptability, and the maintenance cost of enterprise-defined interfaces is high. Based on project practices of benchmark enterprises such as Unilever and Kehua Bio, this paper constructs a tripartite cross-industry ERP integration technical standard system of "interface compatibility – data consistency – security controllability" through a combination of literature research, industry surveys, case analysis, and empirical verification. The system effectively solves data integration problems in fast-moving consumer goods, manufacturing, pharmaceutical, and other industries by establishing unified interface specifications, a data element dictionary, and a tiered security mechanism. Empirical verification shows that after the application of the standard, the enterprise data integration success rate is increased to 100%, synchronization delay is shortened to the minute level, and maintenance cost is reduced by 67%. The standard has been adopted by 87 enterprises and included in the "Enterprise-Level ERP Integration Guide" of the China Software Industry Association. The research results provide a theoretical framework and practical standards for cross-industry system integration and are of great significance for promoting the digital collaborative development of enterprises.

Keywords: enterprise-level ERP system, cross-industry data integration, technical standard, interface compatibility, data consistency, security controllability, data element standardization, heterogeneous data mapping, cross-industry compliance adaptation, RESTful interface specification, data synchronization optimization, digital collaboration

1. Introduction

1.1 Research Background

In the context of the deep integration of the digital economy and the real economy, enterprise digital transformation has entered a stage of full-chain collaboration. ERP systems, as the core resource management hubs of enterprises, need to achieve in-depth data interconnectivity with WMS, CRM, financial systems, and upstream and downstream partner systems. According to the "China Enterprise Digital Transformation Report 2023," more than 75% of large and medium-sized enterprises have deployed ERP systems, of which 68% have cross-industry data integration needs. The significant differences in business characteristics and regulatory requirements across industries lead to a lack of unified standards for ERP system data formats, interface protocols, and security specifications, resulting in "data silos." Surveys have found that the failure rate of ERP and third-party system integration reaches 38%, seriously affecting operational efficiency and decision-making

accuracy. Existing national standards and international vendor solutions are difficult to meet the needs of domestic small and medium-sized enterprises. Therefore, the development of cross-industry ERP data integration technical standards that balance generality and industry adaptability, as well as technical advancement and practicality, is key to solving industry pain points and promoting digital collaboration.

1.2 Industry Pain Points

The problem of heterogeneous data formats is prominent, with cross-industry data differences exceeding 40%, mainly reflected in differences in data definitions, types, and structures. This makes data parsing between systems difficult and directly leads to integration failures. Under the traditional timed batch synchronization mode, the average data synchronization delay reaches 2.3 hours, affecting enterprises' ability to real-time grasp inventory and order progress, resulting in inventory overstock or shortages. Enterprise-defined interfaces lack unified specifications and have poor compatibility, with an integration success rate of only 62% (Li Jun, Wang Tao & Zhang Ying, 2020). Concurrent access and network fluctuations easily cause data conflicts, further reducing integration stability. Enterprises need to develop interfaces separately for different partners, increasing maintenance costs by 55%. Interface upgrade and iteration require coordination among multiple parties, with an adaptation cycle of up to 15 days. Moreover, cross-industry data transmission involves business secrets and compliance information. Some enterprises lack a complete security protection mechanism, with prominent risks of data leakage and tampering.

1.3 Research Significance

1.3.1 Theoretical Significance

The construction of a tripartite standard system of "interface compatibility – data consistency – security controllability" breaks through the limitations of existing research focusing on a single technical dimension. The proposed "industry characteristics – data attributes – integration strategy" matching model enriches the theoretical framework of cross-domain system integration. By quantitatively analyzing the patterns of cross-industry data differences, this research provides empirical support for data standardization theory and fills the gap in cross-industry ERP integration standard research.

1.3.2 Practical Significance

The standard system can be directly applied to multiple industries such as fast-moving consumer goods, manufacturing, and pharmaceuticals, effectively reducing integration failure rates, shortening synchronization delays, and lowering maintenance costs, thereby improving enterprise digital collaboration efficiency. Practices at Unilever, Kehua Bio, and others have shown that after the application of the standard, the integration success rate is increased to 100%, synchronization delay is shortened to within 30 seconds, and annual maintenance costs are reduced by millions of yuan. Meanwhile, the promotion of the standard will standardize cross-industry data integration practices, promote data interconnectivity between upstream and downstream enterprises in the industry chain, and provide technical support for the high-quality development of the digital economy.

Table 1.

Project	Description
Applicable Industries	Fast-moving consumer goods, manufacturing, pharmaceuticals, and other multiple industries
Reduced Connection Failure Rate	Connection success rate increased to 100% after standard application
Reduced Synchronization Delay	Synchronization delay shortened to within 30 seconds
Reduced Maintenance Cost	Annual maintenance cost reduced by over ten million

2. Literature Review and Related Theoretical Foundations

2.1 Domestic and International Research Status

Foreign research on ERP system integration mainly focuses on optimizing technical solutions and improving industry adaptability. SAP's Process Integration platform uses SOA architecture to achieve loose coupling integration between systems but has problems such as insufficient cross-platform adaptability and high implementation costs. Oracle's Fusion Middleware integration suite supports a variety of integration scenarios but lacks a unified cross-industry data standard, requiring extensive customized development. Academic research in this area mostly focuses on a single technical dimension or specific industries, lacking a comprehensive cross-industry standard system.

Domestic research focuses on ERP integration technology and standard development. National standards such as GB/T 30146 specify the technical requirements of enterprise integration platforms but do not clarify specific indicators for cross-industry data integration. Industry standards such as the "Manufacturing ERP System Integration Specification" have insufficient generality. Academic research has made progress in interface standardization, data consistency verification, and security protection strategies but has not yet formed a cross-industry standard system that balances generality, industry adaptability, and multi-dimensional collaboration, failing to meet the actual needs of enterprises.

2.2 Related Theories and Technical Foundations

System integration theory emphasizes the use of technical means to integrate dispersed systems into an organic whole to achieve resource sharing and collaborative work. Its core includes loose coupling integration, standardized interfaces, and data interconnectivity. Loose coupling integration reduces system dependencies through SOA, enhancing flexibility; standardized interfaces ensure interoperability; data interconnectivity addresses data format and semantic differences. This paper constructs a loose coupling, standardized cross-industry ERP integration system based on this theory.

Data standardization technology is the foundation of cross-system data interconnectivity, including three core technologies: data element dictionary, data mapping, and data verification. The data element dictionary clarifies data attributes, data mapping addresses semantic differences, and data verification ensures the accuracy of data transmission and storage. This paper formulates cross-industry data element standards and consistency assurance mechanisms based on these technologies.

Interface development technology is key to system integration. The RESTful architecture and JSON-LD format are mainstream solutions. The RESTful architecture, based on the HTTP protocol, has advantages such as statelessness, cacheability, and scalability; JSON-LD supports semantic description, enhancing data parsing consistency. This paper adopts the "RESTful + JSON-LD" combination solution to design a unified cross-industry interface specification.

Network security technology provides security assurance for data integration, including access control, data encryption, and reliable data transmission technologies. Access control ensures compliant data access, data encryption prevents data leakage and tampering, and reliable data transmission technologies ensure stable data transmission. This paper constructs a tiered security protection system in combination with industry regulatory requirements.

2.3 Comparison and Analysis of Existing Standards and Solutions

Compared with existing national standards, international vendor solutions, and the standard system proposed in this paper, existing standards and solutions have shortcomings in cross-industry adaptability, practicality, and cost control. National standards have strong generality but lack cross-industry adaptability; international vendor solutions such as SAP PI/PO are designed for specific ERP systems with limited industry adaptability. The standard system proposed in this paper achieves cross-industry generalization and supports multi-industry adaptation through unified interface, data, and security standards. It has clear cross-industry data standards, unified interface specifications, and tiered security mechanisms. The implementation cost is low, and the adaptation cycle is short, effectively filling the gap left by existing standards and solutions.

3. Cross-Industry ERP System Data Integration Requirements Analysis

3.1 Core Business Integration Requirements

ERP data integration has both common and specific needs. Common needs include order management integration for full-process data interconnectivity; inventory synchronization for real-time information sharing; financial accounting integration for data consistency; and customer information sharing for precise services. Specific needs vary by industry. The fast-moving consumer goods industry requires support for promotional activity data synchronization and multi-channel sales integration with low data delay requirements. The pharmaceutical industry needs to meet GSP compliance requirements for full traceability of drug data and long data retention periods. The manufacturing industry needs to integrate production planning and material requirements data, coordinating ERP with MES and WMS systems with low data synchronization error requirements.

3.2 Key Indicator Requirements for Data Integration

The key indicator requirements for cross-industry ERP data integration cover compatibility, consistency, security, efficiency, and cost-effectiveness. In terms of compatibility, support for 12 mainstream ERP systems is needed, with high interface reusability and high third-party system adaptation success rates. Consistency requires low data synchronization errors, efficient conflict resolution, and good semantic consistency. Security needs to reach field-level permissions, with encryption strength meeting national standards and long security audit log retention

periods. Efficiency requires short single and batch data transmission delays and fast interface response times. Cost-effectiveness requires low interface development and maintenance costs and short adaptation cycles.

Table 2.

Key Indicators	Requirement Description
Compatibility	Support for 12 mainstream ERP systems; high interface reuse rate; high success rate of third-party system adaptation
Consistency	Low data synchronization error; high conflict resolution efficiency; good data semantic consistency
Security	Field-level permissions; encryption strength in line with national standards; long retention period for security audit logs
Efficiency	Short delay for single and batch data transmission; fast interface response time
Economic Viability	Low interface development and maintenance costs; short adaptation cycle

4. Construction of Cross-Industry ERP System Data Integration Technical Standard System

4.1 Overall Framework of the Standard System

The standard system follows four design principles: combining generality with industry adaptability, balancing technical advancement with practicality, reconciling security with efficiency, and unifying expandability with compatibility. These principles ensure that the system can meet cross-industry needs while maintaining industry flexibility and ensuring data security and efficient integration. The overall architecture is divided into three layers: the core standard layer, the supporting technology layer, and the industry adaptation layer. The core standard layer includes three major modules: interface compatibility, data consistency, and security controllability, which are the core of the system. The supporting technology layer provides technical support such as RESTful architecture, JSON-LD format, and hash verification. The industry adaptation layer formulates differentiated rules for different industries. The three modules work together to achieve efficient, accurate, and secure integration across industries.

4.2 Interface Compatibility Standard

In terms of interface compatibility, eight core data interfaces are standardized, with clear field structures, data types, and interaction protocols. Taking the order management interface as an example, it includes 23 fields, of which 18 are mandatory cross-industry fields and 5 are industry-specific optional fields. The data format is unified to JSON-LD, the interface architecture is based on RESTful design, and it supports HTTP/HTTPS protocols. The interface URL is in the format "/api/v1/industry code/interface name." An innovative interface version self-adaptation algorithm is designed, which automatically identifies interface versions through the "Version" field and has an internal version mapping rule library to achieve compatibility between new and old versions, reducing adaptation time from 15 days to 2 days. Support for 12 mainstream ERP systems is provided, with dedicated adaptation plugins developed, and the compatibility test pass rate reaches over 98.6%. (Wang Fang, Liu Jie & Chen Ming, 2021)

4.3 Data Consistency Standard

Regarding data consistency standards, 327 data elements are sorted out, divided into 246 cross-industry general data elements and 81 industry-specific data elements. They are stored in XML format, supporting automatic parsing and invocation. A "master data – transaction data" two-level mapping rule is established, and data synchronization adopts a combination of "real-time synchronization + timed synchronization." The "timestamp + distributed lock" strategy is introduced to improve conflict resolution efficiency. A multi-layer data verification mechanism is established, including format verification, logic verification, and hash verification, controlling the data error rate within 0.01%.

4.4 Security Controllability Standard

In terms of security controllability standards, a field-level permission matrix based on the RBAC model is designed, with permissions configured differently according to industries and supporting dynamic adjustment. A "TLS 1.3 + National Cryptography SM4" dual-encryption scheme is adopted, with data storage using AES-256 encryption and regular key rotation. A data transmission automatic retransmission mechanism is designed, and a full-process security audit mechanism is established, with log retention periods of ≥1 year.

5. Empirical Application and Effect Verification of the Standard System

5.1 Empirical Application Case Design

Three typical industries' benchmark enterprises were selected as pilot cases: the fast-moving consumer goods industry (Unilever), the pharmaceutical industry (Kehua Bio), and the manufacturing industry (Lanchuan Auto Parts Enterprise). These cases cover different scales and business scenarios and have industry representativeness. The pilot period was 6 months (from July 2023 to December 2023), divided into four stages: solution deployment, trial operation, formal operation, and effect evaluation. Data collection was carried out through "system automatic statistics + manual verification," and the evaluation indicators included integration success rate, data synchronization delay, data error rate, maintenance cost, adaptation cycle, etc. Statistical verification was performed using paired sample t-tests, analyzed through SPSS 26.0 software, with a significance level $\alpha =$ 0.05.

5.2 Fast-Moving Consumer Goods Industry Application Case (Unilever)

Unilever implemented three key measures: deploying standard interface adaptation plugins to unify the format of the distributor's WMS system; enabling interface version self-adaptation mechanisms to achieve automatic adaptation between new and old systems; and deploying data synchronization and verification modules to ensure real-time data synchronization and accuracy. The implementation cycle was 1 month, 80% shorter than traditional solutions. After application, the integration success rate increased from 65% to 100%, data synchronization delay shortened from 2.1 hours to 15 seconds, inventory counting error rate decreased from 8.7% to 0.3%, interface maintenance cost reduced by 67%, and the adaptation cycle for new distributors shortened to 2 days. (Zhang Lei, Zhao Yang & Li Na, 2022)

5.3 Pharmaceutical Industry Application Case (Kehua Bio)

Kehua Bio focused on three main tasks: standardizing drug compliance data fields to meet GSP requirements; deploying tiered access control modules to ensure data security; and adopting a "real-time synchronization + hash verification" mechanism to achieve precise data integration. The implementation cycle was 45 days. After application, data synchronization delay shortened from 4 hours to 12 seconds, traceability accuracy reached 100%, interface development cost reduced by 56%, and maintenance cost reduced by 70%.

5.4 Manufacturing Industry Application Case (Lanchuan Auto Parts Enterprise)

The enterprise completed the integration of ERP with MES, WMS, and customer order systems: replacing custom interfaces with standard RESTful interfaces; resolving semantic differences in data through data mapping rules; and enabling automatic retransmission mechanisms to enhance stability. The implementation cycle was 2 months, 50% shorter than traditional solutions. After application, interface response time shortened from 1.2 seconds to 0.4 seconds, production plan synchronization delay shortened from 1.5 hours to 25 seconds, data error rate decreased from 1.8% to 0.008%, interface maintenance cost reduced by 70%, new system launch cycle shortened to 1 month, and customer order delivery punctuality rate increased to 99%.

Table 3.

Project	Current Metrics	Metrics After Implementation
Implementation Period	Traditional solution: 4 months	2 months
Interface Response Time	1.2 seconds	0.4 seconds
Production Plan Synchronization Delay	1.5 hours	25 seconds
Data Error Rate	1.8%	0.008%
Interface Maintenance Cost	Annual maintenance cost: 2 million yuan	Reduced by 70%
New System Launch Cycle	3 months	1 month
Customer Order Delivery Timeliness	Not specified	99%

5.5 Statistical Verification Results

Twenty cross-industry enterprises (covering fast-moving consumer goods, pharmaceuticals, manufacturing, services, etc.) were selected, and data on five core indicators before and after application were collected for paired sample t-tests. The results showed that the integration success rate increased from 63.2% to 99.5%, data synchronization delay shortened from 826.5 seconds to 22.8 seconds, data error rate decreased from 2.1% to 0.009% (Liu Min & Chen Jing, 2020), maintenance cost decreased from 3.2 million yuan/year to 0.98 million yuan/year, and adaptation cycle shortened from 14.8 days to 1.9 days. All indicator p-values were less than 0.01,

with p-values for integration success rate, data synchronization delay, and adaptation cycle less than 0.001, indicating that the standard application significantly improved all indicators, verifying the effectiveness and generality of the standard system.

Table 4.

Project	Current Status Metrics	Post-Implementation Metrics
Implementation Period	Traditional solution: 4 months	2 months
Interface Response Time	1.2 seconds	0.4 seconds
Production Plan Synchronization Delay	1.5 hours	25 seconds
Data Error Rate	1.8%	0.008%
Interface Maintenance Cost	Annual maintenance cost: 2 million yuan	Reduced by 70%
New System Launch Cycle	3 months	1 month
Customer Order Delivery Timeliness	Not specified	99%

6. Conclusions and Future Work

6.1 Research Conclusions

This paper addresses the challenges of heterogeneous data formats, synchronization delays, and security risks in cross-industry ERP system data integration. Through industry surveys, theoretical research, and empirical verification, a tripartite cross-industry ERP data integration technical standard system of "interface compatibility – data consistency – security controllability" was constructed. The research clarified the core needs and key indicators of cross-industry ERP data integration, covering five major categories of indicators: compatibility, consistency, security, efficiency, and cost-effectiveness, providing a basis for the construction of the standard system. Meanwhile, a standard system comprising three major modules — interface compatibility, data consistency, and security controllability — was established. Specific standards such as eight core interfaces, 327 cross-industry data elements, and tiered security mechanisms were defined, achieving a unity of cross-industry generalization and industry adaptation. After empirical verification at 20 enterprises including Unilever and Kehua Bio, the standard system can increase the integration success rate to over 99.5%, shorten data synchronization delay to within 30 seconds, and reduce maintenance costs by 69.4% (Liu Min & Chen Jing, 2020), significantly improving the effectiveness of cross-industry data integration. Moreover, the standard system has been adopted by 87 enterprises and included in industry guidelines, with supporting tools developed, demonstrating strong practicality and promotability. It provides technical support for enterprise digital collaborative development.

6.2 Research Limitations and Future Work

The research limitations are mainly reflected in two aspects: first, the limited industry coverage of the standard system, which currently mainly covers six industries including fast-moving consumer goods, pharmaceuticals, and manufacturing, with insufficient adaptation to emerging industries such as artificial intelligence and the metaverse; second, the need for further verification of the application effects in ultra-large enterprises with more than 100,000 employees and over 100 systems, as the existing pilot enterprises are mainly large and medium-sized enterprises. Future research will focus on the following directions: continuously expanding the industry coverage of the standard system, formulating dedicated adaptation rules for emerging industries based on their business characteristics to improve the standard system; conducting application pilots in ultra-large enterprises to optimize the performance and stability of the standard in complex scenarios; strengthening international cooperation to promote the internationalization of the standard and enhance the international influence of Chinese enterprise-level software technology; and combining new technologies such as AI, blockchain, and 5G to continuously optimize the technical solutions of the standard system and improve the intelligence and security levels of data integration.

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Research on the Impact of Corporate ESG Performance on ROA

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Abstract

Against the backdrop of China's transition towards high-quality economic development, the impact mechanism of corporate ESG performance on its market value has become a key proposition in deciphering the path of sustainable development. This article is based on data from A-share listed companies from 2015 to 2021, integrating stakeholder theory, resource-based theory, and signal transmission theory to construct a three-dimensional theoretical framework that includes a superlinear production function for green technology innovation, an exponential decay model for supply chain default probability, and a fractional function for governance signal efficiency. The mixed OLS model is used to empirically test the impact of ESG performance on corporate return on assets (ROA). Research has found that for every one level increase in a company's ESG score, ROA can significantly increase by 1.617%, and the positive effect of non-state-owned enterprises is significantly higher than that of state-owned enterprise; Mechanism analysis shows that environmental responsibility improves production efficiency through the marginal revenue increase of green patents and the threshold triggering mechanism of policy subsidies. Social responsibility optimizes asset turnover by reducing the probability of supply chain default. Governance level relies on the degree of marketization to regulate signal transmission efficiency and reduce financing costs. Based on the conclusion, this article proposes a "four-dimensional synergy" policy framework: enterprises need to establish green patent portfolios and dynamic equity incentive mechanisms, the government should implement a tiered environmental subsidy and differentiated disclosure system, investors can develop ESG derivatives and improve risk management models, and the public can promote corporate transparency practices through a technology empowered supervision network, providing theoretical and empirical support for solving the "greenwashing" dilemma and addressing international ESG trade barriers.

Keywords: ESG performance, asset return rate, high quality development

1. Introduction

From the initial proposal of the concept of high-quality development at the 19th National Congress of the Communist Party of China, to its designation as the primary task for comprehensively building a modern socialist country at the Third Plenary Session of the 20th CPC Central Committee in 2024, high-quality development has become part of the core to China's economic agenda. China's economic development has shifted from a stage of high-speed growth to a stage of high-quality development. Data from the National Bureau of Statistics shows that China's GDP growth rate has gradually adjusted from 7.9% in 2012 to 5.2% in 2023, while the mean energy consumption per unit of GDP has decreased by 26.4% cumulatively during the same period. These figures all indicate the truth that current slowdown in growth is not merely a sign of weak growth momentum but rather an inevitable outcome of structural adjustments. To better cope with this revolution, enterprises are expected to evolve from only participants of economic benefits to comprehensive practitioners that simultaneously enhance environmental responsibility, social value, and governance efficacy, thus becoming

part of the crucial actors in China's pursuit of high-quality development.

In response to the increasing global demand for overall corporate practices, ESG (Environmental, Social, and Governance) was first introduced as a concept for investment reference by the United Nations Principles for Responsible Investment (PRI) in 2006, aiming to provide enterprises with a more environmentally friendly development path and a more socially responsible corporate governance approach. This concept quickly gathered significant global attention. And before long the concept was put into practice. In the current development stage of China, the promotion of this concept undoubtedly aligns closely with China's pursuit of high-quality development. In recent years, the concept of ESG has won considerable attention from various fields in China driven by domestic strong intention to promote high-quality corporate development. According to UN PRI statistics, by the end of 2022, China's ESG asset scale had exceeded 1.2 trillion RMB, a 338.9% increase from 0.37 trillion RMB in 2019.

In response to the rising interest in ESG domestically in recent years, relevant policies have also emerged one after another. As early as 2021, the State Council of the People's Republic of China has raised "Action Plan for Carbon Dioxide Peaking Before 2030" explicitly stated that ESG should be joined into corporate development strategic planning. This paper intends to analyze the relationship between corporate ESG performance and corporate value based on recent ESG scores and operational indicators of A-share listed companies in China by using econometric methods to provide empirical support for this relationship. Based on the mentioned findings, this paper will analyze the financial impact of organizational fulfillment of environmental, social, and governance obligations within the framework of China's current institutional background and business ecosystem. Accordingly, it will propose corporate practice directions aligned with local characteristics, administrative suggestions for building a standardized disclosure mechanism, and contribute to cultivating a sustainable value assessment system for the investment reference.

2. Literature Review and Theoretical Framework

2.1 Overall Literature Review

Overall, domestic research on the correlation between ESG performance and corporate value is relatively scarce and can still be considered in its nascent stage. In contrast, foreign research is more mature, with a considerable body of existing studies, although consensus has not been reached. Current scholarly views, both domestic and international, on the relationship between ESG performance and corporate value can be broadly categorized into three perspectives: Most scholars believe that superior ESG performance positively impacts corporate value through pathways such as risk reduction, resource optimization, and reputation enhancement. For example, Khan (2016), analyzing data from 1900 global enterprises, found that the top one-third of companies by ESG score had an average Return on Assets (ROA) 4.8% higher than the bottom third, an improvement attributable to increased operational efficiency from environmental management.

Apart from this view, some scholars also oppose the idea that ESG performance has a positive effect on corporate value. For instance, Friedman (1970) argued that corporate investment in ESG actually deviates from enterprises' primary purpose of maximizing shareholder profit. The additional expenditure on ESG will surely include unnecessary costs and finally reduces corporate value. Furthermore, there exists the possibility of "greenwashing" by companies pursuing ESG performance. Some scholars have concluded that high CSR (Corporate Social Responsibility) investment (especially in the environmental dimension) is negatively correlated with capital allocation efficiency, with similar, more pronounced conclusions found among highly leveraged firms. They suggest the underlying reason is that ESG projects crowd out core business investment, and management might use them to mask inefficient operations.

Beyond these two views, some scholars believe that the value effect of ESG for a company depends on specific contextual factors, such as industry attributes, ownership nature, and moderating institutional environments. Barnett and Salomon (2012) found a U-shaped curve relationship between ESG investment and ROA, where positive returns only materialize when ESG scores exceed an industry threshold.

When further dividing corporate ESG performance into positive and negative performance, different research findings emerge. Some researchers believe that compared to the enhancement of corporate value due to positive ESG performance, negative ESG performance causes greater damage to corporate value. While Aouadi and Marsat (2018) hold a different view, suggesting that companies with ESG controversies might actually achieve higher corporate value because controversial ESG performance can attract more attention to a company's ESG performance.

Building on the aforementioned research foundation regarding the relationship between corporate ESG performance and corporate value, this paper focuses on the relationship between corporate ESG performance and its Return on Total Assets (ROA). It attempts to combine existing theories to propose a theoretical model on how ESG scores affect ROA. The research sample is focused on A-share listed companies in China, conducting

empirical research by constructing a regression model with listed company data. This paper anticipates finding a promoting effect of positive corporate ESG performance on corporate value, interpreting this effect to reveal the economic consequences of corporate ESG responsibility fulfillment under China's current institutional background and market environment. It aims to provide references for Chinese enterprises in fulfilling ESG responsibilities, offer suggestions for the government to improve ESG information disclosure systems, help investors establish responsible investment concepts, and encourage the public to develop related awareness.

2.2 Theoretical Explanation

Based on the economic background of China's pursuit of high-quality development and the policy background aimed at achieving two carbon goals (carbon peaking before 2030 and carbon neutrality before 2060), this paper attempts to theoretically analyze the pathways through which ESG performance affects corporate value from three different theoretical perspectives: Stakeholder Theory, Resource-Based Theory, and Signaling Theory.

- **Stakeholder Theory**: Proposed by Freeman (1984), Stakeholder Theory states that in their production and operational activities, enterprises are influenced not only by their counterparts but also by various pressure groups and entities directly or indirectly affected by the enterprise (such as the natural environment). Therefore, enterprises need to coordinate relationships with relevant stakeholders including shareholders, employees, the government, and the community. From an ESG perspective: In the environmental dimension, companies can increase technological investment to avoid potential future environmental fines and reduce asset losses from sudden environmental issues. From the perspective of social responsibility, they can reduce labor disputes or production interruptions by increasing employee welfare and strengthening internal responsibility management, thereby improving asset turnover. Considering governance dimension, board diversity and establishing effective supervision mechanisms to prevent management corruption can increase investor trust, help attract more capital, and lower equity financing costs.

- **Resource-Based Theory:** Proposed by Wernerfelt (1985), Resource-Based Theory holds the opinion that unique resources or capabilities can be the source of a firm's sustained competitive advantage no matter tangible or intangible, can be the source of a firm's sustained competitive advantage. According to this point of view, engaging in ESG practices helps enterprises obtain green patents and related technologies, forming a degree of technological ability and enhancing asset profitability. Secondly, under the domestic context of pursuing high-quality development and the specific carbon goals, enterprises with better ESG performance can gain prior access to scarce resources such as government subsidies and green credit quotas. Also, enterprises can build and improve their supply chains through management system optimization under ESG practices or effective internal sharing of ESG data, thus promoting cooperation with both upstream and downstream partners.

- **Signaling Theory:** Originating from Spence's (1973) theory, Signaling Theory suggests that firms need to deliver high-quality signals to the market to reduce information asymmetry and ultimately lower transaction costs. Good ESG performance sends different signals to various groups: To investors, it signals the company's commitment to sustainable development, attracting more long-term value investment and lowering equity financing costs. From the perspective of consumers, it signals green development, helping to enhance brand influence, potentially increase product premium rates, and boost operating revenue. In the eyes of the government, it signals the firm's willingness and capability to practice long-term green development. For instance, if a company's ESG information disclosure aligns with current government policy directions and the economic situation, it may receive relevant policy support, such as priority for government procurement orders or tax reduction benefits.

Beyond this simple mechanism analysis, this paper will attempt to combine existing theories to construct simple models for the environmental, social, and governance dimensions through which ESG scores affect Return on Total Assets (ROA), trying to elucidate the mechanisms behind the positive impact of ESG scores on ROA.

3. Empirical Analysis

3.1 Research Design

The econometric model of this paper references the design approach of Wang Bo et al. (2022). The research selects A-share listed companies in China from 2015 to 2021 as the sample. Part of the corporate ESG scores are sourced from Huazheng ESG ratings obtained from the Wind database, while other data are from the CSMAR database. Simple processing was conducted by deleting samples with missing values.

3.1.1 Variable Selection and Measurement

The main variable names, codes, and definitions are shown in the table below: Variable Names, Codes, and Definitions.

Table 1. Variable Name, Code, and Definition

Type of Variable	Variable Name	Variable Code	Variable Definition
Dependent Variable	Return of Assets	ROA	Return on Assets = Net Profit / Average Total Assets
Independent Variable	Huazheng ESG Score	ESG	The score ranges from 9 to 1 according to the Huazheng ESG evaluation system.
Control Variable	Patent Application	PAT	Number of patents applied for by the company that year
	The shareholding ratio of the largest shareholder	TOP	Number of shares held by the largest shareholder / Total shares * 100
	Age of Enterprise	AGE	Time since the company was founded
	Proportion of Independent Directors	IND	Number of independent directors/Number of board members
	Management Shareholding	HO	Number of company shares held by management / Total shares * 100
	Year-end total assets_ RMB	AS	Total assets at the end of the period in RMB

ESG Performance: The Huazheng ESG rating system has a total of nine grades (C, CC, CCC, B, BB, BBB, A, AA, AAA). This paper assigns scores using a nine-point system, with higher scores representing better ESG performance. For final calculation, the average of quarterly scores is taken to measure annual ESG performance.

Corporate Value: This paper uses listed companies' Return on Assets (ROA) as a proxy variable for measuring corporate value.

Control Variables: In the econometric model, this paper uses Patent Applications, Top 1 Shareholder Ratio, Firm Age, Independent Director Ratio, Management Shareholding Ratio, and Year-end Total Assets as control variables.

3.1.2 Descriptive Statistics of Variables

Table 2. Descriptive Statistics of Variables

VarName	Obs	Mean	SD	Min	Median	Max
Return of Assets	31528	0.038	0.204	-30.688	0.039	7.445
Huazheng ESG Score	37196	4.089	1.062	1.000	4.000	8.000
Patent Application	37195	27.962	227.251	0.000	3.000	13536.000
The shareholding ratio of the largest shareholder	36345	34.287	15.105	0.290	31.990	89.990
Age of Enterprise	37196	11.066	7.529	1.000	10.000	32.000
Proportion of Independent Directors	37196	0.378	0.065	0.000	0.364	0.800
Management Shareholding	35967	13.201	19.797	0.000	0.363	89.990
Year-end total assets_ RMB	37084	6.37e+10	8.21e+11	84823.600	3.43e+09	3.52e+13

The above table (Descriptive Statistics of Variables) presents the descriptive statistics for the variables used in the paper. The table includes the number of observations (Obs), mean (Mean), standard deviation (SD), minimum (Min), median (Median), and maximum (Max). From the main economic indicators, the mean Return on Assets is only 0.0375, but the standard deviation is relatively large, and extreme values exist (minimum -30.69, maximum 7.45), indicating significant differences in profitability among enterprises. The mean and standard deviation for year-end total assets are extremely large, indicating a severely right-skewed distribution of asset size.

Regarding ESG and innovation: The mean Huazheng ESG score is 4.09 (range 1-8). The mean number of patent applications is 27.96, with a high variance of 227.25 and a maximum reaching 13536, indicating innovation

activities are concentrated in a few enterprises. From the governance structure perspective, the mean Top 1 Shareholder Ratio is 34.29% (with some approaching 90%), indicating excessive ownership concentration. The mean Independent Director Ratio is 37.79%, meeting the regulatory minimum requirement, but some enterprises have 0%. The mean Management Shareholding Ratio is 13.20%, with large disparities, some reaching nearly 90%. Additionally, the mean firm age is 11.07 years (minimum 1 year, maximum 32 years), indicating the sample includes both start-ups and mature companies.

3.1.3 Model Specification

$$ROA_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \sum Controls + \varepsilon_{i,t}$$

In the above formula, i represents the individual firm, t represents the year, and Controls refers to the several control variables set previously.

3.2 Research Results and Tests

3.2.1 Empirical Analysis Results

Table 3. Empirical Analysis Results

VARIABLES	(1) ROA
ESG	0.016***
	(13.459)
PAT	0.000
	(0.949)
TOP	0.000***
	(6.169)
AGE	-0.001***
	(-5.380)
IND	-0.023
	(-1.260)
HO	0.000***
	(4.762)
AS	0.000**
	(-2.550)
Constant	-0.030***
	(-3.394)
Observations	29,896
R-squared	0.012

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1.

This paper uses a pooled OLS model to test the model. The regression results are shown in the table above. The positive and significant regression coefficient of ESG on corporate value (ROA) indicates that companies in the Chinese market can, to some extent, enhance their economic value by improving their own ESG performance.

3.2.2 Robustness Tests

3.2.2.1 Using Robust Standard Errors

Table 4. Empirical Analysis Using Standard Robust Estimation

VARIABLES	(1) ROA
ESG	0.016***
	(6.032)
PAT	0.000***
	(4.837)
TOP	0.000***
	(5.243)
AGE	-0.001***
	(-3.892)
IND	-0.023**
	(-2.338)
HO	0.000***
	(8.770)
AS	0.000***
	(-11.560)
Constant	-0.030***
	(-4.347)
Observations	29,896
R-squared	0.012

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1.

The homoscedasticity assumption of the classical linear regression model (OLS) cannot be met with data from Chinese listed companies. White (1980) pointed out that when the error term variance changes with explanatory variables (i.e., heteroscedasticity exists), the conventionally estimated standard errors are biased, leading to distorted significance in t-tests and F-tests. To ensure the validity of hypothesis testing results is not distorted by heteroscedasticity, robust standard errors are used. In the model using robust standard errors, the regression coefficient for the core explanatory variable, Huazheng ESG score, remains significant. Furthermore, many control variables that were insignificant in the original model become significant in the corrected model. This suggests that the previously obtained regression results are robust.

3.2.2.2 Adding Control Variables

In addition, this study conducts a robustness test on the original model by adding control variables. The original model's R-squared is only 0.012, indicating a low goodness of fit. Therefore, two control variables, Cash to Total Assets ratio and Revenue Growth (current revenue compared to previous period's revenue), were added to the original model. A higher Cash to Total Assets ratio generally reflects stronger corporate liquidity and better ability to withstand external shocks, while Revenue Growth reflects the firm's development trend. The regression results after adding these two control variables are as follows:

Table 5. Results of Empirical Analysis with Control Variables

VARIABLES	(1) ROA
ESG	0.014***

	(12.136)
PAT	0.000
	(1.081)
TOP	0.000***
	(5.983)
AGE	0.000***
	(-3.451)
IND	-0.018
	(-1.001)
HO	0.000***
	(3.658)
AS	0.000*
	(-1.843)
CAS	0.105***
	(11.910)
REV	0.000
	(0.400)
Constant	-0.046***
	(-5.054)
Observations	29,841
R-squared	0.017

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1.

After adding the new control variables, the correlation coefficient between the explanatory variable and the dependent variable decreased slightly but remained significant. Meanwhile, the overall model R-squared increased from 0.012 to 0.017, indicating improved model fit. The main conclusion of the original model still holds, so the model passes the robustness test.

3.2.2.3 Heterogeneity Analysis

Under China's current context, whether an enterprise is a state-owned enterprise (SOE) impacts its organizational form, social responsibility, policy requirements, and other dimensions. SOEs face greater need to comply with national policy constraints and, to some extent, set an example for other enterprises. On the other hand, because investors and the public have higher expectations regarding policy responsiveness from SOEs themselves, when non-SOEs respond well to national policies concerning ESG performance, investors and the public might have a stronger positive reaction. Based on this theory, the correlation between Huazheng ESG scores and ROA for non-SOEs would be stronger, meaning the correlation coefficient would be larger numerically. The regression results are as follows:

Table 6. Heterogeneity Analysis Empirical Results

	(1) State-owned enterprises (SOEs)	(2) Non state-owned enterprises(NSOEs)
VARIABLES	ROA	ROA
ESG	0.008***	0.020***
	(8.879)	(10.993)
PAT	0.000	0.000
	(0.716)	(0.978)

TOP	0.000***	0.001***
	(6.500)	(4.100)
AGE	0.000***	-0.001***
	(-2.757)	(-4.35865)
IND	-0.024*	-0.016
	(-1.686)	(-0.579)
HO	0.001***	0.000**
	(3.137)	(2.370)
AS	0.000***	0.000
	(-3.346)	(-0.847)
Constant	-0.003	-0.048***
	(-0.510)	(-3.362)
Observations	10,619	18,582
R-squared	0.015	0.012

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1.

It is evident that, given both coefficients are significant, the correlation coefficient between ESG performance and ROA for non-SOEs is significantly higher than that for SOEs, which is largely consistent with the above hypothesis.

3.2.2.4 Empirical Results and Theoretical Analysis

The empirical results of this paper provide support for the earlier theoretical framework and verify the internal mechanisms through which ESG performance enhances corporate value via multi-dimensional pathways. First, the significant positive effect of ESG score on ROA (coefficient 0.01617) supports the expectations of Stakeholder Theory: environmental responsibility investment enhances asset returns through technological innovation and risk hedging; social responsibility fulfillment optimizes turnover efficiency through supply chain synergy; governance improvement reduces financing costs through signaling.

Second, heterogeneity analysis reveals a stronger ESG effect for non-SOEs, which is also largely consistent with the core proposition of Signaling Theory. SOEs' inherent policy endorsement weakens the marginal utility of ESG signals, while non-SOEs rely more on ESG performance to signal governance efficacy (such as measures to reduce agency costs and enhance transparency), thereby gaining higher premiums in a marketized environment.

4. Conclusions and Prospects

This paper studies the relationship between ESG practice and corporate value within the era context of China's transition to high-quality development. By integrating theoretical analysis with empirical testing, it reveals the mechanisms and intrinsic connections. Citing China's structural shift from 7.9% GDP growth in 2012 to 5.2% in 2023 alongside a 26.4% reduction in energy consumption per unit of GDP, the paper argues that the corporate role is evolving from merely an economic actor to a comprehensive vehicle for synergistic enhancement of environmental, social, and governance (ESG).

Addressing the divergent conclusions in existing literature—proponents like Khan (2016) finding ESG leaders with ROA 4.8% higher, opponents linking high CSR investment (especially environmental) to negative capital allocation efficiency, and contextualists like Barnett (2012) proposing a U-shaped curve — this study innovatively constructs its own theoretical framework.

By utilizing data from A-share listed companies (2015-2021), the empirical research employs the nine-level Huazheng ESG score as the independent variable and ROA as the dependent variable, with control variables including patent applications and ownership structure in a pooled OLS model. Results show that improved ESG scores lead to significant ROA growth. Robustness tests confirm its reliability: the ESG coefficient remains significant at the 0.001 level using robust standard errors; model R^2 increases by 41.7% after adding cash ratio (liquidity indicator) and revenue growth rate (development trend indicator). Finally, heterogeneity analysis through grouped regressions for SOEs and non-SOEs concludes that the positive effect of ESG performance on ROA is stronger for non-SOEs.

These findings not only validate the positive driving effect of ESG performance on corporate value but also provide a quantitative basis and pathway selection for constructing an ESG system with Chinese characteristics.

4.1 Policy and Practical Recommendations Based on Research Findings

The core regression analysis indicates a significant positive correlation (coefficient 0.01617) between a firm's Huazheng ESG score and its ROA, suggesting firms can no doubt enhance performance by improving their ESG expression. The significance of most control variable coefficients also offers reference, implying ESG actions boost value through multiple ways like promoting innovation and improving management. Drawing from the theoretical and empirical models, recommendations are proposed from four primary dimensions — corporate, governmental, investor, and public — to systemically enhance ESG performance, thus improving corporate value.

4.1.1 Corporate Perspective

To earn sustainable competitive advantages, enterprises are required to develop dynamic innovation systems focused on clean technologies and actively strive for international patent protection. Industry leaders like CATL, with its solid-state battery development, and Sinopec, through its dedicated new energy research division, both demonstrate how strategic Research and Experimental Development(R&D) can create significant technological barriers. Meanwhile, corporate governance structures require strengthening by attracting ESG-conscious long-term investors, tying executive compensation to clear sustainability targets such as emission reductions, and forming independent ESG committees that include external experts. These steps help reduce agency costs and discourage superficial compliance. Moreover, resource allocation should be differentiated according to company profiles: large firms should prioritize decarbonizing their core operations; SMEs are better positioned to develop specialized solutions for niche markets; and mature enterprises must overcome organizational inertia through structural reforms and cultural renewal.

4.1.2 Government Perspective

Promoting corporate ESG adoption demands a synthetic policy framework that combines regulatory mandates with market incentives. For instance, forcing listed companies to disclose ESG information can be paired with tax benefits for specific highly-rated firms. Corresponding to it, China's carbon market is expected to expand to cover high-emission sectors such as steel and cement, while financial derivatives like carbon futures can enhance market mechanisms. To address implementation bottlenecks, the government should support R&D in key areas like carbon capture, foster innovation in green finance, and incorporate ESG into specialized education programs. Authorities ought to help businesses align with emerging international standards (e.g., the EU's CBAM and CSRD), while strategically promoting global recognition of Chinese ESG frameworks through initiatives like the Belt and Road. Finally, establishing a dynamic evaluation system with unified ESG metrics and regular policy impact assessments will enable evidence-based refinements and allow differentiated approaches for state-owned and private enterprises.

4.1.3 Investor Perspective

Investors possess significant power to influence corporate conduct through their capital allocation. Shifting funds toward ESG-aligned assets, thus creating dedicated financial instruments such as ESG index futures, and advocating for stronger links between executive pay and sustainability performance are effective measures. Deepening the integration of ESG factors into risk management is equally critical. This can involve developing machine learning-based early-warning models to monitor compliance risks and conducting rigorous supply chain penetration audits to identify potential greenwashing. Furthermore, investment decisions can be enhanced by leveraging alternative data — for example, analyzing green patent metrics and applying natural language processing to corporate disclosures. Such approaches help uncover alpha opportunities, assess genuine management commitment, and systematically embed ESG performance into investment team evaluations and accountability frameworks.

4.1.4 Public Perspective

Consumer choice remains a decisive market force. Preferences for certified green products and support for green initiatives like ESG white lists directly reward responsible corporate behavior and penalize poor performers. At the community level, joint participation enables local stakeholders to monitor corporate environmental practices. Meanwhile, the labor market exerts pressure through the job selections of candidates and the shared experiences of employees on professional platforms, collectively building a reputational pricing mechanism for corporate ESG performance. Technological platforms further amplify civic oversight. Applications like which integrate public reporting, corporate data, and government monitoring, create a transparent supervision network that raises overall accountability standards.

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Human Resource Management in Church Development Projects: A Case of Maseno North Diocese of the Anglican Church in Kenya

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Abstract

Upon the departure of the white missionaries from Kenya, leadership of church development projects was handed over to the African Christians. Some of these projects have since stalled, while others are still operational, though at a minimal scale. The study sought to investigate the issues revolving around management of church development projects with specific emphasis on management of human resources in Maseno North Diocese of the Anglican Church of Kenya (ACK). The overall objective of the study was to investigate human resource management issues facing sustainable church development projects in ACK Maseno North Diocese. Scientific management theory was employed as a tool for analysis. Methodologically, this study employed mixed methods for purposes of complementarity. The study population consisted of ten development projects which were in existence. Random sampling through balloting was employed to select the study subjects. The grounded theory approach: in which questionnaires, structured interviews, field notes and Focus Group Discussions (FGDs) were used to collect the data. The study revealed that there was no scheme of service for ACK nursery teachers as well as ACK polytechnic instructors and managers. There was no house allowance, salary scales, timely and consistent salaries. Equally, there was no medical cover and gratuity. The study recommended that ACK church project management committees should develop written human resource policies on recruitment, retention, remuneration and motivation of staff and hand them over to various project managers to enhance their performance.

Keywords: management, projects, human resources, development

1. Introduction

The study examined human resource issues that face church development projects in ACK Maseno North Diocese. This was done by focusing on recruitment of church personnel, training of the workers and dependence of the church on European missionary personnel. It is assumed that the use of unqualified personnel in church affairs led to mismanagement of church development projects. Unfortunately, training programs for church leaders are not sufficient. The leaders are not prepared for managerial roles that they are called to play when they join the ministry (Kivava, 2017). Ninahazwe, Samita and Kearney, (2019) highlight the centrality of human capital through education, training skills as well as vocational training and education enhance productivity and sustainability in informal businesses. This was in the context of Burundian women refugees in Nairobi. Arudo (2010) assessed the factors that influenced the involvement of Christian Community Services (CCS) in the ACK Dioceses of Maseno South and West. According to him, it was on the basis of the church involvement in community services that CCS equally experienced internal conflict and management issues, leading to the collapse of many CCS projects in Maseno South and West Dioceses. The study established that issues that affected the management of CCS included low staff morale and lack of clearly defined job description. Other

issues included lack of open communication system among the project staff, resulting in low interpersonal relationship, suspicion and unfounded fears. In addition, responsibility without authority made it difficult to run and implement project plans. What this means is that lack of clearly spelt out management systems negatively affected programme performance.

1.1 Background of the Study

In some denominations, the pastor is constantly under pressure to produce growth in numbers and develop new programmes. This happens despite the fact that most pastors have not been trained to manage large and dynamic organisations (Myron, 2007). He further insists that part of the reason for the failure of church is the training of its leaders. Currently, most leaders in Christian organisations get the bulk of their management training from secular business world. This means that many Christian leaders manage God's work using secular Philosophy that has been condemned by God. The above observation was supported by Gangel, (1997), who held similar views that many people holding leadership positions lacked the requisite skills. Ill-equipped managers and workers were more likely to create than resolve conflicts. While all these works cited above are related to human resource development in terms of training, none of them addressed the human resource issues in development projects in ACK Maseno North Diocese. The literature though general to church organisations, highlights the importance of trained personnel in an organisation. The current study examined the extent to which training of personnel affected the performance of development projects in ACK Maseno North Diocese.

Mathenge and Ofunya (2015) highlight on the recruitment of the human resource personnel in the Presbyterian church of East Africa, St. Andrews Nairobi Kenya. The research findings revealed that a big percentage of workers of 59.5 were sourced by the church leadership. Only 8.1% of the personnel got their employment after applying for the advertised positions. The rest of the 32.4% were non-committal on how they were hired. The same research indicated that 54.1% of the church personnel were hired based on their spiritual gifts and not for the spiritual aptitude to the job. A 21.6% indicated that leadership was a calling and 2.7% were uncertain of the reasons for their job placement. A percentage of 21.6 declined to comment (Mathenge & Ofunya, 2015, 49).

Hastings (1998) took a historical perspective to analyse the human resource problem of most church projects. He noted that after independence, churches recruited into the mission people of low academic qualifications. The rural areas in particular were more adversely affected in terms of untrained personnel, leading to low performance of many church development projects. Hastings (1998) shares similar sentiments of Gangel (1997) that people holding key positions in the church lacked the required skills and competencies. These findings informed the study on the reasons why church projects have failed over a period of time in general. The current study used the information to assess the training of the personnel and their impact on church development projects in ACK Maseno North Diocese.

Maina (2014) revealed that the competence of staff influenced effective and timely completion of projects. He asserted that construction of structures is a continuous activity in most church sponsored projects. The effectiveness of the project team tasked with church's construction project administration depends to a large extend on the project's staff capacity relative to the demands placed upon them. To be effective, church's construction projects need to have sufficient and capable staff with appropriate mix of skills and expertise, the motivation and the will to act and the incentives and the resources necessary to achieve their mandate. The above literature helped the study to highlight the effect of staff competence on construction of church projects in ACK Thika Diocese. However, the current study intended to assess the extent to which staff competence contributed to stalling or collapse of church projects in ACK Maseno North Diocese.

Speckman (2001) related poor human resource development in Africa to dependency on White Missionaries. Part of it is that Africans had not given themselves space to reflect on their God-given potential and its ability to transform their lot decisively. He further asserted that if sustainability was to be achieved, the solution does not lie in pumping more money into the hands of corrupt managers in the name of development. Rather, it lies in investing in the people and transforming the social structures in a people centred development agenda (Speckman, 2001, 286). The above sentiments of Speckman are in agreement with the theology of relations which put the person at the centre of development. Speckman (2001, 286) held similar views with Gangel (1997) and Hastings (1998) that church trained personnel lacked the prerequisite skills. Speckman (2001) adds that poor human resource is caused by dependency syndrome. Over-dependency on foreigners made African churches not to train their own personnel. The study, therefore, tries to contextualise this dependency and assess the extent to which untrained personnel impacted on management, leading to the collapse of development projects in ACK.

Kondwo (1998) reports that in Uganda, both the laity and the clergy nurtured a misconstrued notion of development partnership. When dioceses submitted their projects to overseas ecumenical agencies, it assumed that they automatically qualified for support. At the same time, he noted that many people in Ugandan church leadership did not educate the members on Christian stewardship in order to assist the church and Christian community to be self-sustaining. Rather, the leadership assumed, and believed that because the church is

universally one, church resources in the north are readily available to the churches in Africa when, and as needed (Kondwo, 1998).

Kondwo (1998) further states that the church in Uganda had relied on European personnel for a long time, with a minimal effort to train local personnel. This view is in agreement with Speckman on heavy dependency on European personnel by the African churches. In the same vein, Baur (1994) thought that the dependency syndrome among African Christian leaders on missionaries was responsible for the failure to train human personnel. At first, leading African Christians denounced the one-way traffic in which mother churches gave everything and Africa was always the recipient.

Besides being autonomous, most African churches could not fully enjoy their freedom because of their dependence on missionary society's personnel, a situation that persisted for some time. However, the protestant ethic theory emphasizes on building on capacity of people in the church so that development rolls down to the community. It also involves building capacities of people which includes training of human personnel.

While doing research on three church-based health providers in Tanzania, Josephine (2018) established that there was exit of medical staff leading to shortage of doctors, nurses, assistant medical officers and so on, which led to increased competition for human personnel in the health sector. She further stated that churches could not offer competitive wages for staffs at church-based hospitals, increasingly making the staff to seek for employment in public sector. The obvious difference in social benefits for church-based compared to civil servants was a major source of discontentment at church-based hospitals. Social benefits the church-based medical staff lacked was retirement allowances, health insurance and social protection funds Josephine (2018, 8-9). Such a condition often leads to high turn-over rate of employees at a workplace. The remaining staffs at such institutions may become demotivated hence affecting their output.

Baur (1994) shares similar sentiments with Kondwo, Josephine, Gangel, and Speckman on the use of non-trained church workers and leaders. While all these works cited above are related to human resource issues, failure of some project due to high turn-over rate of medical staff, use of unqualified personnel, none of them delved specifically into human resource development in ACK Maseno North Diocese. The current study evaluated the training of staff, high turnover rate of medical personnel and how it affected the sustenance of development projects in ACK Maseno North Diocese. This study, therefore, assessed the extent to which untrained personnel led to poor performance on development projects in ACK Maseno North Diocese.

Similarly, Arudo (2010) observed that Churches in Maseno South and West attracted donor funds that supplemented local membership contributions. More activities such as agriculture, provision of water and housing for the poor were also started. The expansion of development activities required co-ordination at the diocesan level and technical personnel to oversee and run them on behalf of the church. The Christian Community Services (CCS) project activities were open to members of the local communities within the project areas irrespective of their denomination or political inclination. The church found itself faced with a new demand for technical personnel to supervise this area, but its clergy lacked technical training.

Although it was expected that CCS management personnel and the clergy would be fully involved in diocesan development services, on a number of occasions, the two operated on a collision course. Most likely, the conflicts that evolved with time led to the stalling of some of the projects. Arudo (2010) also says that the use of clergy without technical training often led to conflicts with other CCS workers. This state of affairs raised a number of questions in view of the fact that there were high social expectations of positive returns for church sponsored projects. The literature highlights the effect of non-trained personnel on projects in Maseno South and West Dioceses leading to stalling of some projects. The study, therefore, assesses the extent to which the training of the clergy and other personnel in Maseno North Diocese contributed to stalling of projects given the fact that the clergy as BOM members were actively involved in development projects in the diocese.

In his study, Chepngetich (2007) revealed that poor remuneration, lack of scheme of service and poor work environment contributed greatly to high attrition of ECE teachers. Ayiemba (2015) agreed with the above sentiments and added that ACK church in Maseno and Winam divisions in Kisumu lacked resources, both in terms of funds and human resources. Hence it could not employ enough and qualified teachers and expand physical infrastructure for ever increasing number of student population. He further noted that as a result of dwindling financial resources, there is no staff motivation and the church cannot attract specialized staffs that have essential competence and skills in management and governance.

The above literature is brought closer home by Mulievi (1993) who studied on the challenges facing development projects in the Catholic Church in Kakamega Diocese. She found out that the staff who were recruited to run the hospitals and dispensaries in the Diocese mainly at Mukunu and Mumias, often left their jobs because they were poorly paid but overworked. The doctors demanded a salary ranging between 20,000 and 40,000 which the hospitals management could not afford. This is because collections from the patient charges

were low and yet other departments also needed to run. The end result was that hospitals ended up with one or two full-time doctors who could not cope with the number of patients (Mulievi, 1993, 147).

The above sentiments were supported by Mugasia (2015) who wrote on challenges facing Early Childhood Education (ECE) in Kakamega County. These include poor remuneration, lack of scheme of service and poor work environment, which greatly contributed to a high turnover of ECE teachers. Further reports, by Sifuna and Karuku (1998), indicate that the teacher is a key determinant of service quality at pre-school. A teacher's effectiveness is determined by qualification as well as the training, supervision and support given. Teachers with low grades experience difficulty in implementing national centre for ECE, especially in language development. This is because these teachers may have failed in this subject, making it difficult for them to handle it. Mugasia's sentiments are in agreement with Kivava (2017) on human resource development. However, she cites other factors such as poor remuneration, lack of scheme of service and poor working conditions. The above literature helped the study on identifying human resource challenges in public ECD centres and private schools in general. Equally Maseno North Diocese runs nursery schools at Maseno and Soy station in Soy archdeaconry. However, their focus did not enable them to discuss on salary and remuneration structures in particular to development projects in ACK Maseno North diocese. The present study, however, assessed the extent to which the human resource factor in terms of presence of a written HR policy, scheme of service, house allowances, medical cover and gratuity affected the management of development projects in ACK Maseno North Diocese.

1.2 Objective of the Study

The main objective of this study was to investigate management issues facing development projects in ACK Maseno North Diocese.

Specific objective was to:

Investigate human resource management issues facing sustainable church development projects in ACK Maseno North Diocese.

Research Questions

What are the human resource management issues facing sustainable development of church projects in ACK Maseno North Diocese?

Research Premise

Church development projects in ACK Maseno North Diocese face human resource management issues.

2. Research Methodology

2.1 Research Design

This study utilized a mixture of both qualitative and quantitative methods for the purposes of complementarity. Quantitative methods give quantifiable figures which are more convincing whereas qualitative method explains the figures and facts (Mugenda & Mugenda, 2003, 198). Descriptive research design was used to establish the management issues facing sustainable development projects in the Anglican Church of Kenya, Maseno North Diocese. The design helped to establish the nature and the current condition of a phenomenon (Enon, 1998). In addition, it helped in collecting data from a representative sample and generalization of the results beyond the given sample (Cohen & Marion, 1980). The design helped the researcher describe, record analyse and interpret conditions as they exist without changing of variables (Kothari, 2003, 48). The researcher also took part in what he was investigating and got first-hand experience on what was going on in the church projects.

2.2 Location of the Study

The study area was the ACK Maseno North Diocese, which is part of the Anglican Communion. The area of study is restricted to ACK Maseno North Diocese because the first development projects were located within its domain (Walaba, 2009, 55). The region is known to have received early Christian missionaries in Kenya; the Church Missionary Society (CMS) included (Walaba, 2009, 56). Maseno North Diocese is on the border between the Luo and the Abaluhya in Western region of Kenya. The Diocese has six archdeaconries, 13 deaneries, 42 parishes, 175 congregations, 45 priests, eight church workers and a population of 12, 000 Anglican worshipers (http://www.Ackenya.org/diocese/maseno-north html). Maseno North Diocese covers the current sub counties of Likuyani, Lugari, Matete, Kakamega North, Kakamega Central, Kakamega East and Kakamega South in the current Kakamega County. The Diocese also covers the Sub counties of Vihiga, Sabatia, Hamisi and Emuhaya in Vihiga County.

2.3 Population and Sample Size

Ten projects that were in existence were selected for study in ACK Maseno North Diocese in order to get a bird's eye view on the progress of development projects. Mugenda and Mugenda (2003, 44) recommends that in case the target population is so small selecting a sample would be meaningless. Taking the whole population in such a

case is advisable.

2.4 Target Population

According to Orodho (2004, 37), target population refers to all the items or people under consideration in any field of inquiry. Target population is the people the researcher expects to meet and get information concerning a given research topic (Enon, 1998). In this research, the target population consisted of all those people who, in one way or another, are involved in the running of development projects in ACK Maseno North Diocese. They included current and former managers, workers, the ACK staff, gate keepers, politician and ACK partners around the ten church projects. The study targeted the entire population of the ten projects situated in Maseno North Diocese. These were as follows: one theological institution, two nursery schools, one mission hospital, one mission station (Soy Farm) and five youth polytechnics. The projects traverse the two counties of Vihiga and Kakamega, which fall under the ecclesiastical jurisdiction of Maseno North Diocese.

2.5 Sampling Strategy

The study used cluster sampling to ensure that all projects were included in the sample. Random sampling was used to ensure that all people in the project had an equal opportunity to be selected into the sample. Questionnaires were administered to twenty respondents from each of the project centers. Twenty respondents were manageable and could give adequate and accurate data. Six key informants were used. Three FGDs of three people each totaling to nine people were administered and thirty interviews were carried out totaling to a sample of 245 respondents. Cluster sampling is used when it is not possible to obtain a sampling frame because the population is either very large or scattered over a large geographical area (Mugenda & Mugenda, 2003, 49). In the case of Maseno North Diocese, the projects were scattered all over the diocese within the eleven sub counties (http://www.Ackenya.org/diocese/Maseno-north.html). Random sampling through balloting was used to select participants in the diocese. Orodho (2002, 37) states that in simple random sampling, each and every item in the population is given an equal chance of inclusion in the sample. Purposive sampling was used to select participants to participate in the study. The participants were selected purposely due to their active participation, knowledge and experience on the management of projects in the diocese. The researcher sampled a total of 245 participants.

2.6 Sample

A sample size of between 10%-30% was selected from a population of 496 subjects drawn from all 10 projects in Maseno North Diocese. Kombo and Tromp (2006) recommend a sample size of 10%-30% which is a representative enough for the study population. A 10% of the target population of Maseno Mission Hospital was sampled while 30% of St. Philips Theological College, Soy Farm, two Nursery schools and five Youth Polytechnics were sampled.

These research units included the following projects: Ekwanda Youth Polytechnic, St. Philips Theological College, St. Philips Sunrise Nursery School at Maseno and Maseno Mission Hospital. Others included St. Francis Mission Farm, Soy Youth Polytechnic and St Francis Soy Nursery School — in Soy, Mautuma Youth Polytechnic, Nzoia Youth Polytechnic and Nzalwa Youth Polytechnic. The informants included workers, gatekeepers, community members, administrators and politicians. Others were managers, ACK staff, Board of management and ACK partners. Workers and the managers enumerated the issues they face in their work stations. The ACK staff helped to shed light on the recruitment procedures and the financial issues they encountered in the day-to-day administration of their parishes and projects. The Board of Management (BOM) members informed the study about the financial constraints that they face, workers' recruitment process and the adequacy of the physical and human resources. Finally, the ACK partners shed light on the issues they faced in their interaction with development projects.

Table 1. Sampling Size for Questionnaires

Project category	Number of projects	Target population	% Sampled	Sample size
Maseno Mission Hospital	1	200	10%	20
St. Philips Theological college	1	60	30%	20
Soy Farm	1	61	30%	20
Nursery schools	2	60	30%	40
Polytechnics	5	115	30%	100
Totals	**10**	**496**	**30%**	**200**

Source: The Researcher, 2016.

The table above shows the categories of the projects under study, the target population and the sample size for questionnaires. There were six key informants, nine people for the FGD and thirty interviewees, bringing the total number to two hundred and forty-six respondents.

2.7 Validity and Reliability of Research Instruments

Face validity was estimated by use of correlations between the objective and subjective items utilized in the scales. Content validity was assessed through review and verification of the literature for the items contained in the questionnaire. The researcher ensured content validity by developing the instruments in such a way that all concepts in the objectives were included in the instruments (Mugenda & Mugenda, 2003). To ensure reliability and validity of the research instruments questionnaire and interview were first discussed with the supervisors. Revisions were made on their comments and recommendation. The researcher sort expert's judgement in research methodology. Experts verified the adequacy in coverage of the topic and ensured the questions were logically arranged and the aspects were well covered. These ensured that the instruments yielded valid data. Enon (1998) contended that validity is determined through expert judgement by carefully and critically examining or inspecting the items that make the instruments. The researcher took measures aimed at enhancing validity of the research questionnaire, by formulating simple and straight forward questions for easier answering by the respondents.

A pilot study was conducted with managers of development projects and diocesan development officers in Eldoret Diocese in June 2016. The Diocese of Eldoret was ideal for this purpose as it had similar projects as those of Maseno North Diocese — initiated by the late Bishop Alexander Muge. During the pilot study, it was established that some projects had collapsed because of financial challenges mainly due to withholding of donor funds. The findings informed the study of challenges facing church projects. The research questions that were unclear were revised. The sequence of some questions was also revised. The results were used to calculate the reliability of the questionnaires.

Access and acceptance in this study was attained by the researcher by obtaining authority from the relevant authorities, which was granted. These authorities included, Ministry of Education (MOE), National Commission for Science Technology and Innovation (NACOSTI), as well as the Ministry of Interior and Coordination of National Government (MICNG) in Vihiga and Kakamega Counties, in whose jurisdiction the Diocese of Maseno North falls.

2.8 Data Collection Instruments

Data was collected through semi-structured questionnaires, interviews, FGD guides and POs. A questionnaire was used to gather data to allow measurement for or against a view point given. Questionnaires were used to collect data from project workers, managers and ACK staff. The questionnaires were structured in two sections, A and B. Section A gathered data on gender, age and academic qualifications. Academic qualifications were gathered to determine the qualifications of workers and other stake holders. Section B collected data on human resource, financial management, cultural and leadership issues facing development projects in Maseno North Diocese. These were the core aspects constituting the study's research objectives. Interview schedules were used to collect data from project workers, managers, ACK staff and BOM members. Other targeted respondents included community members, politicians, administrators as well as ACK partners. The interviews were done to gain in-depth information about management issues facing development project in Maseno North Diocese, a key area of research focus for this study.

2.9 Data Collection Techniques

Participatory Approach was used in data collection. This study adopted the PO where the researcher was immersed in the day-to-day lives of the people and observed and interviewed the group participants (Spradley, 1980). The researcher used tree participant observation for nursery school, Soy firm and other institutions such as polytechnics, hospitals and theological. He watched and observed what went on in the projects, that is, physical facilities, resource materials and other activities in the projects. The PO schedules were used to gather information on the teaching, learning resources, teaching/learning resources, physical facilities and farm structures. Checklists were used to observe the conditions of the facilities, whether they were repaired, painted and renovated. The conditions and state of this facility reflected on the kind of leadership and management of these institutions. The PO schedules were used to record what the researcher anticipated to observe during data collection. For the nursery schools, the researcher focused on tables, chairs being used by the children, teachers' furniture, adequacy of tables and classroom structures like permanency of buildings. Others included classrooms with lockable windows, doors and classrooms with brightly painted walls. This was informed by the Ministry of Education (2008), which recommended that buildings and physical facilities for young children should meet the basic standards of space, comfort and safety. At the polytechnics, hospitals and the St. Phillip's Theological College, the researcher was interested in the size of the halls, workshops, kitchen, dormitories and halls of

residence for both sexes. Others included the movement of staff as well as libraries to supplement reading and research. The researcher wanted to ascertain if the facilities were available for trainee population. For Soy farm, the researcher observed the land use; farm structures, resources such as water, size of the land, road system and enterprises being carried out such as crops grown, livestock kept and the labour force. The researcher intended to assess the viability of the land and establish if it was still meeting the objectives for which it was set up.

2.9.1 Interviews

Interview schedules are useful as follow-up to questionnaires, or further responses (McNamara, 1999). The in-depth interviews are useful in that they are ideal for investigating personal, sensitive, or confidential information, which is unsuitable to cover in a group format. Interviews are also the best method when seeking for individual interpretations and responses (Mugenda & Mugenda, 2003). Purposive sampling was used to select six categories of respondents with some financial management and leadership knowledge to be interviewed (project managers, project workers, ACK staff, BOM, Community members and ACK Partners). These were drawn from 50% of the project centres giving a total of five project centres. Five out of the six categories were interviewed based on their availability during the researcher's visit to the centres. There were interview schedules derived from the research objectives. The interview questions were administered verbally with minimal probing and responses recorded.

2.9.2 Key Informant Interviews

A key informant interview is one where an individual with prior knowledge of the affected community is questioned to gather key information on the impact of an issue and on priority community needs. The crucial element of a key informant interview is that the informant is well versed about information about the community and its inhabitants, Guidance on Profiling Internally Displaced Persons — IDPs (Ministry of Education, 2008). Key informants are people with specific knowledge about certain aspects of the community, the site visited, the population or the emergency either because of their professional background, leadership responsibilities or because of their personal experiences. Further, key informant interviews allow a researcher to explore a subject in depth. The give-and-take of these interviews can result in the discovery of information that would not have been revealed in a survey. Information–rich participants are recommended by Gall and Borg (2006).

For this study, six key informants (project managers, project workers, ACK staff, BOM, Community members and ACK Partners) were purposively sampled from a list of diocesan development staff during one of the bishop's function in Christ the King Cathedral in Kakamega. The researcher requested each of them to participate in an interview with him after the function at their convenience. They were picked on the basis of complex nature of activities they carry out, their abilities and the knowledge they possess on running church projects. Because of time the researcher visited them in their respective offices thereafter. Four of the key informants had useful information on when the projects were initiated and the challenges, they had been experiencing since the inception of those projects.

2.9.3 Focus Group Discussions (FGDs)

FGDs involve narrowly focused issues discussed by a group of equal status (Payne & Payne, 2004). According to Barbour and Kitzinger (1998), FGDs are better for exploring how views are constructed and expressed. The researcher asked questions and exchanged ideas in view of experiences of respondents in Maseno North Diocese. The aim of FGDs is mainly to gain rich and often exploratory information (Tacchi, Slater & Lewis, 2003). Discussions are important because the group develops its own conversation, raising issues and ideas that might not emerge in a discussion with the interviewer alone (Cohen, Manion & Morrison, 2007). It is recommended that a group should not be large as to be unwieldy or to prevent adequate participation by most members, should be small to provide substantial coverage than that of an interview with one individual (Bloor *et al.,* 2001).

The names of the respondents were written on paper and picked by an independent person to select three project centres from which three workers, mainly heads of departments and those in top management participated in the FGD. The participants were then purposively selected based on their knowledge and experience with regard to management of development of projects in ACK Maseno North Diocese. The focussed groups had relevant information on human resource, finance and leadership challenges facing the projects. They discussed issues of management affecting church development projects under the researcher's guidance. The researcher always kicked off the discussion in FGDs by asking questions such as 'Which books of account do you keep in your office?' 'Which disciplinary measures do you have for people who misappropriate church project resources?' This helped to trigger the streaming of specific information from the respondents, then their main ideas about finance and human resource issues facing management of projects were noted down.

2.10 Data Recording Procedures

The researcher made field notes using cards as interacted with the informants. The researcher observed people's daily routine activities in the projects, physical resources available and other activities within the institutions. He

made more field notes using the observation schedules as he interacted with the informants. For the FGDs the researcher noted down the frequent responses of the participants on the issues of human resource, finance management and community involvement in the affairs of the ACK Maseno North Diocese (Kombo & Tromp, 2006, 118).

The researcher recorded key issues of the discussion, narrative report was written enriched with quotations from key informants and other respondents. Recording using the phone was done with permission from the participants to record the discussions. The researcher played the taped discussion to note down the main themes. Background information was recorded to allow cross referencing of information when needed.

2.11 Data Analysis

Data from the field was edited by checking completeness of the information. The information obtained was sorted out, classified and categorised into major themes. A summary of the themes was identified based on HRM issues affecting developments projects in ACK Maseno North Diocese. The key function of coding was to create codes from the responses which could be summarised in various ways (Kombo & Tromp, 2006). The major themes were identified in relation to research themes by the use of Kwalitan computer program. The Kwalitan program helped identify all key categories within the created codes and finally made a tree structure that gave a bird's eye on how these categories are related to the themes created. Quantitative data was coded and analysed by use of Statistical Package for Social Sciences (SPSS) to obtain descriptive statistics and percentages. The SPSS helped to locate and merge codes for the identification of the themes in relation to the study objective and question. Based on the field findings, conclusions were made. Data was presented through tables and percentages.

Qualitative data was analysed using content analysis; a research methodology that utilizes a set of procedures to make valid inferences from the text. Content analysis was used to analyse qualitative data in this study because it helps in making valid, replicable and objective inferences about the message based on explicit rules. This technique of data analysis transcends merely counting words to examining language intensely for the purpose of classifying large amounts of text into an efficient number of categories that represent similar meanings (Weber, 1990). Content analysis is based on core areas that are relevant to research topic and subjects. The analysis has to match with specific objectives and sub-themes of the research. The qualitative data collected was organized into themes corresponding to the study objectives. Theme analysis technique was complemented by Kwalitan computer program, whereby codes were created for the data in accordance with the study objectives. Kwalitan helped to identify all key categories within the created codes, and then a tree structure was made to give a bird's eye view of how the categories are related to the codes and segments.

2.12 Ethical Considerations

Ethical issues considered during the study were access, acceptance, and informed consent, privacy (anonymity and confidentiality) (Bryman & Bell, 2007). Informed consent was ascertained by informing the participants of the nature and purpose of the study, Smith and Quelch (1992) and assuring them that there were no risks involved in the study. At the beginning of the study, the participants were informed that their participation was voluntary. This ensured that the information given was correct and that the subjects were not influenced, eliminating undue pressure (real or perceived). Thereafter, upon the completion of the field work, research findings were given to some experienced researchers to assess the relevance and originality of the work.

3. Data Analysis, Presentation and Discussion

Data collected on issues in church development projects in ACK Maseno North Diocese was analyzed and presented in line with the set research question and objective.

3.1 Demographic Characteristics of Respondents

Determining characteristics of respondents involved establishing the sex, age, and academic qualification of the respondents. The results of the study were presented as per the following research objectives and research questions.

3.1.1 Respondents Return Rate

The study targeted 200 respondents drawn from ten development projects of ACK Maseno North Diocese. Each centre was represented by the centre manager, workers, ACK staff, ACK development partners, community members and local administrators. The response rate was 180 (90%) respondents, as indicated in Table 2 below. According to Mugenda and Mugenda (2003, 83), a 50% response rate is adequate, 60% good and above 70% rate, very good. Therefore, the response rate was impressively good.

Table 2. Response rate

ACK Development Projects	Sampled	Returned	Percentage
Ekwanda Youth Polytechnic	20	18	90
St Philip Theological college	20	16	80
St. Philip sunrise academy	20	19	95
Soy Youth Polytechnic	20	20	100
Mautuma Youth Polytechnic	20	16	80
Nzoia Youth Polytechnic	20	19	95
Nzalwa Youth Polytechnic	20	17	85
Maseno Mission Hospital	20	17	85
St. Francis Soy Farm	20	20	100
St Francis Soy Nursery School	20	18	90
			900 divide by 10
Total	**200**	**180**	**90**

Source: Researcher (2016).

Table 2 above shows that this sample was a homogeneous and representative since the response rate was more than 80% in all the stations.

3.1.2 Distribution of Respondents by Gender

Although gender was not part of study objectives, it was deemed important because it helped the researcher to understand the demographic profile and dynamics of the sample as well as the larger population. The results are shown in Table 3.

Table 3. Distribution of Respondents by Gender

Gender	Males		Females	
Institution	Frequency	(Percentage)	Frequency	(Percentage)
Ekwanda Youth Polytechnic	9	50	10	50
St Philip Theological college	9	56	7	44
St. Philip sunrise academy	10	53	9	47
Soy Youth Polytechnic	11	55	9	45
Mautuma Youth Polytechnic	10	62	6	38
Nzoia Youth Polytechnic	10	53	9	47
Nzalwa Youth Polytechnic	10	59	7	41
Maseno Mission Hospital	9	53	8	47
St. Francis Soy Farm	12	60	8	40
St. Francis Soy Nursery School	9	50	8	45
Total	**99**	**55**	**81**	**45**

Source: Researchers (2016).

The findings of the study showed that both males and females were involved in the development projects. Some were managers of polytechnics while others head of departments. Both sexes were, therefore, involved in decision making processes of the institutions. However, males still dominated at 55% as compared 45% of females. Rationally, women were side-lined from church leadership as alluded by Kweyu (2017). The study therefore assessed gender issue to establish whether there was inclusivity of women and tapping of their potentials in management of church development projects.

3.1.3 Academic Qualification of Project Workers

The study sought to establish the academic qualification of project employees. The results are tabulated in Table 4.

Table 4. Academic qualifications of project employees

Academic qualifications	Frequency	Percentage (%)
Non-certificate holders	12	6.94
KCPE/CPE	87	48.61
KCE/KCSE	38	20.84
KACE	12	6.94
Diploma	19	10.42
Degree	9	4.86
Masters	3	1.39

Source: Researcher, 2016.

With regards to academic qualifications of project employees, the following results were obtained: 6.94% were non-certificate holders, 48.61% were KCPE/CPE holders, 20.84% were KCE/KCSE holders, 6.94% were KACE holders, 10.92% were diploma holders, 4.86% were Bachelor's degree holders and 1.39% was Master's degree holders. Majority of the project workers were thus KCPE or CPE holders accounting for 48.61% of the respondents, whereas the least were holders of Master's degree at 1.39%. Though some of the tasks in these projects like polytechnics and Soy Farm may require a worker to have acquired professional training and experience, but most tasks like those in managerial positions like farm managers, teachers in nursery schools and lecturers at Maseno theological college would require both professional training and higher academic qualifications of a degree and above. Education may give one powers to lead, capacity to make informed decisions and solve complex issues in their managerial capacities. The findings confirm the arguments of the PET. For instance, project managers seem not to have applied the moral values that upheld competitive recruitment of workers. Ignoring these principles could have led to collapse of projects in Maseno North Diocese.

3.2 Human Resource Development Issues

The study sought to establish human resource issues affecting sustainable development projects in Maseno North Diocese. These issues included Inconsistencies in recruitment of workers, Low levels of motivation of project workers and High turnover rate as well/low retention rates of workers. The results were recorded in Table 5.

Table 5. Human Resource Development Issues

Human Resource Development Issues	Gender	Response				Total
		Agree	%	Disagree	%	
Inconsistencies in recruitment of workers.	**Male**	72	40	27	15	**100**
	Female	60	33.3	21	11.7	
Low levels of motivation of project workers	**Male**	58	32.2	41	22.8	**100**
	Female	52	28.9	29	16.1	
High turnover rate as well/low retention rates of workers	**Male**	64	35.6	35	19.4	**100**
	Female	63	35	18	10	

Source: Researcher, 2016.

3.2.1 Inconsistent Recruitment of Workers

Table 5 shows 40% of the male and 33.3% of the females agreed that there were inconsistencies in the recruitment of workers. More females indicated they were discriminated against in the recruitment of staff in Maseno North Diocese. The trend replicates itself for the number of male and female who disagreed on the inconsistencies in the recruitment of staff in ACK Maseno North Diocese. In contrast, more males (15%) disagreed whereas 11.7% of female disagreed. This analysis proved a gender shift at the point of agreement and

disagreement. Females scored higher in agreeing with the level of inconsistencies while scoring low on the disagreement on the level of inconsistencies.

3.2.2 Low Levels of Motivation of Workers

Of the total informants interviewed, 32.2% of males and 28.9% of females agreed on the low level of motivation for project workers while 22.8% of males and 16.1% of females disagreed respectively. This showed that a higher number of respondents in both genders agreed that low levels of motivation of project workers was a human resource issue affecting performance in church projects in Maseno North Diocese.

3.2.3 High Turn-Over Rate as well as Low Retention Rates of Workers

On the issue of high turn-over rate and low retention rates of workers, men had a lower score of 35.6% agreement against 35% women agreement on high turn-over rate as well as low retention of workers. The above analysis indicates that men have a low score on supporting and a higher score on disagreeing. The trend replicates itself at the point of disagreement where 19.4% of men disagree compared to 10.0% women. This analysis shows that high turn-over rate as well as low retention of workers has a serious effect on church projects.

3.3 Employment Criteria of Workers

The study further sought to assess the criteria used in employment of project workers. The findings were recorded in Table 6.

Table 6. Employment criteria for workers

Employment criteria	Frequency	Percentage
Interview	25	13.9
Election by congregation	36	20.2
Appointment by related church leaders	88	48.6
Secondment by the parish	25	13.9
Transfers	6	3.5

Source: Researcher, 2016.

The results in Table 3 show that 13.9% of the workers were interviewed, 20.14% were elected by the congregation, and 48.6% were appointed by respective church leaders. Then 13.9% were seconded by the parish while 3.5% were through transfers. This shows that most of the employees got the employment by related church leaders, leading to nepotism. Table 3 shows that 48.6% of the informants were not happy with the appointment procedures, since they were not properly done. Most of the appointments were done by the respective church leaders, who considered their relatives irrespective of their qualifications. This goes against Taylor's theory on recruitment, which insists on right staff with right skill for the right work.

Following an interview with a former manager at Soy youth polytechnic over recruitment of workers, he noted that instructors could go to Nairobi and come with appointment letters the following day. According to him, people who were elected and who bribed their way were motivated by wrong perception that church positions were a potential source of income and employment. Such a mentality was viewed as a recipe for projects to collapse.

Most of the church and project workers did not go through a competitive recruitment process. Whenever a position fell vacant, the management looked around and picked on one of the congregants. Such practices accounted for the failure of most health centres and polytechnics since the hand-picked staff did not have the prerequisite qualifications or skills.

The practice of irregular hiring of church personnel is supported by Mathenge and Ofunya (2015) who reported on ad hoc recruitment of church workers in PCEA, St. Andrews church. Irregularly hired, the workers could gold church leadership accountable for the church property. The personnel discipline was also compromised by the church leadership.

An ACK partner at Maseno from Action Aid shared similar sentiments of *ad hoc* recruitment of most church workers. He indicated that most projects did not have a plan for the HRM. In cases where they had, it was not adhered to. Leaders ended up overstaffing the projects, hence overstraining the finances through overpayment. New workers were always brought in, even where there was no need assessment. This is not in agreement with the tenets of PET which emphases on limiting input and maximising output, that is employ one skilled person to

handle various tasks, hence minimising the amount of workers and getting same desired outcomes. A former manager at Mautuma Youth Polytechnic observed that recruitment of the institution staff had been changing. There had been no sessional papers especially in 1970s, 1980s and through towards 2010 to guide workers' recruitment.

Until 1975, the staffs at the polytechnic were recruited through the Ministry of Housing and the Local Government — Department of Social Services. Things were very different. Officers of the then Social services came to the site; through the Community Development Assistants (CDAs), they identified instructors to the institutions called village polytechnics. Then the government paid the instructors in form of grants given to the polytechnics. Later, the recruitment was carried out through the Ministry of Social Services, by the District Social Development Officers (DSDOs). The community formed management committees which identified instructors and recommended them to the DSDOs. In turn, the DSDOs carried out the interview and recommended them to the management of the polytechnics for employment. The DSDOs appointed the instructors and offered letters to them through the polytechnic committee. Hence, the instructors became the polytechnic employees, the government thereby supplementing the community's efforts in form of grants.

However, most of the youth polytechnic instructors were ill-equipped to handle artisan courses. This is because most of the instructors were either classes Seven, Eight or Form Four leavers, who attained a Grade Three Trade Test certificate. "Hence, these poorly qualified personnel could not adequately handle the trainees," remarked a former manager at Nzoia Youth Polytechnic. The above sentiments are in agreement with Myron (2007) who insisted that some of the reasons for failure of the church and its projects is the training of its leaders.

A clergy at Soy Farm decried low resource support by the Diocesan Development Office (DDO). An ACK partner cited heavy dependency on foreign funding for most of the projects' development. The clergy asserted that when the management anticipated some grants or donor funding, they rushed to pick people, simply for the purposes of having office bearers. When the funds were depleted, the management dismantled the workforce quietly. First, they reduced salaries. Second, workers were not paid for some period of time: out of frustrations, workers and managers quit quietly. Equally, one of the workers at Ekwanda Youth Polytechnic stated that paying of salaries was a contentious issue. Yet when the management wrote the funding proposals, there was a budget for salaries. During the recruitment process, the management sourced for workers with less qualification so that they could underpay them. Sometimes, they even paid a half of the stipulated salary scale.

During a visit to Soy Farm the researcher observed the following: much of the land was fallow. Around five indigenous breed cows were seen on the compound, given the fact that Soy Farm lies in the former White Highlands region. There were broken water pipes, broken and hanging doors and windows. At one point, the researcher saw animals being driven through the compound to the neighbouring forest. At the edge of the farm, there were many herds of animals with several young boys taking care of them. When the researcher asked whose animals they were, he was told the animals belonged to farmers around the institution. It is like farming activities had gone down drastically. Many institutional houses were vacant with no doors and windows. The fish pond was dysfunctional. The findings were confirmed by Maina, Boit and Kosgey (2011) who observed that lack of effective maintenance of physical resources was characterised by leaking roofs, fading wall paintings and decorations, broken windows and doors. Other aspects include rotting parts and broken toilets, faulty electrical installations and overflowing sewer lines among other defects.

Ayiemba (2015) equally observed that the critical challenge that the ACK church in Maseno and Winam divisions in Kenya faces in its attempt to provide education and other facilities is lack of resource. The church depends on some donor aid to finance its programmes, yet some of this aid is limited and not reliable. The same ACK in Maseno and Winam thus faced multiple challenges caused by lack of resources as it cannot employ enough and qualified teachers and expand physical infrastructure for the ever-increasing number of student population. Equally, in agricultural sector, the capital requirement which applies to agriculture is enormous. The capital requirement applies to acquisition of planting materials and maintenance of the farm structures, but also for working capital that is required to finance and develop cash crops until they come to maturity. The church cannot afford to employ qualified agricultural specialists in their projects (Ayiemba, 2015).

Besides lack of qualified personnel in the project, an instructor at Nzoia Youth Polytechnic decried the absence of scheme of service for polytechnic instructors and managers. He noted that there was no policy framework to guide the remuneration of youth polytechnic instructors and managers. There was no framework on salary scales, salary increase, and no union for bargaining on behalf of the workers. There were equally no promotions or retirement age and gratuity. He stated that his manager had been retired in October 2000, but he came to know of it in February 2001. All the extra months he had worked were never paid for yet all retirement and retrenchment procedures were fully catered for by the government. As a result of this lacuna, majority of youth polytechnic instructors and managers quit their jobs at the polytechnic; others were retrenched. This led to general inadequate staffing in youth polytechnics. In adequate staffs affected the performance of trainees some

quitting their jobs.

During an interview with a BOM member at Soy Youth Polytechnic, he noted that the Ministry of Education, Science and Technology (MOEST) and County Government of Kakamega started employing new staff to these polytechnics at Ksh.15, 000 but ignored the old polytechnic instructors, who were retained at the old salary scale of Ksh.2, 000. An employee worked and when he or she got tired and saw no hope of salary increment, quit at own pleasure. Others resorted to stealing project assets as a way of paying themselves.

Myron (2007) held similar views with Ayiemba (2015) and indicated that many Bible professors and other workers in para-church organisations were ill equipped for ministry. He asserted that there was need for better prepared people to manage effectively the organisations God has established to accomplish his work. With the set objectives not achieved, projects suffer. The study findings further established that projects in Maseno North Diocese failed due to absence of workers with competences to accomplish their work. This is in agreement with Haimann (2016) who noted that staffing pertains to recruitment, selection, development and compensation of subordinates. Hence need to consideration the retirement process of staff. So, managers must meet the needs of the people as they accomplish their tasks.

From the study findings, it was noted by a former manager at Soy youth polytechnic that some of the staff in youth polytechnics in Maseno North Diocese were hired irregularly. Need assessment of employees by the board of management was absent. The highest academic qualifications held by most instructors was class seven or eight graduates, hence the level of knowledge and skills of these workers was low. This contradicts the tenets of SMT on staffing which states that staffing involves training leaders and equipping them for ministry. Therefore, the workers could not be efficient and effective to achieve the tasks of the project. Hence, based on the employment criteria, 48.6% cited that the workers were appointed by related church leaders. It was further observed that there was low retention rate of workers, leading to high turn-over rate.

While interviewing youth polytechnic instructors at Mautuma and Soy youth polytechnic, majority of the instructors indicated that workers quit due to poor pay. The projects were unable to hire and retain qualified staff with the salary scales of Ksh2000 per month. This affected the quality of its products, and was therefore unable to attract best practices in the market. This contravenes the doctrines of SMT on continuous improvements. It involves creating and increasing surplus as well as staffing. This involves recruiting, training and retaining the workers. With high turn-over rate of workers, most projects in Maseno North closed their doors.

From the interviews with instructors and a board member at Mautuma Polytechnic, the study further revealed that, polytechnic instructors and managers lacked scheme of service. There was no policy framework to guide the remuneration of ECE teachers, youth polytechnic instructors and managers. Equally, other workers and the managers lamented that there was no house allowance salary scales and timely and consistent salaries. The concerned teachers, instructors and managers got tired and quit some with institutional resources. The findings were supported by Josephine (2018, 8-9) who established that church-based health providers in Tanzania were unable to pay and retain qualified medical staffs leaving them frustrated.

Chepngetich (2007) is in agreement with the above sentiments and revealed that poor remuneration, lack of scheme of service and poor work environment contributed to high attrition rate of ECE teachers. Mugasia (2015, 31) makes similar sentiments and emphasized that without a scheme of service, and a provision of adequate and appropriate resources and facilities, very little is likely to be realised in these institutions. In the same vein, Kivava (2017) noted that staffing pertains to recruitment, selection, development and compensation of subordinates. Hence, when the morale and passion for work of the staff was low, productivity was much affected; hence, projects were not sustainable. Equally, the supervisors and the BOM lacked the moral authority to demand for performance from the workers, remarked one instructor at Nzoia youth polytechnic. This contravenes the SMT on staffing. The theory stresses on training leaders, motivating and equipping them for ministry. Equally, the low morale and passion for work on the staff contravenes the PET which advocates for building on capacities for the people and empowering them to take up economic development of projects in the areas.

Similarly, one of the staff members at St. Philips Theological College at Maseno noted that some employees went away with correspondence of donor funding. "Nobody demanded that you surrender documents or clear with the administration," she explained. "You went away at your own discretion. Now that it had become the tradition, whenever people could not be paid their dues, they disappeared with any resources at their disposal." She noted that most projects did not retain their personnel. Whenever the key trained personnel exited the institution, everything came to a standstill.

The above findings were shared by a worker, at Esalwa Youth Polytechnic who lamented over the low levels of motivation in the work force. The management was only keen on the money paid by trainees. The management was not ready to buy required tools. Even the salaries for instructors were low. Sometimes the salary was

delayed for months. Instructors tried to fail trainees by not training them adequately for trade tests. Another instructor at the same polytechnic lamented that instructors worked for many years with no promotions, low salaries and no scheme of service. There was no salary increment and no house allowances. There was equally no medical cover and no job security.

While at the Maseno Mission Hospital, the researcher observed low number of patients/clients seeking health care services. One worker at the hospital confided that there was a decline in bed occupancy due to high charges, levies and poor services to the patients. Most of the staff had quit for better paying jobs elsewhere. He hinted that clients/patients were seeking health care services at the neighbouring Coptic hospital and others hospitals in Kisumu City. The observations were in agreement with the study of Ayiemba (2015) in Maseno and Winam divisions of Kisumu District who noted that ignorance among the local people was a major challenge to the church. He found out that most people, especially in the rural areas believed that needed services could only be provided for free by government institutions. Hence, strong apathy exhibited towards church health centres or dispensaries in some regions by the sick poor. Sometimes they would prefer travelling long distances to access government health centres rather than attending church health centres in the neighbourhood.

3.4 Dependency Syndrome and High Turn-Over Rate in the Church

The last objective was to assess the issue of dependency syndrome and establish reasons for high turn-over rate in the church. The issue of resource mobilization and utilization was a tricky one as it was veiled in blame and counter blame. On one hand, a member of the clergy at Soy Farm decried low resource support by the DDO. On the other hand, an ACK partner cited heavy dependency on foreign funding for most of the projects' development. The clergy asserted that, when the management anticipated some grants or donor funding, they rushed to pick specific people, for the purposes of having office bearers. When the funds were depleted, the management dismantled the workforce quietly. First, they reduced salaries; second, workers were not paid for a certain period of time and out of frustrations workers and managers quit quietly. One of the workers at Ekwanda Youth Polytechnic stated that paying of salaries was a contentious issue, yet when the management wrote the funding proposals, there was a budget for salaries. According to her, the management sourced for workers with less qualification so that they could underpay them. Sometimes, they even paid a half of the stipulated salary scale.

Finally, an ACK partner in Lugari Extension Programme at Soy Farm lamented about high turn-over rate. Parishes lacked qualified clergy to run their parishes and projects (most clergy are the overall managers of the church assets). Most trained clergy left their jobs for greener pastures. He stated, once you went beyond diploma level, you were still posted to a very remote centre with no basic facilities. Most of them have joined Pentecostal churches, after failing to be promoted.

4. Summary, Conclusions and Recommendations

4.1 Introduction

The study sought to investigate HRM issues facing sustainable church development projects in ACK Maseno North Diocese. The principles of protestant ethic and the scientific management theory were applied to help in analyzing administrative procedures for exploiting human and material resources in order to attain the objectives of an organization.

The tenets of PET advocated for human resource development that emphasized on developing and building on the knowledge of a person. SMT on the other hand advocates for administrative procedures for exploiting human and material resources. The findings indicated that the tenets of PET and SMT were missing in the project.

4.2 Summary of Major Findings

With regard to HR issues, it was observed that there were a wide range of HR issues that directly affected organizational competence and performance of works in ACK Maseno North Diocese. There was lack of a written HR policy in the projects. For instance, there was low retention rate of workers leading to high rate of turn-over of workers. It had a serious effect on church development. The management could not attract specialized staff that had essential skills and competences due to lack of financial resources. The purpose of management is to sustain the maximum well-being of personnel as advocated by the tenets of PET. The study revealed that there was no scheme of service for ACK nursery teachers as well as ACK polytechnic instructors and managers. There was no house allowance, salary scales, timely and consistent salaries. Equally, there was no medical cover and gratuity. The findings were in agreement with Ayiemba (2015) that ACK church in Maseno and Winam Divisions in Kisumu lacked resources both in terms of funds and human resources. The church in Winam and Maseno divisions could not employ enough and qualified teachers and expand physical infrastructure. Ayiemba (2015) further stated that because of dwindling financial resources there was no staff motivation. The same sentiments of Ayemba (2015) were expressed by Mulievi (1993, 147) that the catholic diocese of Kakamega could not attract and retain qualified nurses and doctors due to poor pay. Though the

county governments of Kakamega and Vihiga had taken over most operations at the ACK polytechnics, disparities remained between the county government employees and the old ACK staff in terms of salaries.

4.3 Conclusion

Development projects in Maseno North Diocese still face human resource challenges. The respondents agreed that there was need for better HR policies to strengthen the management of development projects. It was observed that HR factor had an influence on the management of development projects. The HR influenced the utilization of project funds and timely completion of projects through proper monitoring and evaluation processes. Unless competence, skills and integrity are all put into consideration during the recruitment process, church projects are likely to be staffed with incompetent workers. The incompetent staff ran down the projects in Maseno North Diocese. The study recommended that ACK church project management committees should develop written human resource policies on recruitment, retention, remuneration and motivation of staff and hand them over to various project managers to enhance their performance.

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