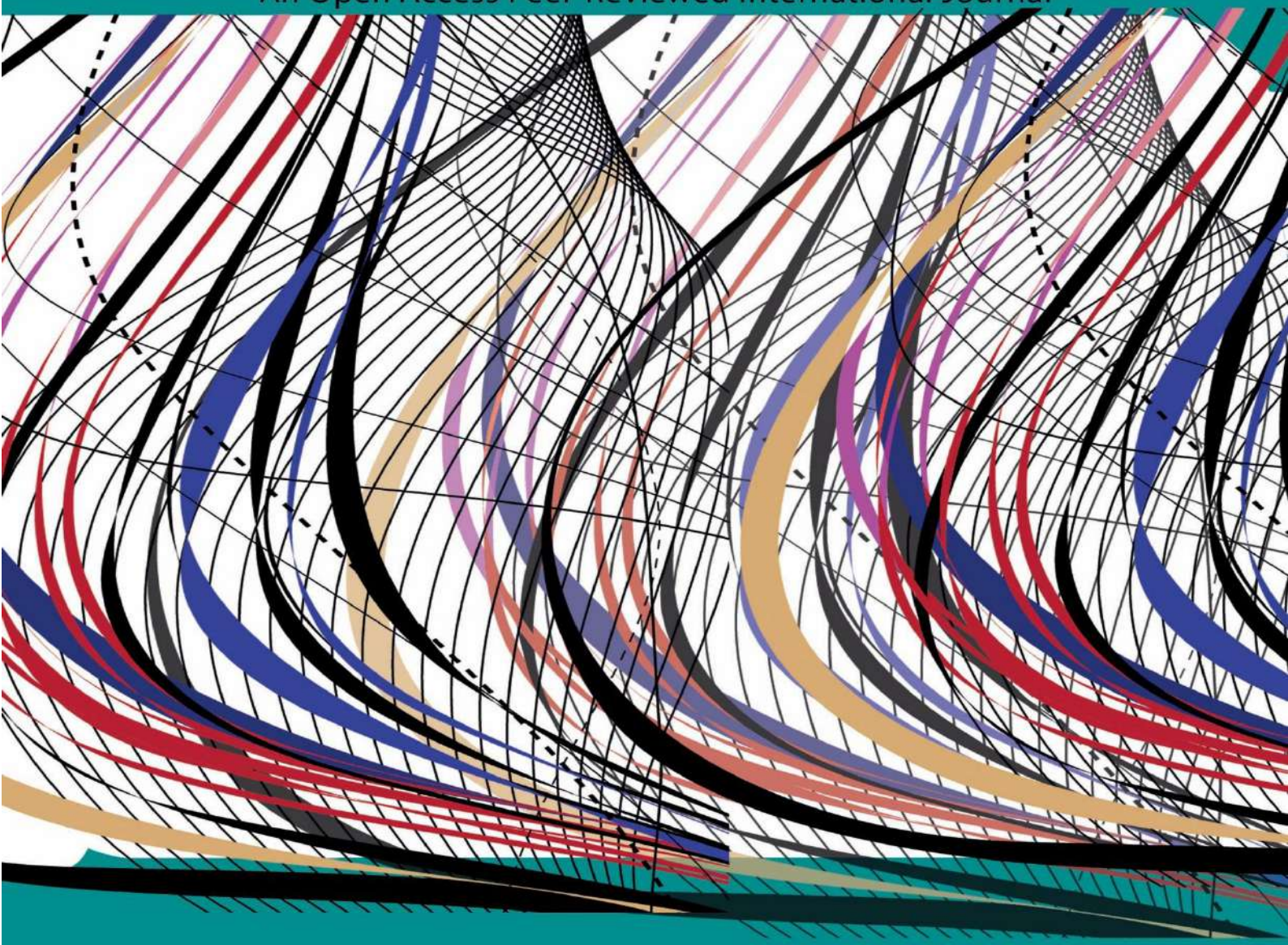
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Evaluating the Impact of the Skills Training Course on the Operation and Maintenance of the Rice Processing System (RPS) on the Operational Efficiency and Asset Sustainability of Farmers' Cooperatives and Associations in Nueva Ecija, Philippines

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Abstract *— This study evaluated the operational, technical, and cognitive impact of a five-day Skills Training Course on the Operation and Maintenance of the Rice Processing System (RPS) administered across Nueva Ecija, Philippines. Using an evaluative mixed-methods concurrent triangulation design combined with a one-group pre-test/post-test quasi-experimental approach, the study monitored fifteen (15) purposively selected beneficiaries (12 Farmers' Cooperatives and Associations and 3 Local Government Units) spanning Level 1, 2, and 3 facilities, alongside forty (40) individual operators. Quantitative records covering one full cropping season before and after the intervention were subjected to a paired-samples t-test at a = 0.05, supplemented by qualitative focus group discussions. Empirical results for the operational cohort (n = 10) revealed a marked increase in mean Milling Recovery Rate (MRR), rising from a baseline of 58.67% to a post-training average of 64.34% (+5.67 percentage points), bringing facilities into the 63.0–65.0% designed operating range of modern multi-pass systems. Unplanned facility downtime dropped by 78.75%, from 16.00 to 3.40 hours per month, while moisture tracking accuracy improved from 62.40% to 91.80%. Individual technical knowledge assessments (n = 30 paired records) showed a statistically significant mean score expansion from 12.87 to 14.77 out of 25 items, t(29) = 3.738, p = 0.0007, with secondary analysis identifying learning variances attributable to cognitive overload in the most technically complex competency areas. Post-test scores correlated strongly with both the Milling Efficiency Index, r(8) = .742, p = .014, and the Asset Sustainability Index, r(8) = .795, p = .006. Contextual audits revealed that five (5) distributed facilities were structurally constrained from immediate operationalization due to a lack of active three-phase power grid connectivity or ongoing construction backlogs. Post-training survey metrics confirmed a distinct cultural transition away from reactive breakdown frameworks toward checklist-driven preventive maintenance routines, with the asset sustainability composite score advancing from 1.77 to 4.40 out of 5.00. The study concludes that targeted capacity building is a necessary prerequisite for sustainable postharvest mechanization, and recommends that national line agencies institutionalize mandatory operator certification and enforce stricter inter-agency utility grid coordination prior to machinery distribution.*

Keywords *— **Asset sustainability, milling recovery rate, Nueva Ecija, operational efficiency, postharvest mechanization, Rice Processing System (RPS), skills training evaluation, three-phase power grid.***

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I. INTRODUCTION

Agricultural mechanization serves as a structural backbone for competitive postharvest management in modern agrarian economies. In the Philippines, particularly in Nueva Ecija — historically designated the "Rice Bowl of the Philippines" — postharvest grain losses remain a persistent engineering challenge. Traditional, non-mechanized handling, variable sun-drying on open roads, and single-pass milling systems collectively contribute to substantial physical and economic losses. To address these inefficiencies, the government has provided Rice Processing Systems (RPS) under the Rice Competitiveness Enhancement Fund (RCEF), equipping local farming groups with modern recirculating batch dryers and multi-pass rice milling facilities intended to accelerate production and preserve grain quality (Aquino & dela Cruz, 2021; De Guia & Sebastian, 2022).

However, machinery distribution alone addresses only part of the underlying problem. As capital investment in postharvest infrastructure has expanded, the operative constraint has shifted from equipment availability to the technical capacity to operate it. When advanced automated systems are transferred to Farmers' Cooperatives and Associations (FCAs) whose members have historically relied on traditional farming methods, a pronounced technical gap emerges. In the absence of formal mechanical training or structured troubleshooting skills, these machines are susceptible to miscalibration, accelerated wear, and prolonged operational downtime resulting from otherwise minor technical faults (Alavi & Leach, 2019; Mendoza & Ramos, 2023).

This gap between equipment capability and operator readiness represents a critical point of failure in engineering management terms: distributing hardware without a corresponding investment in operator training undermines the sustainability of the asset itself. A five-day Skills Training Course was developed to address this gap directly. This study evaluates the effectiveness of that training intervention in improving operational efficiency and supporting long-term asset sustainability across fifteen (15) designated RPS beneficiaries in Nueva Ecija.

1.1 Postharvest Mechanization Ecosystem in the Philippines

The structural transformation of agricultural systems relies heavily on deploying capital machinery to minimize systemic grain losses. Historically, the Philippine rice sector has lost an estimated 15% to 16% of total production during postharvest handling (Philippine News Agency, 2023). This is largely due to handling practices, traditional road-drying, and single-pass village-level hullers. Under national modernization mandates, state programs have accelerated the rollout of heavy industrial facilities (PHilMech, 2026).

These configurations are distributed based on a tiered infrastructure framework tailored to the processing scale of the recipient communities. An RPS Level 1 facility comprises one (1) unit of a multi-stage rice mill with a capacity of 1.5 tons per hour paired with two (2) units of recirculating dryers running at 6 tons per batch. Stepping up to mid-scale commercial production, an RPS Level 2 facility upgrades the setup to one (1) unit of a multi-stage rice mill with a capacity of 2 to 3 tons per hour, fed by two (2) units of higher-capacity recirculating dryers operating at 12 tons per batch. At the highest automated industrial scale, an RPS Level 3 facility leverages one (1) unit of a large multi-stage rice mill running at 4 to 5 tons per hour supported by three (3) units of 12-ton-per-batch recirculating dryers.

These setups reduce reliance on erratic weather and achieve high hulling efficiencies. However, empirical observations indicate that delivering complex engineering arrays does not automatically guarantee efficiency. Instead, long-term success depends on matching equipment drops with structured human operator capabilities (Japan International Cooperation Agency [JICA], 2025).

1.2 Mechanical Factors Driving Milling Recovery Rates

The Milling Recovery Rate (MRR) is a primary technical indicator of postharvest processing efficiency. Traditional field methods produce an MRR of 55% to 58%, resulting in high broken grain levels and heavy economic discounts (National Food Authority [NFA], 2024). Modern multi-pass systems — regardless of whether they operate at a Level 1 pace of 1.5 tons/hour or a Level 3 velocity of 4–5 tons/hour

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— are engineered to achieve a target baseline MRR of 63.0% to 65.0% (NFA, 2024).

Achieving this recovery range requires precise operational calibrations. Operators must adjust clearances on the rubber rollers, set standard air flows in the aspiration chambers, and regulate counterweights on the friction whiteners. If operators do not master these technical factors, the multi-stage equipment can experience excessive structural friction. This friction breaks the rice kernels, negating the benefits of the capital investment.

1.3 Moisture Content Management Dynamics

Controlling the Moisture Content (MC) of incoming paddy is essential for preventing physical grain damage. For long-term storage and high-yield milling, rough paddy must be dried uniformly to a target MC of 14.0% (International Rice Research Institute [IRRI], 2022). Milling grain with an MC above 15.0% causes soft kernels to crack under pressure inside the whitening chambers, creating high volumes of broken rice and bran contamination. Conversely, over-drying paddy below 13.0% wastes furnace energy and causes grain fissures through thermal shock, which increases grain breakage during hulling (IRRI, 2022).

Operators must regularly use grain moisture meters to monitor drying curves and avoid over-drying across batch units, whether managing 6-ton batches at Level 1 or full 12-ton batches at Level 3. Effective moisture management requires a structured routine in which operators run multiple tests on grain lots before beginning operations. The governing paddy processing moisture curve proceeds from wet harvest (>24% MC), through recirculating batch drying, to target safe storage (14% MC), and finally to optimal multi-pass milling.

1.4 Asset Sustainability and Preventive Care Transitions

In engineering management, asset sustainability is defined as a facility's ability to maintain high operational availability while minimizing long-term component wear. Rural cooperative facilities often operate under a reactive repair framework, addressing equipment only after components fail. This approach leads to extended downtime and premature hardware failure.

Transitioning cooperatives toward preventive maintenance requires introducing daily pre-operation checklists, structured belt tensioning procedures, and scheduled gear lubrication routines. Teaching local operators to identify early signs of wear — such as loose elevator belts, vibrating bearings, or uneven screen wear — allows cooperatives to reduce unplanned downtime and operate independently of external technicians (JICA, 2025).

1.5 Cognitive Capacities and Training-to-Field Translation

Structured vocational training is essential for improving human capabilities in sociotechnical systems. However, transferring technical knowledge from a structured classroom to an open industrial floor can present challenges such as cognitive overload. This issue is common when training programs compress advanced mechanical, electrical, and thermal concepts into short timelines.

While short courses can successfully teach entry-level technical skills and safety procedures, they often fall short in teaching advanced troubleshooting diagnostics. Operators must understand complex engineering relationships, such as how rubber roller clearance affects hulling percentages or how screen wear changes the grading of milled rice. Evaluating this learning gap requires comparing baseline pre-tests with post-tests.

According to the foundational pedagogical framework established by Colt et al. (2010), the use of paired pre-test and post-test assessments serves as an objective, reliable tool for quantifying cognitive knowledge acquisition and measuring the immediate structural efficacy of short-term technical interventions. This methodology isolates intellectual growth from external field variations, providing engineering managers with clear verification of baseline competency development before technical operators are permitted to manage high-capital industrial assets.

1.6 Research Gap and Conceptual Framework

Existing literature establishes that agricultural mechanization and capital infrastructure investment reduce postharvest grain losses (PHilMech, 2026; Philippine News Agency, 2023). However, a distinct gap remains in the localized evaluation of human capacity interventions within FCAs; much of the

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existing literature emphasizes machinery adoption and funding allocation rather than post-implementation operator proficiency and its downstream effects on performance.

This study addresses that gap by applying the paired pre-test/post-test evaluation framework validated by Colt et al. (2010) within an industrial engineering management context. Rather than relying on machinery adoption statistics alone, this research links quantified operator learning gains directly to facility performance data across a full cropping cycle. By examining how training affects milling recovery rates, moisture content management, and facility downtime across Level 1, 2, and 3 setups, the study shifts the evaluative focus from equipment procurement toward the human–machine interactions that determine long-term asset sustainability (JICA, 2025; IRRI, 2022).

The evaluation is organized around an Input–Process–Output (IPO) model suited to engineering management interventions of this kind, presented in Fig. 1. The Input stage captures baseline facility and operator conditions: the starting conditions of the 15 designated RPS facilities, including their location, RPS level, building readiness, and operational status, along with operators' knowledge prior to training. The Process stage describes the delivery of the five-day training course and the tools used to measure its success, including paired t-tests on test score improvements, physical facility logbook audits, daily milling data monitoring, and correlation tests linking test scores to machine performance (Creswell & Creswell, 2018; Santos & Gamit, 2023). The Output stage identifies the resulting improvements in milling recovery, moisture content accuracy, reduction of sudden machine breakdowns, and the establishment of a proactive daily preventive maintenance habit (Mendoza & Ramos, 2023).

INPUT	PROCESS	OUTPUT
Baseline Profile of 15 RPS Facilities: • Geographical location and status • RPS Level (1, 2, or 3) • Infrastructure / building readiness • Operator baseline knowledge	Five-Day Skills Training Course Intervention; Mixed-Methods Evaluation: • Pre-test / post-test assessment • Paired-samples t-tests • Logbook and audit data • Daily milling metrics and correlation analyses	Improvements: • Higher milling recovery • Accurate moisture content • Fewer sudden machine breakdowns • Preventive maintenance culture

Fig.1: Conceptual framework of the study (Input–Process–Output model)

1.7 Objectives of the Study

The main objective of this study is to evaluate the impact of the Skills Training Course on the operational efficiency and asset sustainability of the fifteen (15) designated Rice Processing System (RPS) beneficiaries in Nueva Ecija. Specifically, it sought to answer the following questions:

1. What is the baseline profile of the fifteen (15) designated RPS beneficiaries in terms of (1.1) geographical location; (1.2) machine setup level (Level 1, Level 2, or Level 3); (1.3) infrastructure readiness; and (1.4) operational status?
2. What is the performance of the course participants in the Skills Training Course based on their baseline pre-test and final post-test technical assessment results?
3. What are the operational efficiency and asset sustainability of the RPS beneficiaries after the implementation of the skills training course in terms of (3.1) milling recovery rate; (3.2) moisture tracking accuracy; (3.3) unplanned downtime; (3.4) preventive maintenance compliance; and (3.5) troubleshooting capability?
4. Is there a significant relationship between the participants' technical assessment performance

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and the operational efficiency and asset sustainability of the RPS beneficiaries?

1.8 Scope and Delimitation

This study focused on fifteen (15) purposively selected RPS beneficiaries across the congressional districts of Nueva Ecija, comprising twelve (12) registered FCAs and three (3) Local Government Units (LGUs). Analysis of individual operator learning was based on the 40 operators who completed the five-day training course; long-term field performance tracking, by contrast, was delimited to the subset of 10 facilities with active power infrastructure and complete cropping-season logbooks. This distinction in sample size across analyses is addressed further in Section II.

Field operational data was limited to one wet and one dry cropping season. Technical evaluation focused specifically on Milling Recovery Rate (MRR), operator accuracy in reaching the 14.0% target grain moisture standard, and total unplanned downtime hours recorded in facility logbooks. Broader cooperative finances, local rice price trends, and external market shifts fell outside the scope of this study.

1.9 Operational Definitions

Asset Sustainability Index. A composite metric measuring operator compliance with daily machine inspections, routine lubrication, and component calibrations (JICA, 2025).

Milling Recovery Rate (MRR). The percentage weight of clean, polished white rice obtained relative to the total weight of the raw paddy input.

Unplanned Downtime. The total number of hours per month a facility is non-operational due to mechanical failures or unexpected technical component breakdowns.

1.10 Significance of the Study

This research provides actionable insights for several agricultural stakeholders. For national agricultural line agencies, it provides empirical data to refine future machinery allocation frameworks and establish mandatory operator certification standards. For FCAs, it serves as an operational blueprint to shift localized facility management from reactive breakdown repairs to structured, preventive maintenance routines. For operators and engineers, it highlights the specific technical skills required to improve milling efficiency and prolong equipment lifespans. For future researchers, it offers an evaluative model and baseline field data for studying human–machine interfaces in agricultural engineering projects.

II. METHODOLOGY

2.1 Research Design

This study employed an evaluative mixed-methods concurrent triangulation design, integrated with a one-group pre-test/post-test quasi-experimental approach. Quantitative methods tracked shifts in technical test scores, mechanical downtime logs, and milling recovery data. Following the evaluative tracking model validated by Colt et al. (2010), the pre-test instrument was administered at the start of the training course to establish baseline cognitive competencies among the operator cohort, while an identical post-test instrument was administered upon course completion to isolate the extent of knowledge gained. Qualitative methods, conducted through focus group discussions (FGDs), contextualized the technical variations, infrastructure gaps, and behavioral transitions in maintenance practices identified in the quantitative data.

2.2 Locale of the Study

The research was conducted within the province of Nueva Ecija. This region is an ideal location for postharvest evaluations due to its high concentration of state-funded Rice Processing Systems across various municipal cooperatives and local government facilities.

2.3 Respondents and Sampling

The study drew on three overlapping but distinct samples, reflecting the different units of analysis addressed by the research questions:

RPS Beneficiaries (N = 15). Fifteen purposively selected regional entities — twelve (12) cooperatives and three (3) municipal LGUs — were profiled to establish the baseline infrastructure and operational status reported under Objective 1.

Technical Personnel (N = 40). Forty individual facility operators completed the five-day training course and the paired knowledge assessments; this group forms the basis for the item-level competency analysis in Objective 2 (Table 5). A subset of this group (n = 30)

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had complete, matched pre-test and post-test records and was used for the paired-samples t-test in Table 4.

Operational Tracking Subset (n = 10). Of the fifteen beneficiary facilities, ten maintained active three-phase power connections and complete, continuous processing logbooks across a full cropping cycle. Long-term operational and asset sustainability metrics (Objectives 3 and 4) were delimited to this subset, since the remaining five facilities lacked the infrastructure or logbook continuity needed for valid before/after comparison.

This layered sampling structure allows the study to draw on the full beneficiary and operator population where appropriate, while restricting causal before/after claims to facilities where operational data was complete and uncontaminated by infrastructure downtime unrelated to training.

2.4 Data Gathering Instruments

Data collection relied on four primary tools:

1. Standardized Technical Knowledge Assessments: a 25-item test measuring proficiency in machinery mechanics, multi-pass calibration rules, and diagnostic safety procedures adapted from industry training baselines.
2. Operational Logbooks: standardized logs tracking raw input weights, final polished rice yields, digital moisture readouts, and exact breakdown durations across specified mill sizes and dryer combinations.
3. Structured Asset Sustainability Surveys: a five-point Likert scale instrument measuring daily checklist usage, lubrication frequencies, and operator troubleshooting.
4. Focus Group Protocols: open-ended qualitative guidelines used to capture operational experiences, identify training-to-field knowledge transfer limitations, and document external infrastructure challenges.

2.5 Data Gathering Procedure

Data collection proceeded in three sequential phases:

1. Baseline Auditing: historical data extraction from existing cooperative records to log pre-training milling indices, baseline unplanned downtime, and facility infrastructure configurations.
2. Training and Knowledge Tracking: administering the standardized 25-item technical test immediately before and after the five-day training intervention to document operator learning gains (Colt et al., 2010).
3. Post-Implementation Monitoring: field tracking across a full cropping season to monitor post-training operational logs, compile survey metrics, and conduct qualitative focus group discussions.

2.6 Data Analysis Technique

Descriptive Statistics. Frequency distributions, percentages, and weighted means were used to characterize baseline cooperative attributes, assess site infrastructure readiness, and measure overall maintenance compliance levels.

Paired-Samples t-test. Applied to evaluate differences between operator test scores and monthly unplanned downtime before and after the training intervention, with significance set at $\alpha = 0.05$ and degrees of freedom reported alongside each t-value (Colt et al., 2010).

Pearson Product-Moment Correlation Coefficient (r). Used to determine the strength and direction of the relationship between operator technical scores and postharvest facility performance metrics, with degrees of freedom ($n - 2$) reported for each coefficient (Santos & Gamit, 2023).

III. RESULTS AND DISCUSSION

This section presents, analyzes, and interprets the data gathered in the study. The presentation follows the exact sequence of the specific questions raised in the objectives of the study. Problem 1 establishes the baseline profile of the fifteen (15) designated RPS beneficiaries; Problem 2 reports the technical assessment performance of the training participants; Problem 3 presents the operational efficiency and asset sustainability outcomes of the beneficiary facilities; and Problem 4 tests the relationship between the two. Qualitative evidence drawn from the focus group discussions is integrated within the problem to which it directly pertains, consistent with the concurrent triangulation design described in Section II.

3.1 Baseline Profile of the Fifteen (15) Designated RPS Beneficiaries

The first research question sought to establish the baseline profile of the fifteen (15) designated RPS beneficiaries in terms of (1.1) geographical location,

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(1.2) machine setup level, (1.3) infrastructure readiness, and (1.4) operational status. An audit of official engineering asset logs revealed substantial variation across all four profile dimensions, summarized facility-by-facility in Table 1 and consolidated in frequency-and-percentage form in Table 2.

Table 1. Profile of Designated RPS Beneficiaries (N = 15)

No.	Name of RPS Beneficiary	Address	Setup Level	3-Phase Grid Status	Operational Status
1	City LGU of Cabanatuan	Kapitan Pepe, Cabanatuan City	Level 3	1 (Active)	Operational
2	Makabagong Magsasaka MPC	Palagay, Cabanatuan City	Level 1	1 (Active)	Operational
3	Cabanatuan City Seed Growers MPC	Dionisio S. Garcia, Cabanatuan City	Level 1	1 (Active)	Functional / Stagnant (Not Yet Trained)
4	Coop. Enterprise for True Economic Reform	Cabaruan, Guimba	Level 2	1 (Active)	Operational
5	Pakul Primary MPC	Pakul, Jaen	Level 2	1 (Active)	Operational
6	Bantug Agricultural MPC, Inc.	Bantug, Talavera	Level 2	1 (Active)	Operational
7	Kilusang Lima Para sa Lahat MPC	Maestrang Kikay, Talavera	Level 1	1 (Active)	Operational
8	South Nueva Ecija Seed Growers MPC	Poblacion, San Isidro	Level 1	1 (Active)	Operational
9	Provincial LGU of Nueva Ecija	Singalat, Palayan City	Level 1	0 (No Grid)	Functional / Delayed Grid Connection
10	SIPAG MPC	Poblacion, Aliaga	Level 1	0 (No Grid)	Functional / Stagnant (Not Yet Trained)
11	Licaong Agriculture Cooperative	Licaong, Science City of Muñoz	Level 1	0 (No Grid)	Functional / Stagnant (Not Yet Trained)
12	City LGU of Muñoz	Franza, Science City of Muñoz	Level 2	1 (Active)	Operational
13	Kasangga Ng Rang-Ay Irrigators' Assoc.	Gabaldon-Rangayan Rd, Muñoz	Level 1	1 (Active)	Operational
14	Caridad Sur Farmers MPC	Caridad Sur, Llanera	Level 1	1 (Active)	Operational
15	Talabutab Norte Primary MPC	Talabutab Norte, General Natividad	Level 2	1 (Active)	Functional / Stagnant (Not Yet Trained)

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Table 2. Summary Distribution of the Baseline Profile Variables (N = 15)

Profile Variable / Category	Frequency (f)	Percentage (%)
1.1 Geographical Location		
Cabanatuan City	3	20.00
Science City of Muñoz	3	20.00
Talavera	2	13.33
Guimba, Jaen, San Isidro, Palayan City, Aliaga, Llanera, General Natividad (1 each)	7	46.67
1.2 Machine Setup Level		
Level 1 (1.5 t/hr mill + two 6 t/batch dryers)	9	60.00
Level 2 (2–3 t/hr mill + two 12 t/batch dryers)	5	33.33
Level 3 (4–5 t/hr mill + three 12 t/batch dryers)	1	6.67
1.3 Infrastructure Readiness (3-Phase Grid)		
Active 3-phase grid connection	12	80.00
No active 3-phase grid connection	3	20.00
1.4 Operational Status		
Operational	10	66.67
Functional / Stagnant (Not Yet Trained)	4	26.67
Functional / Delayed Grid Connection	1	6.67
Beneficiary Type		
Farmers' Cooperatives and Associations (FCAs)	12	80.00
Local Government Units (LGUs)	3	20.00

3.1.1 Geographical Location

The fifteen beneficiary facilities are distributed across ten (10) cities and municipalities spanning the congressional districts of Nueva Ecija. Cabanatuan City and the Science City of Muñoz each host three (3) facilities, or 20.00% apiece, while Talavera hosts two (2) or 13.33%. The remaining seven (7) facilities, representing 46.67%, are singly distributed across Guimba, Jaen, San Isidro, Palayan City, Aliaga, Llanera, and General Natividad. This dispersion reflects the allocation intent of the Rice Competitiveness Enhancement Fund, which distributes postharvest capacity across producing districts rather than concentrating it in a single processing hub.

3.1.2 Machine Setup Level

Level 1 configurations dominate the allocation at 60.00% (f = 9), followed by Level 2 multi-pass setups at 33.33% (f = 5), with only one facility, the City LGU of Cabanatuan, reaching the commercial automated Level 3 scale at 6.67% (f = 1). The concentration of grants at the Level 1 tier indicates that the prevailing capacity profile in the province is the 1.5-ton-per-hour mill paired with two 6-ton-per-batch recirculating dryers, a scale suited to cooperative-level rather than commercial-volume throughput.

3.1.3 Infrastructure Readiness

Infrastructure readiness was operationalized as the presence of an active three-phase power grid

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connection at the facility site, since the multi-stage mill and recirculating dryer motors cannot be energized without it. Twelve (12) facilities, or 80.00%, held active three-phase connections at the time of audit. Three (3) facilities, or 20.00% — the Provincial LGU of Nueva Ecija (No. 9), SIPAG MPC (No. 10), and Licaong Agriculture Cooperative (No. 11) — had no active three-phase grid connectivity at handover. This constitutes a pre-handover infrastructure mismatch: the capital asset was delivered and installed in advance of the utility service required to operate it, producing stagnation that is entirely independent of operator skill or training exposure.

3.1.4 Operational Status

Ten (10) facilities, or 66.67%, were classified as Operational, meaning they held active power, had completed operator training, and maintained continuous processing logbooks across the cropping cycle. These ten facilities constitute the operational tracking subset (n = 10) used in Problems 3 and 4, as delimited in Section II. Four (4) facilities, or 26.67%, were classified as Functional/Stagnant (Not Yet Trained), and one (1) facility, or 6.67%, as Functional/Delayed Grid Connection.

3.1.5 Non-Operational Facilities: A Distinct Structural Finding

Five (5) of the fifteen beneficiary facilities — 33.33% of distributed RPS assets — were not yet realizing operational value at the time of data collection, and were therefore excluded from the operational tracking analysis. The reasons for exclusion differ in kind and warrant separate treatment, as summarized in Table 3.

Table 3. Constraint Classification of Non-Operational RPS Facilities (n = 5)

No.	Facility	3-Phase Grid	Training Status	Governing Constraint
9	Provincial LGU of Nueva Ecija	None	Trained	Utility coordination (grid only)
10	SIPAG MPC	None	Not yet trained	Utility coordination + rollout schedule
11	Licaong Agriculture Cooperative	None	Not yet trained	Utility coordination + rollout schedule
3	Cabanatuan City Seed Growers MPC	Active	Not yet trained	Program rollout schedule only
15	Talabutab Norte Primary MPC	Active	Not yet trained	Program rollout schedule only

Three (3) of the five cases are governed wholly or partly by an absent three-phase grid connection, representing a pre-handover infrastructure failure situated outside the scope of the training intervention. The remaining two (2) facilities held active power but had simply not yet been scheduled into the training cycle at the time of data collection. This distinction matters for interpretation: grid-related stagnation reflects an inter-agency utility coordination failure, while training-related stagnation is a scheduling artifact of program rollout rather than evidence against the intervention's effectiveness. Neither category constitutes a negative training outcome.

The focus group discussions corroborate this reading. Under the theme Infrastructure Gaps, an operator assigned to a grid-constrained site reported that the facility remained idle notwithstanding completed instruction:

> *"Gusto sana nating i-apply agad yung natutunan sa training pero wala pa ring dumarating na 3-Phase power supply mula sa kooperatiba ng kuryente."*

The statement confirms that cognitive capacity had been successfully built at these sites, but that external utility deficits prevented that capacity from translating into regional processing volume. This finding is carried forward into the interpretation of Problems 2 and 3, where item-level mastery in dryer architecture is shown to coexist with zero field throughput at the affected facilities.

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3.2 Performance of the Course Participants in the Skills Training Course

The second research question examined the technical assessment performance of the participants across the paired pre-test and post-test instruments. Two complementary analyses are presented: an aggregate paired-samples t-test on the matched score records (Table 4), and an item-by-item frequency and percentage distribution isolating the specific competency vectors in which learning occurred (Table 5).

3.2.1 Aggregate Knowledge Acquisition

Table 4. Paired t-test Analysis of Trainee Examination Scores (n = 30)

Evaluation Instrument	Mean Score	Net Change	t-value	p-value	Statistical Significance
Pre-Test Score (out of 25)	12.87	+1.90	t(29) = 3.738	0.0007	Highly Significant (p < 0.01)
Post-Test Score (out of 25)	14.77	—	—	—	—

Table 4 presents the paired-samples t-test comparing pre-test and post-test scores of the RPS operators with complete matched records. The baseline evaluation yielded a pre-test mean of 12.87 out of 25, indicating a moderate initial level of technical familiarity. Following the intervention, the post-test mean rose to 14.77 out of 25, a net change of +1.90 points. The analysis generated a computed value of t(29) = 3.738, p = 0.0007. Because the p-value falls substantially below the 0.01 threshold, the null hypothesis is rejected. The result is statistically highly significant, demonstrating that the skills training course produced a genuine, non-random improvement in the technical competencies of the FCA operators with respect to RPS operation and maintenance.

3.2.2 Item-Level Competency Distribution

Table 5. Frequency and Percentage Distribution of Operator Correct Responses (N = 40)

No.	Core Competency Vector	Pre-Test	Post-Test	Net Gain
1	Loss Factors Awareness (Moisture/Insects)	32 (80.0%)	39 (97.5%)	+17.5%
2	Postharvest Interaction System Matrices	28 (70.0%)	38 (95.0%)	+25.0%
3	Macro Anatomy of Paddy Grain Structures	25 (62.5%)	36 (90.0%)	+27.5%
4	Micro Structural Internal Component Anatomy	18 (45.0%)	29 (72.5%)	+27.5%
5	Target Safe Milling/Storage Moisture (14%)	14 (35.0%)	37 (92.5%)	+57.5%
6	Drying System Mechanics and Storage Theory	30 (75.0%)	39 (97.5%)	+22.5%
7	Mechanical Component Grouping	22 (55.0%)	35 (87.5%)	+32.5%
8	Commercial Dryer Layout Categorizations	16 (40.0%)	31 (77.5%)	+37.5%
9	Physical Grain Classification Standards	26 (65.0%)	38 (95.0%)	+30.0%
10	Primary Operator Accountability Mandates	34 (85.0%)	40 (100.0%)	+15.0%
11	Flatbed Dryer Architecture Classifications	15 (37.5%)	32 (80.0%)	+42.5%
12	External Postharvest Loss Factor Isolation	20 (50.0%)	34 (85.0%)	+35.0%
13	Warehouse Bag Stack Spacing Regulations	11 (27.5%)	28 (70.0%)	+42.5%
14	Moisture Testing Methodologies	13 (32.5%)	30 (75.0%)	+42.5%

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No.	Core Competency Vector	Pre-Test	Post-Test	Net Gain
15	Chemical Degree Testing (Bran Staining)	8 (20.0%)	22 (55.0%)	+35.0%
16	Sizing/Grading Separation Mechanics	21 (52.5%)	35 (87.5%)	+35.0%
17	First-Line Warehouse Sanitation Defenses	29 (72.5%)	39 (97.5%)	+25.0%
18	Phase-Sequencing of Milling Processes	19 (47.5%)	33 (82.5%)	+35.0%
19	Warehouse Fumigation Protective Measures	12 (30.0%)	26 (65.0%)	+35.0%
20	Field Sample Replication Testing Frequencies	10 (25.0%)	29 (72.5%)	+47.5%
21	Cross-Infestation Biosecurity Vulnerabilities	14 (35.0%)	31 (77.5%)	+42.5%
22	Milling Extraction Grading Profiles	9 (22.5%)	24 (60.0%)	+37.5%
23	Husker Rubber Roller Clearance Settings (50%)	6 (15.0%)	23 (57.5%)	+42.5%
24	Inventory Control Management Logic (F.I.F.O.)	31 (77.5%)	40 (100.0%)	+22.5%
25	Fluid-Air Velocity Calibration Diagnostics	7 (17.5%)	25 (62.5%)	+45.0%
	Cumulative Mean	**47.00%**	**81.30%**	**+34.30%**

Table 5 shows the evaluation matrix across the twenty-five (25) core competency vectors comprising the assessment instrument. Prior to the intervention, cumulative baseline knowledge was deficient, yielding a mean pre-test score of 47.00%. This low baseline exposes systemic technical vulnerabilities in local postharvest handling, particularly in advanced diagnostic calibrations and chemical testing metrics. Following the training course, the cumulative mean post-test score advanced to 81.30%, a net knowledge gain of +34.30%.

The most pronounced breakthrough occurred in Item 5, Target Safe Milling/Storage Moisture (14%), which surged by +57.5% to a mastery level of 92.5%. Perfect mastery (100.0%) was recorded for both Item 10, Primary Operator Accountability Mandates, and Item 24, Inventory Control Management Logic (F.I.F.O.), indicating that operators thoroughly absorbed institutional accountability frameworks and warehouse structural flows. These three items are the competency vectors most directly implicated in the operational outcomes reported under Problem 3.

3.2.3 Residual Competency Gaps and Cognitive Calibration Overload

Notwithstanding uniformly positive net gains, residual deficiencies persist within advanced technical and chemical diagnostic workflows. Item 15, Chemical Degree Testing via Bran Staining Reagents (55.0%), and Item 23, Husker Rubber Roller Clearance Settings (57.5%), lagged materially behind all other categories, indicating that these competencies require a longer learning curve than a five-day format allows.

Focus group data under the theme Cognitive Overload and Calibration Limits explains the lag directly:

> *"Mabilis naituro yung chemical testing (bran staining) pero nalilito pa rin kami, pati rin sa porsyento ng clearance ng rollers lalo na kapag paiba-iba ang laki ng palay."*

Operators reported that biochemical testing procedures were clearly presented during lecture, but that applying that knowledge proved substantially more difficult. Specifically, operators struggled to compute percentage clearances on rubber rollers because incoming raw grain dimensions varied continuously. This pattern suggests that fixed-parameter training templates do not fully prepare operators for highly variable field conditions, and that a five-day window provides insufficient time to build adaptive troubleshooting skill.

Left unaddressed, these gaps carry a direct operational risk. As established in Section I, improper roller clearance increases structural friction and grain breakage inside the husking chamber. This finding

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should therefore be read as a specific, actionable design constraint on future training cycles rather than as a general shortfall of the intervention.

3.3 Operational Efficiency and Asset Sustainability After the Training Course

The third research question evaluated the operational efficiency and asset sustainability of the beneficiary facilities following the intervention, across five indicators: (3.1) milling recovery rate, (3.2) moisture tracking accuracy, (3.3) unplanned downtime, (3.4) preventive maintenance compliance, and (3.5) troubleshooting capability. Consistent with the delimitation established in Section II, this analysis covers the ten (10) facilities holding active power connections and complete cropping-season logbooks. Indicators 3.1 through 3.3 are drawn from operational logbook records and presented in Table 6; indicators 3.4 and 3.5 are drawn from the structured asset sustainability survey and presented in Table 7.

Table 6. Postharvest Processing Efficiencies and Operational Status (n = 10)

Metric	Pre-Training	Post-Training	Net Shift	Implication
3.1 Milling Recovery Rate (MRR)	58.67%	64.34%	+5.67 pp	Higher profitability, reduced raw grain waste
3.2 Moisture Tracking Accuracy	62.40%	91.80%	+29.40 pp	Precise pricing, mold prevention, optimized storage
3.3 Unplanned RPS Downtime	16.00 hrs/mo	3.40 hrs/mo	−78.75%	Extended machine lifespan, continuous operations

3.3.1 Milling Recovery Rate

The Milling Recovery Rate, the primary technical indicator of postharvest processing efficiency, advanced from a baseline of 58.67% to a post-training level of 64.34%, a net yield increase of +5.67 percentage points. This post-training figure falls squarely within the target MRR range of 63.0% to 65.0% established for modern multi-pass systems (NFA, 2024) and discussed in Section I, indicating that trained operators brought facility performance up into the equipment's designed operating envelope. The baseline of 58.67%, by contrast, sat at the upper edge of the 55% to 58% band characteristic of traditional field methods, meaning that prior to training the facilities were operating modern multi-pass equipment at effectively traditional recovery levels.

3.3.2 Moisture Tracking Accuracy

Moisture tracking accuracy improved by +29.40 percentage points, from a baseline of 62.40% to 91.80%, ensuring closer alignment with the 14.0% target moisture standard and materially reducing spoilage risk during storage. This is the largest proportional gain among the operational indicators, and it corresponds directly to the largest item-level knowledge gain reported under Problem 2 (Item 5, +57.5%). Focus group evidence under the theme Moisture Control Shift traces the mechanism:

> *"Dati sa kalsada kinapakapa lang namin kung tuyo na ang palay. Noong nalaman namin yung saktong 14%, mas kaunti na ang nadudurog na bigas sa loob ng whiteners."*

Operators noted that their historical baseline routine relied on subjective physical assessment of paddy on open roads rather than instrument-based verification. Replacing that habit with objective moisture testing at the 14% threshold produced an immediate, visible reduction in grain fracturing inside the milling equipment. This rapid workplace feedback loop reinforced classroom learning and helps explain why this competency was internalized faster than any other. The convergence between the +57.5% item gain, the +29.40 pp accuracy gain, and the elevated MRR of 64.34% constitutes the strongest evidentiary chain in the study, linking a single discrete cognitive gain to a measurable physical yield outcome.

3.3.3 Unplanned Downtime

Unplanned RPS downtime decreased from an average of 16.00 hours per month to 3.40 hours per month, a reduction of 78.75%. This finding is consistent with the asset sustainability literature

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reviewed in Section I (JICA, 2025), which links structured preventive maintenance routines to reduced component failure rates. The magnitude of the reduction observed here suggests that daily pre-operational inspection habits and first-line troubleshooting capability were the primary drivers of continued operational continuity for the multi-million-peso RPS asset. Expressed in operating terms, the facilities recovered approximately 12.6 productive machine-hours per month, a recovery of particular consequence during peak harvest windows when drying and milling capacity is rate-limiting.

Table 7. Behavioral Maintenance Metrics and Asset Sustainability Indices (n = 10)

Asset Care Vector	Pre-Training	Post-Training	Shift	Behavioral Shift
3.4 Daily Pre-Operation Checklist Execution	1.40 (Poor/Reactive)	4.60 (Excellent)	+3.20	Rare to Highly Consistent
3.4 Systematic Lubrication & Belt Tensioning	1.80 (Marginal)	4.50 (Excellent)	+2.70	Neglected to Routinely Conducted
3.5 Independent Plant Failure Troubleshooting	2.10 (Marginal)	4.10 (Compliant)	+2.00	External-Dependent to Autonomous
Composite Asset Care Index	**1.77 (Marginal)**	**4.40 (Compliant)**	**+2.63**	**Reactive Upkeep to Preventive Care**

3.3.4 Preventive Maintenance Compliance

Preventive maintenance compliance was measured through two behavioral vectors. Daily Pre-Operation Checklist Execution registered the single most notable behavioral evolution in the study, rising by +3.20 points from a baseline mean of 1.40 (Poor/Reactive) to a post-intervention mean of 4.60 (Excellent). Systematic Lubrication and Belt Tensioning advanced from 1.80 (Marginal) to 4.50 (Excellent), a shift of +2.70 points, indicating that previously neglected scheduled tasks are now routinely integrated into daily operations.

Focus group evidence under the theme Maintenance Culture Shift documents the underlying institutional change:

> *"Hindi na namin hihintayin na maputol ang elevator belt bago ayusin. Ngayon, bago magpaandar sa umaga, sinusunod na namin yung checklist sa tensyon at langis."*

Rather than relying on reactive, breakdown-driven repairs, operators reported actively institutionalizing structured pre-shift protocols, running standardized oiling, tensioning, and sequential inventory checklists each morning before activating machinery. This behavioral internalization corresponds to the perfect post-test mastery recorded for Items 10 and 24 under Problem 2, and directly explains the movement of the Composite Asset Care Index from 1.77 (Marginal) to 4.40 (Compliant), which relocates the institutional culture into the Compliant behavioral threshold.

3.3.5 Troubleshooting Capability

Independent Facility Failure Troubleshooting rose from 2.10 (Marginal) to 4.10 (Compliant), a shift of +2.00 points. While this vector registered both the lowest post-training mean and the smallest absolute gain among the three behavioral indicators, the shift nonetheless signifies a meaningful reduction in dependency on external technicians and a transition from an externally dependent to a substantially autonomous maintenance posture.

The comparatively restrained gain in this vector is internally consistent with the residual competency gaps identified under Problem 2. Troubleshooting is the behavioral expression of exactly those diagnostic competencies — roller clearance calibration (Item 23, 57.5%) and chemical degree testing (Item 15, 55.0%) — that remained least mastered at post-test. The two findings converge on the same interpretation: routine, rule-based maintenance behaviors transferred readily from classroom to plant floor, whereas adaptive, judgment-dependent diagnostic behaviors transferred only partially within the five-day window.

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3.4 Relationship Between Technical Assessment Performance and Facility Outcomes

The fourth research question tested whether a significant relationship exists between the operator competency established under Problem 2 and the facility-level outcomes established under Problem 3. A Pearson product-moment correlation coefficient was computed between operators' post-test scores and two institutional metrics: the Milling Efficiency Index and the Asset Sustainability Index.

Table 8. Correlation Matrix — Participant Performance vs. Facility Efficiencies (n = 10)

Correlated Variables	Pearson r	p-value	Inference
Post-Test Scores vs. Milling Efficiency Index	r(8) = .742	0.014	Strong Positive (Significant)
Post-Test Scores vs. Asset Sustainability Index	r(8) = .795	0.006	Strong Positive (Highly Significant)

The relationship between operators' post-test scores and RPS milling efficiency is strong, positive, and statistically significant, r(8) = .742, p = .014. Because the p-value falls below the conventional α = .05 threshold, the null hypothesis is rejected, indicating that higher post-training technical competency is strongly associated with improved milling recovery, lower broken-grain rates, and reduced downtime during peak harvest.

The correlation between post-test scores and the Asset Sustainability Index is stronger still, r(8) = .795, p = .006, a highly significant relationship at the α = .01 level. This suggests that technical competence is a critical determinant of machinery longevity: operators with higher proficiency scores demonstrate stronger adherence to preventive maintenance schedules, more precise troubleshooting, and more consistent calibration, directly reducing the risk of premature equipment depreciation.

That the competency–sustainability association exceeds the competency–efficiency association is itself interpretively significant. Milling recovery is jointly determined by operator skill and by exogenous variables outside the operator's control, including incoming paddy variety, harvest maturity, and field moisture at intake. Maintenance behavior, by contrast, is almost wholly operator-determined. The stronger coefficient on the sustainability index therefore reflects the indicator on which operator competency exerts the most direct causal leverage.

Taken together, these coefficients provide statistical evidence that targeted technical skills training is a meaningful driver of both immediate operational efficiency and long-term asset sustainability for agricultural cooperatives in Nueva Ecija. It should be noted, consistent with the delimitation in Section II, that the correlation is computed on the ten-facility operational subset, and that association at this sample size does not by itself establish causal direction.

3.5 Convergence of Quantitative and Qualitative Findings

Consistent with the concurrent triangulation design, the qualitative themes derived from the focus group discussions were coded and mapped against the research problem to which each pertains. Table 9 presents the consolidated coding matrix, integrating the verbatim field transcripts discussed under Problems 1 through 3.

Table 9. Qualitative Coding Matrix for Transcribed Operator Responses

Theme	Related Problem	Typical Verbatim Statement (Tagalog Field Transcript)	Operational Management Meaning
1. Infrastructure Gaps	Problem 1 (1.3, 1.4)	"Gusto sana nating i-apply agad yung natutunan sa training pero wala pa ring dumarating na 3-Phase power supply mula sa kooperatiba ng kuryente."	Explains why infrastructure variables limit immediate field efficiency despite strong Item 8 mastery; utility delays stall automated storage rollout.

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Theme	Related Problem	Typical Verbatim Statement (Tagalog Field Transcript)	Operational Management Meaning
2. Cognitive Overload & Calibration Limits	Problem 2 (2.3)	"Mabilis naituro yung chemical testing (bran staining) pero nalilito pa rin kami, pati rin sa porsyento ng clearance ng rollers lalo na kapag paiba-iba ang laki ng palay."	Confirms that a short training window provides insufficient time to master precision settings under variable load inputs; explains the lag in Items 15 and 23.
3. Moisture Control Shift	Problem 3 (3.1, 3.2)	"Dati sa kalsada kinapakapa lang namin kung tuyo na ang palay. Noong nalaman namin yung saktong 14%, mas kaunti na ang nadudurog na bigas sa loob ng whiteners."	Validates the statistical jump in Item 5; connects empirical moisture management to higher MRR and fewer broken grains.
4. Maintenance Culture Shift	Problem 3 (3.4, 3.5)	"Hindi na namin hihintayin na maputol ang elevator belt bago ayusin. Ngayon, bago magpaandar sa umaga, sinusunod na namin yung checklist sa tensyon at langis."	Explains the structural shift behind the Asset Sustainability Index jump; reinforces mastery of Items 10 and 24.

The mapping demonstrates that the qualitative data does not merely restate the quantitative findings but explains their distribution. Themes 3 and 4 account for where gains were largest, Theme 2 accounts for where gains were smallest, and Theme 1 accounts for where gains could not be expressed in field performance at all. The convergence across both strands supports the validity of the overall evaluative conclusion while identifying, with precision, the two boundaries — cognitive and infrastructural — that constrained it.

IV. CONCLUSION

This study evaluated the impact of a five-day Skills Training Course on the operation and maintenance of the Rice Processing System upon the operational efficiency and asset sustainability of fifteen (15) designated RPS beneficiaries in Nueva Ecija, comprising twelve (12) registered Farmers' Cooperatives and Associations and three (3) Local Government Units, encompassing forty (40) trained operators. Drawn in the sequence of the research problems, the study concludes that:

1. The baseline allocation of RPS assets in Nueva Ecija is skewed toward cooperative-scale Level 1 configurations and is not synchronized with local utility readiness. One-fifth of distributed facilities lacked the three-phase grid service required to energize the equipment at handover, and one-third of all assets were not yet generating operational value at the time of study. Capital distribution has therefore outpaced both the utility coordination and the training rollout necessary to activate it, leaving idle assets whose stagnation is attributable to program sequencing rather than to recipient capability.
2. The five-day Skills Training Course produced a statistically highly significant and non-random improvement in operator technical competency, but the gain is not uniform across competency types. Rule-based and threshold-based knowledge — target moisture, accountability mandates, inventory logic — was acquired to near or full mastery, whereas adaptive, judgment-dependent diagnostic competencies involving chemical assessment and mechanical clearance under variable grain loads remained substantially unmastered. A compressed timeline is sufficient to establish standards but insufficient to build calibration judgment.
3. The training intervention translated into measurable operational and behavioral gains at the facility level across all five indicators. Milling recovery moved from traditional-method performance into the equipment's designed

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operating range, moisture accuracy and downtime improved substantially, and cooperative maintenance culture shifted from a reactive breakdown framework to a structured, checklist-driven preventive regime. The comparatively restrained gain in independent troubleshooting mirrors the diagnostic learning gap identified above, confirming that field behavior tracks the specific structure of what was learned rather than the aggregate fact of training.

4. Operator technical competency is a statistically significant correlate of both operational efficiency and asset sustainability, with the stronger association attaching to asset sustainability. Structured human capacity building is therefore not an adjunct to postharvest mechanization but a determinant of whether distributed machinery achieves its designed performance and its intended service life. Procurement and distribution of high-capital machinery without matched investment in operator proficiency constitutes a systemic engineering management gap.

V. RECOMMENDATIONS

Proceeding from the conclusions above, the following are recommended:

1. To national line agencies and program implementers: mandate pre-handover infrastructure readiness audits. Physical machine allocation should be synchronized with local utility capability, with active three-phase electrical service verified and energized prior to equipment distribution and operator training. Formal coordination instruments with local electric cooperatives should be executed at the site-selection stage rather than after installation, and training schedules should be sequenced to follow rather than precede facility commissioning.
2. To training implementing units: extend training windows and provide focused refresher modules. Future interventions should expand the course timeline or offer specialized hands-on follow-up sessions targeting the specific competencies shown here to resist short-format transfer — adaptive rubber roller clearance adjustment under variable grain dimensions and chemical bran staining diagnostics. Instruction in these areas should employ variable-parameter practice on live equipment rather than fixed-parameter classroom templates.
3. To Farmers' Cooperatives and Associations and managing stakeholders: institutionalize standardized compliance and accountability frameworks. Formal internal monitoring systems should mandate continuous use of daily pre-operation checklists, routine lubrication schedules, and continuous logbook accounting, so that the behavioral gains recorded here are sustained beyond the immediate post-training period and survive operator turnover.
4. To national line agencies: institutionalize mandatory operator certification as a precondition of asset custody. Given the demonstrated correlation between operator competency and both processing efficiency and asset longevity, certification of at least one qualified operator per facility should be established as a formal requirement prior to the transfer of custody of high-capital postharvest equipment.
5. To future researchers: extend the evaluative window beyond a single cropping cycle to test the durability of the observed behavioral gains, and replicate the design in provinces with differing utility-readiness profiles to isolate the infrastructure effect from the training effect.

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Integration of AI-Assisted Development Tools into Modern Software Delivery Workflows and Their Impact on Engineering Productivity

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Abstract**—** *AI-assisted development tools now enter routine software delivery through code completion, repository-aware coding assistants, automated pull request (PR) comments, and AI-supported testing. Their effect on productivity depends on the workflow stage in which engineers use them, the quality controls around generated output, and the way senior developers preserve ownership of design decisions. This article develops an analytical model for integrating AI code generation and AI-driven pull request review into modern software delivery. The study uses comparative source analysis, conceptual synthesis, typologization, and analytical generalization based on ten recent academic and industry-facing publications on large language models in software engineering, GitHub Copilot, automated review, hallucinations, package risks, and security attacks. The article separates measured evidence from practitioner-reported operational estimates. It identifies where AI shortens implementation work, where it adds review burden, and which governance mechanisms protect code quality, onboarding, mentoring, dependency control, and release stability.*

Keywords**— AI-assisted software development, code generation, pull request review, engineering productivity, software delivery workflows, GitHub Copilot, large language models, code quality, software governance, developer experience**

I. INTRODUCTION

AI-assisted development has become part of everyday engineering work. Developers use code completion, conversational coding, repository-aware assistants, AI-generated tests, and automated pull request comments inside delivery pipelines that already contain IDE automation, linters, static analysis, peer review, CI/CD checks, and security scanning. Productivity in such environments cannot be reduced to the speed with which one developer writes a function. Engineering teams judge productivity through cycle time, defect leakage, review latency, release stability, rework, onboarding speed, and the ability to scale delivery without losing architectural control.

The topic matters because AI tools change the location of effort inside the software delivery chain. A coding assistant can shorten the time between task description and first working draft. The same draft still has to pass tests, review, merge, deployment, and operational monitoring. A pull request reviewer can flag a missing check or an unsafe pattern before a senior engineer reads the change. The same reviewer can fill the thread with weak comments that slow the merge. The productivity question therefore belongs to the workflow, not to the coding session alone.

The aim of this article is to develop an analytical model for integrating AI-assisted development tools into modern software delivery workflows and evaluating their influence on engineering productivity without treating practitioner estimates as controlled research results.

Three research objectives guide the argument. The first objective is to distinguish two layers of AI use in the software development lifecycle: AI code generation and AI-driven pull request review. The second objective is to examine how these layers affect coding speed, review

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capacity, integration time, quality control, onboarding, mentoring, and senior engineering work. The third objective is to define governance principles for adoption, including measurement, risk control, human ownership, mentoring routines, and decision rules for high-risk code.

The novelty of the article lies in its workflow-centered interpretation of AI-assisted development. Existing studies often examine developer speed, user perception, review comments, hallucinations, or security exposure as separate topics. The present article connects those findings into one delivery model that places AI between developer cognition, repository conventions, quality gates, and organizational learning.

The hypothesis is that AI-assisted development improves engineering productivity when teams integrate code generation and pull request review as governed workflow components. Ungoverned adoption can raise local coding speed while shifting hidden costs into review queues, integration delay, security exposure, mentoring gaps, and long-term maintainability.

II. MATERIALS AND METHODS

The material base was formed through targeted literature selection in ACM Digital Library, arXiv, USENIX, Microsoft Research, SSRN, and scholarly indexing services. Search phrases combined "AI coding assistants," "GitHub Copilot productivity," "large language models for software engineering," "automated code review," "pull request review LLM," "AI-generated code hallucination," "package hallucination," and "code completion security." Inclusion criteria covered publication date from 2023 to 2026, direct relevance to software delivery workflows, focus on code generation or pull request review, presence of empirical evidence or systematic synthesis, and sufficient methodological transparency. Exclusion criteria removed generic AI management papers, vendor marketing materials without reproducible claims, articles outside software engineering, and publications where productivity claims had no connection to software delivery mechanisms. The initial pool contained 42 works. Screening of titles, abstracts, methodology descriptions, and relevance to the three objectives reduced the corpus to 10 sources. The final corpus combines controlled productivity research, field experiments, public-sector deployment, systematic review literature, ACM-published evidence on AI-assisted code review, peer-reviewed research on LLM-supported code-quality remediation, user-study evidence on LLM-assisted programming, and security research on hallucinations, package risks, and code completion attacks (Cui et al., 2026, Hou et al., 2024, Ng et al., 2024, Patcas & Motogna, 2026, Peng et al., 2023, Spracklen et al., 2025, Vijayvergiya et al., 2024, Weber et al., 2024, Yan et al., 2024, Zhang et al., 2025). Practitioner-reported engineering experience was used as illustrative boundary evidence for adoption patterns, especially where engineering leadership experience concerns AI development strategy, generative AI code review, and a business-logic AI proof of concept. These materials were not treated as experimental measurements.

The article uses comparative analysis to separate AI code generation from AI-assisted pull request review. Source analysis supports evaluation of findings from recent studies. Conceptual synthesis connects productivity with SDLC stages. Typologization helps define adoption patterns. Analytical generalization supports governance principles. These methods correspond to the research objectives: comparison clarifies the two AI layers, synthesis explains productivity effects across workflow stages, and typologization supports the implementation model.

III. RESULTS

Recent research on AI-assisted development first requires a distinction that managerial language often blurs. AI code generation and AI-driven pull request review enter the software delivery chain at different points. Code generation shapes the moment when a developer turns intent into code. Pull request review shapes the moment when a proposed change becomes visible to teammates, maintainers, CI systems, and release governance. Treating both layers as a generic AI productivity tool weakens evaluation because each layer changes a different bottleneck.

Controlled evidence on GitHub Copilot links AI pair-programming with shorter completion time under bounded conditions. In an experiment where developers implemented an HTTP server in JavaScript, the Copilot group completed the task 55.8% faster than the control group (Peng et al., 2023). The finding matters for the first objective because it isolates the effect of AI code generation on implementation speed. The task design also limits the scope of inference. A bounded programming task differs from enterprise work where a developer must preserve domain rules, backward compatibility, security constraints, deployment behavior, and cross-team ownership. The result supports AI generation for well-scoped implementation work, while enterprise delivery still requires validation across the full pipeline.

Field experiments extend this interpretation. Evidence from software development settings at Microsoft, Accenture, and a Fortune 100 company connects generative AI use with productivity changes in high-skilled software work (Cui et al., 2026). The value of this evidence lies in

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the organizational setting. Developers worked inside company environments with existing codebases, workplace routines, and productivity measures defined by the organization. For the second objective, this strengthens the claim that teams should read productivity across the workflow, including developer experience, task allocation, review practices, and adoption conditions.

User-study evidence on LLM-assisted programming gives a more cautious reading of coding acceleration. Weber et al. (2024) compare programming conditions with and without AI support and show that LLM-based assistance can reduce task completion time in controlled programming work. The same line of evidence keeps the evaluation tied to correctness, maintainability, and verification behavior. For software delivery, this distinction matters: a faster draft has value only when developers still check whether the generated code satisfies requirements, follows local conventions, and fits the surrounding codebase (Weber et al., 2024).

Public-sector evidence brings onboarding and developer satisfaction into the same discussion. A GovTech Singapore study of GitHub Copilot adoption reports higher coding or task speed, strong perceived developer satisfaction, and particular gains for junior developers (Ng et al., 2024). This source links AI adoption with learning conditions, not only task velocity. Junior engineers can benefit from immediate examples, syntax support, and faster exploration of unfamiliar APIs. The same mechanism can weaken learning when engineers accept generated solutions without understanding them. In workflow terms, AI supports onboarding when code reading, review feedback, and explicit discussion of design reasoning remain part of the process. It becomes risky when the tool replaces the mentoring conversation that connects a task to system architecture.

A systematic literature review of large language models for software engineering maps LLM use across requirements, code generation, testing, maintenance, and software analysis (Hou et al., 2024). This review supports the first objective because AI-assisted development reaches beyond code completion. Software delivery contains several transformation points. Requirements become design choices, design choices become implementation, implementation becomes reviewed change, reviewed change becomes deployable artifact, and deployed artifact becomes operational behavior. AI can enter each point, but engineers can trust output only when local repository knowledge, acceptance criteria, and engineering standards are available for validation.

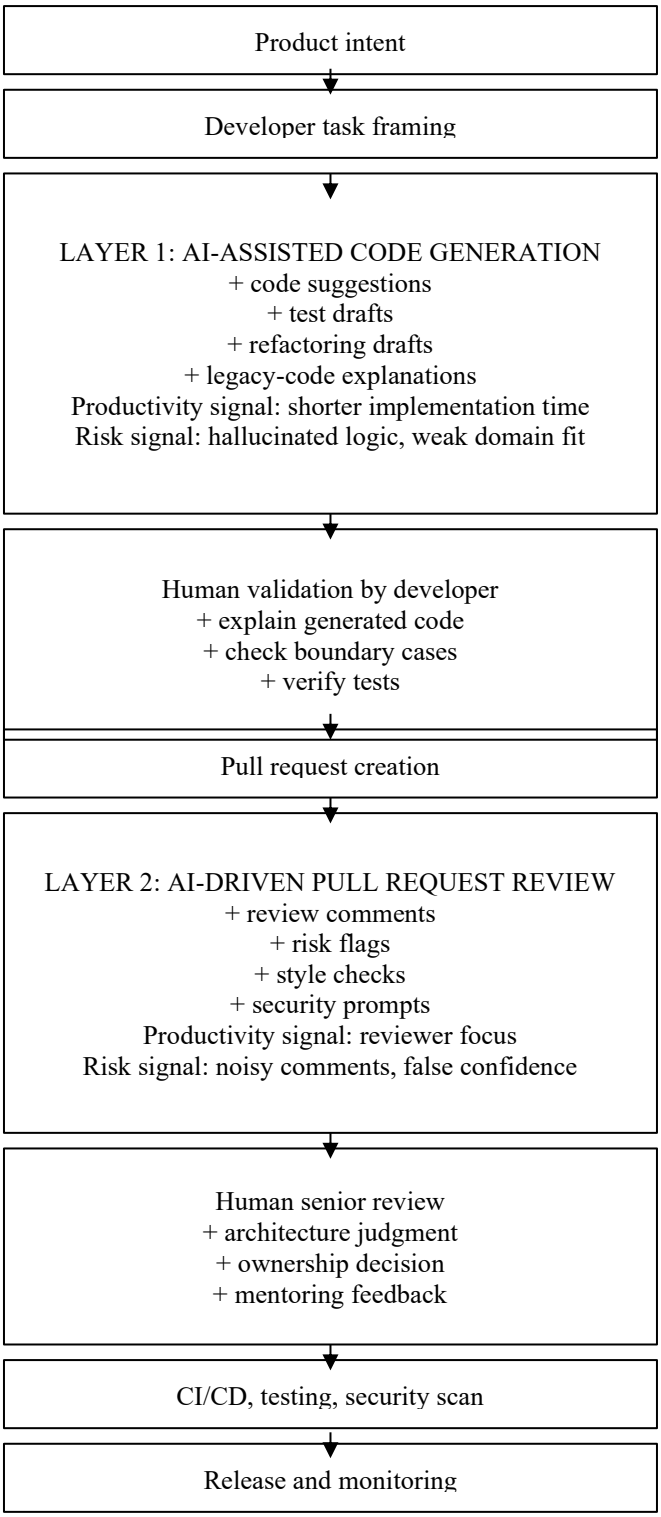
The first layer of the proposed model concerns AI code generation. It covers prompt-to-code transformation, completion of repeated patterns, generation of unit tests, explanation of legacy code, refactoring suggestions, and creation of scaffolding. Its productivity contribution is strongest where the task has a recognizable pattern and clear acceptance criteria. Examples include DTO mapping, boilerplate service methods, test skeletons, small UI state changes, migration scripts, and API client code. Risk rises when code generation touches domain-specific pricing logic, financial calculations, authorization, data retention, concurrency, or infrastructure configuration. These areas require repository-specific and business-specific reasoning that general-purpose models can imitate without controlling the underlying constraints.

The second layer concerns AI-driven pull request review and adjacent code-quality checks. ACM-published industrial evidence on AutoCommenter shows that an LLM-backed system can learn and enforce coding best practices across several programming languages in a large code-review environment (Vijayvergiya et al., 2024). This result supports the second objective because it treats AI review as part of an established engineering workflow, not as a standalone comment generator. Code review in a delivery workflow is a judgment process involving defect detection, maintainability, architecture, team norms, and release risk. If an AI reviewer increases comment volume without improving signal quality, human reviewers must classify, accept, reject, or explain the tool's suggestions. That work reduces the practical value of automation.

Peer-reviewed evidence on LLM-supported code-quality remediation strengthens this filter-based interpretation. Patcas and Motogna (2026) evaluate several state-of-the-art LLMs on issues identified by SonarQube and report that generated fixes can reduce static-analysis findings, although effectiveness varies by model, issue type, and semantic preservation. For the workflow model, the implication is narrow but useful: AI can support reviewers by addressing routine quality findings before senior engineers spend time on architecture, hidden coupling, risk trade-offs, and long-term maintainability (Patcas & Motogna, 2026). Figure 1 presents the two-layer model of AI-assisted delivery integration. It shows AI code generation as an upstream acceleration layer and AI pull request review as a downstream quality-assistance layer. The figure is a conceptual map linking tool placement to productivity indicators and governance gates.

Figure 1. Two-layer model for integrating AI-assisted tools into software delivery workflows (compiled by the author based on Hou et al., 2024, Vijayvergiya et al., 2024, and Patcas & Motogna, 2026)

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The figure separates acceleration from containment. AI generation increases the pace at which code enters the repository. AI review attempts to improve the quality of that inflow before merge. Without governance, the second layer becomes a compensation mechanism for risks created by the first layer. With governance, the layers complement each other: developers use AI to draft and explore, while PR-level assistance helps reviewers concentrate on non-trivial judgment.

Code quality drift follows from this model. It appears when generated code works locally but gradually changes the texture of the codebase. Naming conventions lose consistency. Abstractions multiply. Test coverage becomes shallow. Dependency choices become opportunistic. Domain concepts lose precision. The systematic review literature confirms that LLMs now cover many software engineering tasks, but broad coverage does not guarantee repository-level coherence (Hou et al., 2024). Repository coherence depends on architectural memory, review habits, test design, and local conventions. AI-generated code respects those conventions only when prompts, context windows, retrieval mechanisms, and review procedures expose them.

Hallucination research gives this concern a technical basis. Repository-level code generation studies identify hallucinations as a practical problem in complex development settings where models must handle dependencies, project context, and non-local constraints (Zhang et al., 2025). This matters for both code generation and review. In generation, hallucination can appear as invented methods, incorrect API use, missing imports, unreachable control flow, or plausible code that violates business rules. In review, hallucination can appear as criticism of a defect that is not present or advice that misunderstands surrounding code. The workflow cost differs in each case. Generated hallucination creates defects. Review hallucination creates noise and reviewer fatigue.

Package hallucinations make the supply-chain risk concrete. Research on code-generating LLMs found hallucinated package names across programming languages and model types, creating a package confusion threat where attackers can register invented packages that AI systems have suggested (Spracklen et al., 2025). This finding matters for the third objective because it moves the discussion beyond code correctness. AI-assisted development can affect dependency governance, build security, and open-source risk. A team that allows AI-generated dependency suggestions without package allowlists, internal mirrors, SBOM review, or security scanning creates a risk that unit tests may miss.

Security research on code completion models extends the issue further. Backdoor attack studies show that attackers can manipulate code completion systems through poisoned fine-tuning data or disguised vulnerabilities that evade detection (Yan et al., 2024). This finding affects organizations exploring private fine-tuning, internal code assistants, or repository-specific models. Local AI customization can improve relevance, but it expands the attack surface. Strong governance therefore has to go beyond rules about secrets in prompts. It needs model

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provenance, dependency scanning, prompt-injection awareness, secure configuration, and auditability of generated code paths.

The relationship between AI tools and senior engineers requires separate attention. Studies on AI-assisted review and code-quality remediation show that LLM-based support can help teams address routine findings and apply coding practices when engineers use it as a filter (Patcas & Motogna, 2026, Vijayvergiya et al., 2024). Senior engineers therefore remain central to the delivery chain. Their work shifts. They evaluate generated work, maintain architectural coherence, design review standards, and mentor junior developers in the interpretation of AI output. Seniority becomes less tied to manual production of every solution and more tied to system judgment.

This shift affects onboarding. AI assistants can shorten the distance between a new developer and the first meaningful contribution by explaining code, generating examples, and reducing syntax friction (Ng et al., 2024, Peng et al., 2023). Over-reliance creates another pattern: a junior developer can learn to accept plausible solutions before learning why a design fits the product. AI-assisted onboarding works best when tool use is paired with mentoring rituals: explain the accepted suggestion, compare it with the repository standard, write a test that proves the behavior, and document the reason for the chosen implementation. Productivity then includes learning velocity, not only ticket velocity.

The boundary between developer tooling AI and business-logic AI should stay visible. Practitioner-reported engineering experience describes an AI proof of concept for a discount system where a small team trained a model to interpret submitted project details and suggest eligible discounts from historical information. This case illustrates another AI layer. It concerns business decision automation, data warehouse readiness, and organizational data maturity. It should not serve as evidence that code generation tools automatically improve SDLC productivity. Its value for this article is contrastive. Developer tooling AI changes how engineers produce and review software. Business-logic AI changes what the software decides for customers. Both require governance, but the validation object differs. In the first case, engineers validate code, tests, review, and delivery metrics. In the second case, the organization validates data quality, eligibility logic, business accountability, model drift, and decision auditability.

The comparative reading of productivity, review, and security literature supports the hypothesis with a necessary qualification. AI-assisted development can improve engineering productivity when organizations define which workflow stage the tool serves, what output counts as acceptable, who owns the final decision, and which metrics reveal hidden costs. Productivity evidence from controlled, field, and user-study research supports acceleration in coding activity under defined conditions (Cui et al., 2026, Peng et al., 2023, Weber et al., 2024). Code-review and code-quality research shows that AI assistance works best when teams connect it to existing review rules, static analysis, and human validation (Patcas & Motogna, 2026, Vijayvergiya et al., 2024). Security and hallucination research shows that the cost of unguided AI output may accumulate in dependency risk, false confidence, and maintainability loss (Spracklen et al., 2025, Yan et al., 2024, Zhang et al., 2025).

Organizations sometimes report internal improvements such as faster delivery or fewer release issues after AI adoption. Academic writing should frame such figures as practitioner-reported operational evidence. These estimates are useful because they reflect managerial experience in real teams. They should not be converted into experimental findings unless the organization provides baseline definitions, sampling logic, measurement windows, and comparable control groups. A reported 40% or 50% improvement in delivery speed can inform a measurement plan that tracks cycle time, PR size, review latency, escaped defects, rework, and developer satisfaction before and after rollout.

The results indicate that AI-assisted software delivery works as a governed socio-technical arrangement. The technical layer contains models, IDEs, PR bots, static analysis, CI pipelines, tests, and dependency controls. The social layer contains review culture, senior mentoring, team norms, trust calibration, and leadership decisions. Productivity emerges from the interaction between these layers. Two organizations can adopt the same tool and receive different outcomes because the surrounding workflow differs.

IV. DISCUSSION

A restrained positive position follows from the results: engineering teams should integrate AI-assisted development tools as bounded workflow components. Tools such as GitHub Copilot, Cursor, Claude Code, and PR review bots already help with many routine tasks. The decisive managerial question concerns placement, ownership, and verification. A coding assistant inside an IDE accelerates a developer's movement through implementation. A review assistant inside the pull request pipeline changes the information available to reviewers. These interventions require separate adoption rules.

The first implementation principle is task-envelope design. Teams should encourage AI code

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generation for repetitive, low-risk, pattern-heavy work where acceptance criteria are clear. Examples include scaffolding, test drafts, small refactors, interface adapters, documentation snippets, and local transformations. Teams should require additional review for authorization logic, pricing logic, financial workflows, cryptography, infrastructure permissions, data deletion, and production incident fixes. Broad AI policies often fail because they give developers abstract permission. Useful policies name tasks, risks, and gates.

The second principle is human ownership. Every AI-generated fragment entering the repository needs a human owner who can explain the behavior, test boundary cases, and defend the design during review. The responsible developer cannot treat the assistant as an external author. In delivery terms, code ownership remains indivisible. A tool proposes. An engineer commits.

The third principle concerns senior engineers. AI adoption raises the value of senior judgment because the volume of plausible code grows. Senior engineers should spend less time policing formatting and obvious patterns, but more time on architecture, hidden coupling, non-functional requirements, test sufficiency, and mentoring. Engineering leaders should reflect this shift in workload planning. If AI tools produce more pull requests, reviewer capacity must grow or the organization must narrow the scope of automated generation. Otherwise, gains at the coding level become review queues. Table 1 compares adoption decisions for the two layers of AI-assisted development. Its purpose is to separate tool function, benefit, risk, and control mechanism so engineering leaders do not treat all AI tooling as one intervention.

Table 1. Decision logic for adopting AI-assisted development tools in software delivery workflows (compiled by the author based on Peng et al., 2023, Hou et al., 2024, Vijayvergiya et al., 2024, and Patcas & Motogna, 2026)

Adoption layer	Appropriate use	Expected productivity effect	Main risk	Governance response
AI code generation	Boilerplate, tests, local refactoring, API examples, code explanation	Shorter implementation time and faster exploration of unfamiliar code	Plausible code that misses repository conventions or business rules	Human explanation requirement, test coverage rule, restricted use for high-risk domains
AI-driven PR review	Routine comments, style issues, suspicious patterns, missing checks, preliminary security prompts	Reduced reviewer load and earlier defect discovery when comment quality is high	Noisy comments, faulty corrections, longer PR closure	Signal-quality monitoring, reviewer override, comment taxonomy, periodic sampling
AI-assisted onboarding	Guided code reading, examples, first-task scaffolding, local explanations	Faster entry into codebase and lower syntax friction	Shallow learning and uncritical acceptance	Mentored AI use, explanation logs, pair review, task retrospectives
AI in business logic	Discount suggestions, document classification, customer-facing decision support	Process automation outside developer tooling	Data drift, accountability gaps, decision opacity	Model validation, data governance, audit trails, human approval for sensitive decisions

The table supports conditional adoption. AI code generation is most defensible when the team can specify expected behavior and verify it through tests or review. AI PR review has value when the assistant improves signal density, not when it floods the thread with generic comments. AI-assisted onboarding should accelerate learning while keeping mentoring in place. Business-logic AI belongs to another governance regime because it affects organizational decisions, not only engineering throughput.

A staged implementation model follows from this logic. The first stage is limited enablement. A team allows AI coding tools for low-risk tasks and collects baseline metrics for cycle time, PR size, review time, rework rate, escaped defects, and developer satisfaction. The second stage introduces validation rules: the committer must understand generated code, tests must cover intended behavior, and every new dependency must pass verification. The third stage adds PR-level AI review after the team defines comment categories and measures whether automated comments are actionable. The fourth stage scales adoption through governance dashboards, training, and periodic audits.

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Measurement needs care. Many engineering organizations already track velocity, but velocity alone is too blunt for AI-assisted delivery. A team can finish more tickets while increasing rework, weakening tests, or moving risk into production. Metrics should combine speed, quality, and learning. A practical dashboard should include median cycle time, review latency, PR closure time, reopened work, defect leakage, test coverage movement, dependency additions, security findings, review comment acceptance, and developer self-reported cognitive load. The aim is not bureaucratic surveillance. The aim is to detect whether productivity gains are real or displaced. Table 2 proposes a monitoring matrix for AI-assisted development adoption. Its purpose is to connect observable indicators with managerial interpretation and intervention.

Table 2. Monitoring matrix for AI-assisted development productivity and risk (compiled by the author based on Weber et al., 2024, Ng et al., 2024, Zhang et al., 2025, Spracklen et al., 2025, and Yan et al., 2024)

Monitoring area	**Indicator**	**Interpretation**	**Corrective action**
Delivery speed	Cycle time from task start to merge	Detects whether coding acceleration reaches the delivery pipeline	Compare by task type and PR complexity
Review burden	PR closure time and reviewer comment load	Detects whether AI creates integration friction	Limit bot comments, tune prompts, refine review categories
Code quality	Escaped defects and rework rate	Detects hidden cost after merge	Strengthen tests, require design review for AI-heavy changes
Security	New dependencies, vulnerability alerts, suspicious generated patterns	Detects package and code completion risk	Enforce allowlists, SBOM review, dependency scanning
Learning	Junior developer task completion and explanation quality	Detects whether AI supports onboarding or masks weak understanding	Use pair review and explanation requirements
Senior workload	Time spent on architecture, mentoring, and repeated AI-output corrections	Detects whether senior attention shifts productively	Separate routine checks from expert judgment and adjust staffing

The matrix protects adoption from two errors. One error appears when managers treat faster coding as proof of organizational improvement. The other appears when teams reject useful tools because hallucinations and security risks exist. A measured approach avoids both. It treats AI as a delivery capability whose value has to be maintained through feedback loops.

Governance should include prompt and context discipline. Developers need training in framing tasks with repository constraints, expected behavior, test expectations, and non-functional limits. Review bots should focus on categories where they help: missing null checks, unsafe dependency additions, inconsistent error handling, missing tests, potential security problems, and style deviations already defined in team standards. Generic comments should be suppressed. AI review earns trust when it respects the team's definition of useful feedback.

Engineering governance should separate confidence from correctness. AI tools often produce fluent explanations that create an impression of certainty. Teams should counter this tendency through evidence requirements. A suggestion that changes business behavior needs tests. A suggestion that adds a package needs dependency verification. A change touching security needs security review. A modification of shared architecture needs senior approval. This is ordinary software engineering discipline applied to a faster source of proposed change.

Practitioner-reported engineering leadership experience fits this model when handled with care. Reported improvements such as faster delivery, fewer release issues, or higher team output can signal operational potential. They become stronger when paired with transparent measurement design. For an engineering leader, the most defensible claim is that AI adoption, standardized SDLC workflows, and PR-level review automation can improve delivery conditions when the organization implements governance. The claim becomes weak when estimated percentages appear as research findings without data structure.

The discount-system proof of concept gives a useful boundary case. A model intended to reduce manual input in discount eligibility can expose the need for centralized data collection, historical data quality, and

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cross-unit data governance. That lesson transfers indirectly to developer tooling. AI coding tools expose whether a company has clear architecture standards, coherent documentation, stable tests, and reliable review practices. AI does more than automate a workflow. It reveals where the workflow relied on informal knowledge.

Engineering managers therefore need a cautious acceleration sequence. Start with low-risk generation. Document acceptable use. Gather baseline metrics. Add PR-level AI review only where it improves reviewer signal. Train developers to explain AI output. Formalize security gates for dependencies and sensitive code paths. Senior engineers should lead these rules because they know where local productivity gains can damage long-term maintainability.

V. CONCLUSION

AI-assisted development tools improve software delivery most convincingly when teams treat code generation and pull request review as separate SDLC layers. Code generation mainly accelerates implementation and exploration. AI-driven review affects validation, integration, and senior engineering attention. Their combination can increase delivery capacity, but each layer requires different controls because each creates different risks.

The productivity impact is multidimensional. Evidence supports faster completion of bounded coding tasks and positive developer experience. Studies of LLM-assisted programming, code review, and code-quality remediation identify the need for verification, signal control, and human judgment around generated output. The strongest interpretation is workflow-based: AI can increase local speed, but organizational productivity depends on review, testing, security checks, merge decisions, and release stability.

The hypothesis is confirmed with qualification. AI-assisted development improves engineering productivity when teams integrate it through governance, measurement, and human ownership. Without these conditions, gains can become hidden costs: code quality drift, hallucinated logic, insecure dependencies, senior-review overload, and weaker mentoring. A sustainable implementation model pairs cautious enablement with validation rules, monitoring metrics, secure dependency control, and senior-led review standards.

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The Relationship among Experiential Marketing, Experiential Value, Customer Satisfaction and Customer Loyalty —An Empirical Study of Taiwan Cultural & Creatives Park

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Abstract— *With the advent of the experience economy, the gap between products and services has become increasingly smaller. What customers pursue is hands-on participation and the acquisition of a unique experiential feeling. This study mainly explores the relationships among experiential marketing, experiential value, customer satisfaction, and customer loyalty, and takes Taiwan's cultural and creative parks as the research object. Questionnaires were distributed using convenience sampling. The research methods mainly adopted descriptive statistics, analysis of variance, correlation analysis, and regression analysis. The findings reveal that, among visitors to Taiwan's cultural and creative industry parks: 1. Experiential marketing has a positive relationship with experiential value. 2. Experiential marketing has a positive relationship with customer satisfaction. 3. Experiential value has a positive relationship with customer satisfaction. 4. Customer satisfaction has a positive relationship with customer loyalty.*

Keywords— ***Experiential marketing, experiential value, customer satisfaction, customer loyalty.***

I. INTRODUCTION

With the transformation of economic value, experiential marketing has become today's mainstream marketing strategy. In an era of rising culture and arts, local cultural industries have become one of the important local tourism strategies, and cultural industries have become one of the strategies for symbolic economy and urban regeneration in cities of advanced countries.

At present, regarding the five cultural and creative industries parks planned by the Council for Cultural Affairs (CCA), Taiwan (Cultural and Creative Industries Park, Taichung Cultural and Creative Industries Park, Chiayi Cultural and Creative Industries Park, Tainan Cultural and Creative Industries Park, and Hualien Cultural and Creative Industries Park), this study finds that previous research subjects have mostly approached from multiple dimensions such as tourism and sightseeing areas, including products, marketing strategies, services, customer loyalty, and satisfaction surveys. In Taiwan, few studies have conducted correlation research specifically on cultural parks. Therefore, this study explores the dimensions of experiential marketing, value perception, and situational factors. Through the creative cultural industries, this study intends to explore, from the perspectives of experiential marketing, value perception, and consumption situation, the consumption experience, value perception, and situational factors of Taiwan's cultural and creative industries, so as to positively enhance consumers' behavioral intentions and enhance diverse local cultural characteristics. It is also hoped that, through this paper, suggestions will be put forward for cultural and creative industries policies, and that this will help Taiwan actively carry out policies for the development of distinctive local cultural industries, so as to achieve the research purposes of this study, summarized as follows:

1. To understand, in Taiwan's cultural and creative parks, the actual situation of consumers' satisfaction with experiential marketing, experiential perception, customer satisfaction, and customer loyalty in Taiwan's creative cultural parks.

2. To explore the effects of personal background variables on the variables of experiential marketing, experiential perception, customer satisfaction, and customer loyalty.

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3. To explore the degree of correlation among the variables of experiential marketing, experiential perception, customer satisfaction, and customer loyalty.

4. To explore the predictive power and path relationships of experiential marketing, experiential perception, customer satisfaction, and customer loyalty.

5. To provide suggestions for relevant government marketing policies and improvement strategies, as well as suggestions for future research by subsequent researchers.

Based on the research motivation and objectives, this study first collected various materials and conducted preliminary reading, then determined the direction to be studied in the future, further explored relevant literature, established a research framework, and thereby derived the hypotheses of this study. Then, according to the variables proposed in this study, a questionnaire and appropriate statistical data analysis were designed. Finally, after the questionnaire survey and collection, the collected data were analyzed and verified, and the conclusions and suggestions of this study were proposed. The research flowchart of this study is shown in Fig. 1 below:



Fig. 1: Research Flowchart

Source: Compiled by this study

II. LITERATURE REVIEW

According to the main purpose of the research, theories, studies, and literature in related fields were sought, and relevant literature was first organized.

2.1 The Origin of Cultural Industries and Their Relationship with Policy

The United States was the earliest country to use culture and arts as a model for enhancing urban development. Kong pointed out that cultural industry strategies implement the benefits of cultural economic policy through physical environmental planning and resource integration[1], as described below: 1. The establishment of cultural production infrastructure; 2. The implementation of flagship development plans; 3. The revival of urban public spaces; 4. Partnership relationships between enterprises (the private sector) and the public sector. Relevant research literature pointed out that the connotations covered by cultural industries and their policies are as follows[2]: 1. The establishment of cultural and social relationships; 2. The establishment of trust relationships; 3. The interaction between politics and culture.

2.2 Taiwan's Cultural and Creative Industries

Cultural and creative industries have been one of the important policies promoted by the government in recent years. They not only help enhance national economic development but also help promote local cultural characteristics. How to internationalize cultural and creative products is the best marketing method for cultural and creative products. Local cultural and creative industries possess the characteristics of general commodities and cultural features. While moving toward internationalization, they must simultaneously possess commercial vision and cultural perspective. Cultural and creative industries encompass three parts: culture, creativity, and industry, and each stage has its important function and meaning.

2.3 Experiential Marketing

With changes over time and the rise in consumer capacity, the traditional service-oriented economic era will be changed, moving toward a developmental trend form of consumer experience consumption[3]. Experience is a characteristic of life, not a characteristic of products or services. What is important is that it can create value for life; through experience, both the senses and the mind obtain value[4]. In view of its difference from traditional marketing, today's experiential marketing focuses on value creation and jointly establishing deep emotions with customers, emphasizing customers' overall sensory experience and experience in the consumption process.

With changes in consumption patterns and the rise of consumer awareness, the experiential marketing part has become even more important. Schmitt proposed that experience refers to individual events involving certain stimuli to an individual[5]. Experience encompasses the overall quality of life and is an event caused by direct observation and participation. Moreover, in the marketing

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process, appropriate environments and situations are provided to allow customers to deeply feel the experience. In the study, five strategic modules were proposed, namely sensory experience (Sense), emotional experience (Feel), thinking experience (Think), action experience (Action), and related experience (Relate).

The influence of experiential marketing on "customer engagement" and further on "brand loyalty" was explored[6]. Alam pointed out that over the past two decades, research on experiential marketing in the tourism field has grown significantly, and the relationships among experiential marketing and variables such as tourist behavior, satisfaction, and experiential value are one of the mainstream topics of research[7]. Maheswari & Wahyunanda analyzed a tourist attraction in Indonesia and found that experiential marketing strategies have a significant positive impact on increasing the number of tourist visits[8], suggesting that experiential marketing can promote tourism motivation by enhancing tourists' "experiential value" (e.g., sensory, emotional, participatory aspects).

2.4 Experiential Value

Experiential value is a new concept that has emerged only in recent years. With the advent of the experience economy era, the concept of experiential value has been brought forth. It mainly originates from the concept of customer value, replacing customer value with experiential value.

Soloman et al. considered value to be the benefits generated by customers in the process of purchasing products or receiving services. In past research, most customer value perspectives adopted the angle of the "rational perspective" to define and explore customer value[9]. However, the "rational perspective" and the "experiential perspective" are not completely opposed. The experiential perspective merely compensates for the deficiencies of the rational perspective and explains problems that the rational perspective cannot explain. "Experiential value" is the "experiential perspective" within customer value, emphasizing that consumption experience is the basis for customer evaluation and is a subjective ideology. Mathwick et al.defined experiential value as the measurement of consumers' sensory, emotional, and aesthetic feelings toward a product or service after consumption[10]; and the enhancement of experiential value can be achieved through the products or services provided by enterprises interacting with consumers, helping or hindering the achievement of consumer goals.

2.5 Customer Satisfaction

Cardozo and Howard and Sheth were the earliest to apply customer satisfaction to consumer research, and considered that consumers' inputs and returns constitute a cognitive behavior, emphasizing the results of evaluation and comparison[11,12]. Hemple considered that the degree of truth of the product or service expected by customers determines the final customer satisfaction; that is, customers' evaluation of the difference between expectations and reality determines their own degree of satisfaction[13].

Woodside, Frey, and Daly considered customer satisfaction to be a special consumer attitude, showing consumers' post-purchase preference response after experiencing a service, that is, an overall attitude based on experience[14].

Zeithaml and Bitner defined it as customers' realization response, a judgment of whether the characteristics of a product or service can provide a pleasant level[15]. Fornel proposed that satisfaction refers to an overall feeling that can be directly evaluated[16]. Consumers compare products and services with their ideal standards; therefore, consumers may originally be satisfied with a product or service, but after comparison with original expectations, they may consider the product ordinary.

2.6 Customer Loyalty

In traditional consumer behavior theory, loyalty refers to the degree to which consumers, through processes such as awareness, trial, and repetition regarding a certain brand, continue to purchase a certain brand's products or services[17]. However, more scholars believe that merely exploring behavioral theory cannot fully explain customer loyalty; consideration of psychological preference for the product or service must also be added[18]. Day considered customer loyalty to be enabling customers to have a favorable attitude toward a product and to have repurchase behavior[19]. The attitude part can be further divided into true loyalty and false loyalty. So-called false loyalty is due to customers' extremely high switching cost considerations, or customers' lack of choices leading to purchase behavior that appears loyal. Parasuraman, Zeithaml, and Berry [20]proposed that measurement items for measuring customer loyalty can be divided into the following five points: 1. willingness to build word of mouth for the company; 2. possibility of recommending to others; 3. possibility of complaining; 4. possibility of willingness to pay more; 5. possibility of switching purchase targets. The definition of customer loyalty also refers to customers' willingness to repeatedly purchase a certain brand product or repeatedly enjoy a certain service. It can be extended to an enterprise's competitiveness in the market. High customer loyalty may also attract more potential customers; therefore, enterprises often list enhancing customer loyalty as one of their main operational goals. This study will also divide customer loyalty into the "behavioral aspect" and the "attitudinal aspect" to explore whether experiential value has a positive impact on the two dimensions of customer loyalty.

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2.7 Relationships among Experiential Marketing, Experiential Value, Customer Satisfaction, and Customer Loyalty

Regarding the relationship between experiential marketing and experiential value, after exploring the literature on experiential value, it can be known that the characteristics of experiential value include: it comes from consumers' cognition and preference for the product or service itself, the perceived rewards evaluated by consumers, and both functional and emotional characteristics. Therefore, based on relevant theories, this study defines experiential value as "the perceived rewards generated after consumers' cognition and preference for a product or service undergo interactive evaluation by reason and emotion." Experiential marketing emphasizes that customers possess both rationality and sensibility. What distinguishes experiential marketing from traditional marketing in the past is the creation of a special, unique experience, while experiential value is derived from experience. Therefore, good experiential marketing can bring consumers positive experiential value; hence, good experiential marketing will lead to the enhancement of experiential value.

Regarding the relationship between experiential value and customer satisfaction, Woodruff et al. considered that in consumers' views of product experience, value and satisfaction are intertwined with each other. In other words, creating better experiential value can bring consumers greater satisfaction[21].

Elshaer et al. took customers of Egyptian tourism, hotels, and travel agencies as research subjects to explore how information asymmetry affects customer satisfaction through trust and perceived value[22]. The study found that experiential value has a positive impact on customer satisfaction.

Bagheri et al. studied tourists in the Algarve, Portugal, and proposed a model of tourist experience (four experience domains) on tourists' "sense of well-being" and on tourist satisfaction and loyalty[23]. The results indicated that experience promotes customer satisfaction by enhancing well-being. Lin and Wang pointed out that when customers feel high-quality experiential value during the consumption process, their satisfaction will significantly increase, which further drives customer loyalty behavior[24]. In their study, experiential value was regarded as one of the main driving factors affecting customer satisfaction.

Zhang et al. found that the higher the satisfaction customers obtain from the experience provided by a brand, the stronger their loyalty to that brand[25]. This positive relationship emphasizes that brands should attach importance to the design of customer experience in marketing strategies and take effective measures to enhance customer satisfaction, thereby promoting customers' repeat purchases and active recommendations.

Regarding the relationship between experiential value and customer loyalty, Cronin et al. considered that the monetary or non-monetary costs and service quality that consumers must pay to obtain benefits (products or services) will affect customers' perceived value[26]; therefore, value will directly affect loyalty. Neal considered that in order to retain customers and promote their repeat purchases, enterprises should convert customer satisfaction into customer value and customer loyalty[27].

In summary, experiential marketing and experiential value significantly affect customer satisfaction, and customer satisfaction plays a key role in the formation of customer loyalty. This chain suggests that when formulating marketing strategies, enterprises need to fully consider all aspects of customer experience in order to enhance overall customer satisfaction and loyalty.

III. RESEARCH METHODS

This study organizes the research framework of this study from the literature review in Chapter 2 to explore the effects of demographic variables on experiential marketing, experiential value, customer satisfaction, and customer loyalty, and to understand the relationships of experiential marketing and experiential value with customer satisfaction and customer loyalty. The research framework of this study is shown in Fig. 2 below:

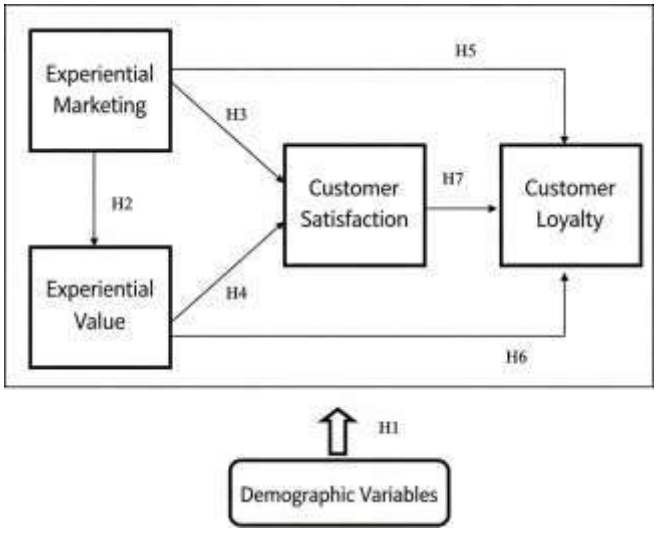


Fig. 2: Research Framework

The operational definitions of each variable in this study are mainly organized based on the aforementioned literature review. The operational definitions of each variable are described separately as follows:

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3.1 Experiential Marketing

The measurement of experiential marketing in this study mainly refers to the five dimensions proposed by Schmitt —sensory experience, emotional experience, thinking experience, action experience, and related experience—as measurement items. The operational definitions are as follows:

3.1.1 Sensory Experience

Tourists' sensory perception of experiential media, including visual, auditory, olfactory, gustatory, and tactile modes, completing the pattern of stimulus, process, and response, and creating experiences of positive perception.

3.1.2 Emotional Experience

The positive emotions generated by tourists after participating in the experiential activities provided by the park.

3.1.3 Thinking Experience

The concentrated thinking, divergent thinking, and curiosity generated by tourists after participating in the experiential activities provided by the park.

3.1.4 Action Experience

Experiential media trigger consumers to engage in actual activity participation, interpersonal interaction experiences, and influence changes in personal lifestyle.

3.1.5 Related Experience

Tourists form connections through brand purchase and use, obtaining social identification and belonging.

3.2 Experiential Value

The measurement of experiential value in this study mainly refers to the four dimensions proposed by Mathwick, Malhotra and Rigdon—consumer return on investment, service excellence, aesthetics, and playfulness—as measurement items. The operational definitions are as follows:

3.2.1 Consumer Return on Investment

The degree of benefits generated by consumers during the transaction process provided by purchasing a product or service.

3.2.2 Service Excellence

The degree to which consumers can perceive excellent service from the performance of service providers in delivering their professional skills and related tasks.

3.2.3 Aesthetics

Aesthetics is the experience directly felt by consumers, which can include the degree of visual, auditory, gustatory, physical feeling, comfort, inner feeling, aesthetic characteristics of a certain product, as well as the visual and psychological feeling of the entire corporate environment.

3.2.4 Playfulness

Playfulness exists in the activities in which consumers engage during the entire process of product or service use, and is the degree of immediate intrinsic tangible pleasure generated from the feelings of happiness, excitement, joy, and escapism.

3.3 Customer Satisfaction

This study adopts Fornell's viewpoint and directly evaluates customer satisfaction as an overall feeling, thereby understanding tourists' subjective comprehensive and holistic psychological feelings toward the products or services experienced.

Therefore, this study defines customer satisfaction as the degree of holistic psychological feeling generated by customers from their expectations before the experience and the value obtained after the experience.

3.4 Customer Loyalty

For the measurement of loyalty after tourists' experience, this study adopts the behavioral loyalty dimension of positive behavioral intentions proposed by Parasuraman, Zeithmal and Berry as the measurement dimension, and defines customer loyalty as the degree to which customers are satisfied with the products or services provided by the operator, have the willingness to visit again, and are willing to conduct positive publicity behaviors for the operator.

Based on the research framework and literature review results of this study, the research hypotheses of this study are established to understand the relationships among personal background variables, experiential marketing, experiential value, customer satisfaction, and customer loyalty of tourists visiting Taiwan's cultural and creative parks. This study proposes null hypotheses that can be statistically tested, specifically described as follows:

H1: The part exploring differences in experiential marketing, experiential value, customer satisfaction, and customer loyalty among tourists with different characteristics.

H2: Experiential marketing has a significant impact on experiential value.

H3: Experiential marketing has a significant impact on customer satisfaction.

H4: Experiential value has a significant impact on customer satisfaction.

H5: Experiential marketing has a significant impact on customer loyalty.

H6: Experiential value has a significant impact on customer loyalty.

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H7: Customer satisfaction has a significant impact on customer loyalty.

The questionnaire in this study is divided into two parts. The first part contains the respondents' basic information and tourism-related information. The second part develops and designs relevant questionnaire items based on the operational definitions of the aforementioned variables. The variables are measured using a five-point Likert scale, from 1—strongly disagree to 5—strongly agree. For reverse-coded items, the reverse scoring method is adopted. The scales in this study were all developed through support from literature review and clarification of concepts related to relevant dimensions. Furthermore, expert valuable opinions and relevant personnel were sought to revise and discuss the questionnaire.

After further data collection, this study uses the PASW 18 statistical software package to conduct statistical analysis on the various data measured by the questionnaire. First, reliability and validity analysis is conducted on the questionnaire scale; second, "descriptive statistics" is conducted on the research variables; finally, "correlation analysis" and "path analysis" are conducted on the research variables and research hypotheses of this study to verify the research hypotheses proposed in this study.

IV. DATA ANALYSIS

The questionnaire in this study targeted people who had previously visited the Taiwan Cultural and Creative Park. The survey period was from September 1, 2024 to October 31, 2024. A total of 350 questionnaires were distributed to the research subjects, and 309 questionnaires were recovered in total. After deducting 33 invalid questionnaires that were incompletely filled out, there were 276 valid questionnaires in total. The valid questionnaire recovery rate reached 89.3%. Based on the recovered questionnaire data, a sample structure analysis was conducted on consumers' personal attribute variables.

4.1 Basic Tourist Information

From the survey analysis of the Taiwan Cultural and Creative Park, the basic information of the interviewed respondents was obtained, including seven variables: gender, age, education, marriage, occupation, average monthly income, and place of residence. The frequency distribution of each variable is described as follows: From the survey analysis of the Taiwan Cultural and Creative Park, it was found that among the interviewed tourists, males accounted for 47.8% and females 52.2%. In terms of gender distribution, females were the majority. In terms of age, those under 20 accounted for 25.7%; those aged 20-29 accounted for 50.4%; those aged 30-39 accounted for 16.3%; those aged 40-49 accounted for 6.2%; and those aged 50 and above accounted for 1.4%. Those aged 20-29 accounted for the largest proportion. In terms of educational level, junior high school or below accounted for 12.7%, senior high school (vocational) accounted for 18.1%, junior college/university accounted for 62.7%, and master's degree or above accounted for 6.5%. It can be seen that the majority of the educational levels were junior college/university students. Unmarried persons were more numerous, accounting for 72.1%, while married persons accounted for 27.9%. Unmarried persons were the majority. In terms of occupation, military, government, and teaching personnel accounted for 11.2%, industry accounted for 5.1%, business accounted for 12.7%, service industry accounted for 8.7%, liberal professions accounted for 4%, retired or homemakers accounted for 1.4%, students accounted for 51.4%, and others accounted for 5.4%. Students were the most numerous. In terms of income, no income accounted for 27.2%, under 20,000 accounted for 23.6%, 20,000-39,000 accounted for 27.9%, 40,000-59,000 accounted for 17.8%, and 60,000 or above accounted for 3.6%. 20,000-39,000 was the most common, followed by no income. In terms of place of residence, northern Taiwan (Keelung, Taipei, Taoyuan, Hsinchu) accounted for 4.7%, central Taiwan (Miaoli, Taichung, Changhua, Yunlin, Nantou) accounted for 14.5%, southern Taiwan (Chiayi, Tainan, Kaohsiung, Pingtung) accounted for 80.4%, and eastern Taiwan (Yilan, Hualien, Taitung) accounted for 0.4%. People from southern Taiwan were the most numerous among visitors, while people from eastern Taiwan were the fewest.

The tourism characteristics of the interviewed respondents of the Taiwan Cultural and Creative Park included six variables: number of visits, number of companions, whether expenditure occurred, expenditure situation, acquisition of tourism information, and favorite place. The frequency distribution of each variable is described as follows: In terms of number of visits, the first time accounted for 56.9%, the second time accounted for 19.9%, the third time accounted for 6.2%, and four times or more accounted for 17.0%. Tourists visiting for the first time were the most numerous. In terms of companions, by myself accounted for 6.2%, 2 people accounted for 33.7%, 3-4 people accounted for 37.3%, 5-7 people accounted for 10.9%, and 8 people or more accounted for 12.0%, totaling five categories. The proportion of 3-4 people visiting together was the highest. In terms of expenditure in the park, those with expenditure accounted for 66.3%, and those without expenditure accounted for 33.7%, indicating that tourists visiting here did not aim at consumption. Although most tourists did consume, more than 30% of tourists still did not consume. The expenditure situation was: only tickets accounted for 0.7%, beverages and food accounted for 59.4%, and both of the above accounted for 6.2%, indicating that most tourists who spent money mainly bought beverages or food, and few people only

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bought tickets. From the survey analysis of the Taiwan Cultural and Creative Park, it was found that the Multi-functional Arts and Cultural Center accounted for 31.70%, the Arts and Culture Exhibition Hall accounted for 15.60%, Yatang Hall accounted for 18.20%, the Tobacco Storage Warehouse accounted for 1.50%, the Music Rehearsal Room accounted for 2.30%, Hengdao Hall accounted for 3.10%, the International Performance Hall accounted for 6.90%, Qiushi Academy accounted for 3.10%, and the Outdoor Plaza accounted for 17.60%. The place most liked by tourists should be the Multi-functional Arts and Cultural Center.

4.2 Reliability Analysis

This study adopts the reliability testing method commonly used in the Likert attitude scale method (Cronbach's Alpha) to test the reliability of the scale. A Cronbach's Alpha coefficient of 0.7 or above is acceptable. For this study, the Cronbach's α values of each dimension of experiential marketing, experiential perception, customer satisfaction, and customer loyalty were 0.96, 0.95, 0.96, and 0.97, respectively, all greater than 0.8. The Cronbach's α value of all dimensions in this study was 0.978.

4.3 Analysis of Variance

This section will use the t-test (used to test whether there is a difference between the means of two populations) and one-way analysis of variance (used to test whether there is a difference among the means of three or more populations) to separately examine the differences in each dimension factor of the personal attribute variables of the interviewed respondents visiting the Taiwan Cultural and Creative Park, and explain the empirical results. The following will sequentially analyze each research dimension with each personal attribute variable of gender, age, educational level, marital status, occupation, average income, and place of residence. After that, post hoc tests will be conducted on the demographic variables whose test results reached significance, and the Duncan method will be used for post hoc comparisons.

4.4 Chi-Square Test

The chi-square test is mainly used for data analysis of categorical data. The variables that can be explored are two discrete variables (nominal scale or ordinal scale). The main purpose of the chi-square test is to test whether the actually observed sample frequencies or percentages are associated with the theoretical or population expected frequencies or percentages, or whether there is a significant difference. This study aims to understand the relationships between the tourism categorical variables of average income, number of visits, and number of companions and whether expenditure occurred among the interviewed respondents visiting the Taiwan Cultural and Creative Park, and to conduct cross-analysis from the basic information.

4.5 Correlation Analysis

Before conducting data analysis, this study used Pearson correlation coefficient analysis to test the problem of collinearity among variables, as shown in Table . According to the test results, the correlation coefficients of any two variables among experiential value, customer satisfaction, and customer loyalty were not greater than 0.8, so the independent variables in this study did not have a collinearity problem.

4.6 Regression Analysis

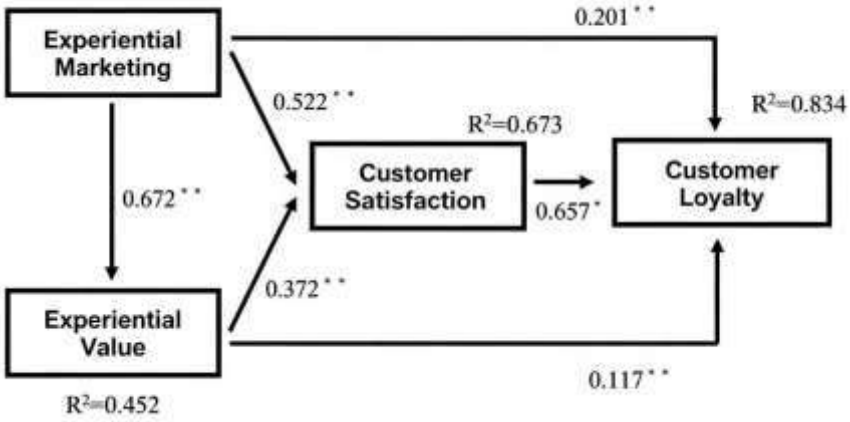
To further understand the influence of customer satisfaction and each factor dimension on customer loyalty, this study adopts the enter method of multiple regression analysis, with experiential marketing as the independent variable and experiential value, customer satisfaction, and customer loyalty as the dependent variable measurement indicators, in order to clarify the key factors affecting loyalty. This study uses linear regression analysis to establish a predictive model for each variable. Since the explanatory variables affecting the dependent variable in this study's model are more than one, it is necessary to establish a multiple regression model with multiple explanatory variables and simultaneously include multiple independent variables to explain and predict the dependent variable.

4.7 Path Analysis

This study adopts path analysis, composed of a series of multiple regression analyses, to test the hypotheses of each dimension, describe the causal structural relationships among research dimensions, explore the overall causal relationship model of dimension variables, and conduct estimation and verification, so as to deeply investigate the key factors affecting related dimensions.

Based on the theoretical framework of the research model and after the aforementioned analysis of the observed data, this study, after confirming that each dimension has a certain degree of reliability and validity, constructs a causal relationship model of the dimensions of experiential marketing, experiential value, customer satisfaction, and customer loyalty, as shown in Fig. 3, the path diagram.

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**P＜0.01 indicates significant.

Fig. 3: Path Analysis

V. RESEARCH CONCLUSIONS

Based on the purpose of this study, which is mainly to explore and understand the Taiwan Cultural and Creative Park and the relevant discussion of consumers' experiential marketing, experiential perception, customer satisfaction, and customer loyalty, this section explains the empirical analysis results according to the research hypotheses as follows:

H1-1: There are significant differences in the cognition of experiential marketing, experiential value, customer satisfaction, and customer loyalty in the Taiwan Cultural and Creative Park by different genders—not supported.

H1-2: There are significant differences in the cognition of experiential marketing, experiential value, customer satisfaction, and customer loyalty in the Taiwan Cultural and Creative Park by different ages—not supported.

H1-3: There are significant differences in the cognition of experiential marketing, experiential value, customer satisfaction, and customer loyalty in the Taiwan Cultural and Creative Park by different educational levels—not supported.

H1-4: There are significant differences in the cognition of experiential marketing, experiential value, customer satisfaction, and customer loyalty in the Taiwan Cultural and Creative Park by different marital statuses—not supported.

H1-7: There are significant differences in the cognition of experiential marketing, experiential value, customer satisfaction, and customer loyalty in the Taiwan Cultural and Creative Park by different places of residence—not supported.

After t-tests and analysis of variance, it was found that different genders, different ages, different educational levels, different marital statuses, and different places of residence had no significant differences in the cognition of experiential marketing, experiential value, customer satisfaction, and customer loyalty in the Taiwan Cultural and Creative Park, indicating that in terms of gender, the degree of feeling of males and females is the same; among different age groups, differences cannot be determined; different educational levels also have the same cognition of each dimension; whether single or married, there is also no difference in the degree of feeling of each dimension; in terms of place of residence, it also cannot be determined that there are differences in cognition of each dimension, so where one lives has the same degree of feeling for each dimension.

H1-5: There are significant differences in the cognition of experiential marketing, experiential value, customer satisfaction, and customer loyalty in the Taiwan Cultural and Creative Park by different occupations—supported.

In terms of experiential marketing, in sensory experience and emotional experience, it was found that people whose occupation is labor have stronger sensory perception than those in liberal professions, such as vision, hearing, smell, taste, and touch, and their positive emotions are also higher than those of people in other industries. In thinking experience, action experience, and related experience, it was found that people whose occupation is business have higher curiosity, interpersonal interaction experience, and connection generated by visiting the Taiwan park and obtaining social identification and belonging than people in other occupations. In terms of experiential value, in consumer return on investment, it was found that the degree of benefits generated by students

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in the transaction process provided by purchasing products or services is much higher than that of retired people and homemakers; in service excellence and playfulness, students, compared with people in other occupations, consider the park employees' performance of professional skills and related tasks and the degree of service to be higher, and are also more able to engage in activities throughout the product or service use process and feel intrinsic tangible pleasure. From this aspect, when people of different occupations visit the Taiwan Cultural and Creative Park, students are more relaxed. It is suggested that government authorities can design different activities to attract people from other industries to visit. In terms of customer satisfaction and customer loyalty, it was found that people whose occupation is business have a higher degree of holistic psychological feeling generated from their expectations before the experience and the value obtained after the experience, and a higher willingness to visit again.

H1-6: There are significant differences in the cognition of experiential marketing, experiential value, customer satisfaction, and customer loyalty in the Taiwan Cultural and Creative Park by different incomes—partially supported.

In terms of experiential marketing, including sensory experience, emotional experience, thinking experience, action experience, and related experience, people with income below 60,000, compared with people with income of 60,000, believe that visiting the Taiwan Cultural and Creative Park can create value for life and obtain value for both the senses and the mind through experience. In the experiential value part, there is no significant difference among people with different incomes, indicating that after visiting and consuming at the Taiwan Cultural and Creative Park, people with different incomes have the same degree of sensory, emotional, and aesthetic feelings toward the product or service. In terms of customer satisfaction and customer loyalty, people with income of 40,000-59,000 are more satisfied and more loyal than people with income above 60,000. Regarding the income part, it was found that people with higher incomes have a lower experiential marketing part. Park authorities should understand what stimuli can arouse the emotions of high-income people and promote consumers' active participation, including brand and positive mood, emotional connections such as joy and pride, etc.

H1-8: Different average incomes affect consumption in the Taiwan Cultural and Creative Park—supported.

H1-9: Different numbers of visits affect consumption in the Taiwan Cultural and Creative Park—not supported.

H1-10: Different numbers of companions affect consumption in the Taiwan Cultural and Creative Park—supported.

There is a significant effect of different average incomes on consumption in the Taiwan Cultural and Creative Park. From the cross-table, it was found that people with no income are less likely to consume when visiting the Taiwan Cultural and Creative Park. It is possible that the visitors are residents living nearby who come here to walk around, and some are housewives or retired personnel who may come to the outdoor plaza to exercise. Different numbers of visits have no significant effect on consumption in the Taiwan Cultural and Creative Park, indicating that the number of visits does not affect consumption. Different numbers of companions have a significant effect on consumption in the Taiwan Cultural and Creative Park. From the cross-table, it was found that when only one person comes to the Taiwan Cultural and Creative Park, there is relatively less consumption, while the probability of consumption when two or more people come is relatively higher.

H2: Experiential marketing has a significant impact on experiential value—supported.

H3: Experiential marketing has a significant impact on customer satisfaction—supported.

H4: Experiential value has a significant impact on customer satisfaction—supported.

H5: Experiential marketing has a significant impact on customer loyalty—supported.

H6: Experiential value has a significant impact on customer loyalty—supported.

H7: Customer satisfaction has a significant impact on customer loyalty—supported.

Experiential marketing affects experiential value, and its experiential marketing can explain 45.2% of experiential value. When the dependent variable is overall satisfaction, experiential marketing and experiential value are significant, indicating that experiential marketing and experiential value have an impact on customer satisfaction, and their experiential marketing and experiential value can explain 67.3% of customer satisfaction. Experiential value and customer satisfaction have significant effects on customer loyalty, indicating that experiential value and overall satisfaction affect customer loyalty. Its experiential marketing, experiential value, and customer satisfaction can explain 83.4% of customer loyalty. Among them, experiential marketing also affects customer loyalty through experiential value or customer satisfaction, and also has an indirect effect. Experiential marketing and experiential value also affect customer loyalty through customer satisfaction, and also have an indirect effect.

In terms of the number of visitors to the Taiwan Cultural and Creative Park, people living in southern Taiwan are the most numerous, indicating that the travel habits of people in southern Taiwan may mainly be based

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on free admission or a traditional cultural recreational atmosphere. Most tourists in Taiwan who come to this place to visit obtain tourism information from information on the Internet, or through word-of-mouth introductions by relatives and friends. Therefore, it is suggested that if the cultural and creative park wants more people to know the information, it can also publicize through television media or newspapers and magazines. Because those who obtain information from the Internet may be younger groups, older groups may be less able to obtain information from the Internet. Since there are many places in the Taiwan Cultural and Creative Park that can be rented, such as the music rehearsal room, international performance hall, etc., it is suggested that other methods of publicity can be used to let more people know about this place, thereby increasing the number of visitors and stimulating consumption.

The experiential activities, natural landscapes, environmental facilities, and historical buildings provided by the Taiwan Cultural and Creative Park leave tourists with a deep impression after the experience, thereby prompting tourists to have the desire to experience again. At the same time, tourists' overall satisfaction with the service attitude of the service personnel and hosts of the cultural and creative park is good, enhancing tourists' loyalty to the tourist attraction. Therefore, this study confirms that experiential marketing has a significant positive impact on the degree of customer satisfaction and customer loyalty. After data analysis, it was found that experiential value directly affects customer loyalty, and can also indirectly affect customer loyalty through customer satisfaction. In the view of most people, within the park I can efficiently arrange my itinerary as a relaxed and comfortable leisure attraction, and the architectural features are attractive to the public, so tourists have special experiential value and feel a sense of getting more than their money's worth. When they have a high degree of satisfaction, they generate word-of-mouth recommendations to relatives and friends and revisit behavior toward the Taiwan Cultural and Creative Park. This shows the importance of tourists' experiential value.

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Cybersecurity Challenges in Pakistan's Financial Sector

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Abstract *— The rapid digital transformation of Pakistan's financial sector has significantly improved banking efficiency, financial inclusion, and customer convenience through the adoption of internet banking, mobile banking, fintech services, and digital payment systems. However, this digital expansion has simultaneously increased exposure to cybersecurity threats, making cybersecurity a critical concern for financial institutions. This study investigates the major cybersecurity challenges affecting Pakistan's financial sector, examines their impact on financial institutions and customers, evaluates the effectiveness of existing cybersecurity frameworks and regulatory measures, and proposes strategies to strengthen cybersecurity resilience. Using a qualitative research approach based on secondary data analysis, the study reviews literature, regulatory guidelines, industry reports, and international cybersecurity frameworks, including those of the State Bank of Pakistan (SBP), ISO/IEC 27001, and the NIST Cybersecurity Framework. The findings reveal that rapid digitalization has expanded the attack surface of financial institutions, with phishing attacks emerging as the most prevalent threat. Other significant risks include ransomware, data breaches, insider threats, and third-party vulnerabilities. While regulatory initiatives and international cybersecurity standards have improved governance and risk management practices, challenges such as a shortage of cybersecurity professionals, limited awareness, and uneven cybersecurity maturity persist. The study concludes that strengthening cybersecurity governance, enhancing workforce capacity, promoting cybersecurity awareness, and investing in advanced security technologies are essential for ensuring the resilience, stability, and trustworthiness of Pakistan's evolving digital financial ecosystem.*

Keywords *— **Cybersecurity, Financial Sector, Pakistan, Digital Banking, Phishing Attacks, Cyber Resilience, Financial Technology (FinTech), Data Breaches, Regulatory Frameworks, NIST Cybersecurity Framework, ISO/IEC 27001, Digital Transformation, Cyber Risk Management, Financial Inclusion, Information Security.***

I. INTRODUCTION

Over the last decade, the financial sector in Pakistan has undergone tremendous digital transformation, which has been driven by the development of information technology, financial inclusion policies, and the growth of digital services. Internet banking, mobile banking applications, digital wallets, and branchless banking solutions are now available at commercial banks, fintech companies and payment platforms (Shrestha, 2025).

Raast instant payment system of State Bank of Pakistan has further bolstered real-time digital transactions (Bokhari, 2022). These advancements have made things more efficient, more accessible, more convenient; but they've also introduced an increased risk of cybersecurity issues. This has made cybersecurity a critical aspect of safeguarding sensitive information, bolstering financial stability, and preserving trust in the digital financial landscape.

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Research Objectives

This study aims to:

1. To identify the major cybersecurity challenges affecting Pakistan's financial sector.

2. To examine the impact of cyber threats on financial institutions and customers.

3. To evaluate the effectiveness of existing cybersecurity frameworks and regulatory measures.

4. To recommend strategies for enhancing cybersecurity resilience within Pakistan's financial sector.

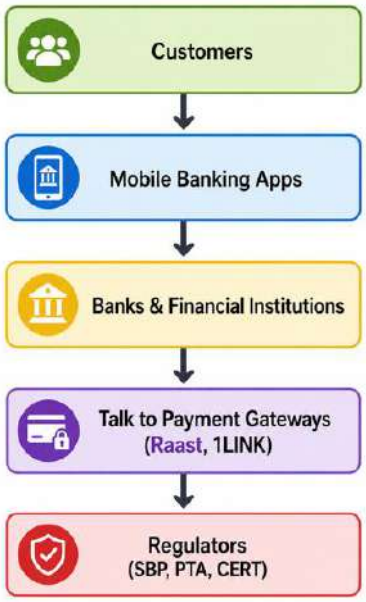


Fig.1 Digital financial ecosystem of Pakistan

Problem Statement

The swift adoption of digital technologies by Pakistan's financial institutions has enhanced banking efficiency, customer convenience, and financial inclusion (Raza et al., 2024). But, it has been a digital transformation that has also meant added exposure to cyber threats. Phishing, ransomware, malware, data breaches, and social engineering attacks pose increasingly significant threats to financial institutions, including the potential for financial losses, disruption of operations, damage to the institution's reputation, and destruction or compromising of customer data (Bello et al., 2025).

While regulatory bodies and organizations take steps to enhance cybersecurity practices, there are still obstacles to overcome such as lack of cybersecurity awareness, a shortage of cybersecurity experts, outdated cybersecurity infrastructure, and regulatory compliance problems. Furthermore, more third-party vendors, cloud services, and fintech platforms are relying on these platforms, increasing vulnerabilities (Omolere, 2026). In an era where the financial sector plays a crucial part in maintaining economic stability, it is imperative to address these cybersecurity challenges to ensure the resilience and security of financial operations.

Research Question

What are the major cybersecurity challenges facing Pakistan's financial sector, and how can financial institutions enhance their cybersecurity resilience to effectively mitigate emerging cyber threats?

II. LITERATURE REVIEW

A. Cybersecurity in Global Financial Institutions

Financial institutions are facing growing challenges from the increasing nature and sophistication of cyberattacks and have made cybersecurity a critical concern for their businesses around the world (Umoga et al., 2024). Banks and financial service providers are vulnerable targets, given the sensitive data they hold and the significant financial transactions they conduct. Cyber incidents have become a serious threat to financial stability, and could have an impact on payment systems, banking operations and financial markets, the International Monetary Fund (IMF) said (Brando et al., 2022). The World Bank also highlights the increased attack surface of financial institutions due to the digital transformation and the need for strong cyber security (Kudinova et al., 2025). As a result, financial firms are putting significant resources into cyber risk management, threat detection, and incident response technologies to build their cyber-resilience against new threats.

B. Digital Transformation and Emerging Cyber Threats in Pakistan

Internet banking, mobile banking, fintech services, and branchless banking solutions are the major measures that have witnessed a rapid digital transformation of the banking sector in Pakistan (Sikandar, 2025). The launch of the State Bank of Pakistan's (SBP) Raast payment system has further boosted digital transactions and financial inclusion

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(Bokhari, 2022). These advancements have made things easier and faster, but have also led to greater reliance on digital systems and exposure to cyber risks.

Phishing and social engineering attacks are among the most frequent threats, where the cybercriminal communicates via deceptive emails, messages, and fake websites (Choi, 2023). Human error continues to be a large part of the successful attack, especially when dealing with users who may lack cyber security awareness. Cybercrime like malware and ransomware is also hazardous, causing disruption, information theft and loss of revenue. Financial firms are very vulnerable as they have services and data of high value (Edu, 2022).

The additional threat is data breach and insider threats which hamper cyber security efforts (Achor, 2022). The unauthorized use of customer information may lead to fraud, identity theft, reputational harm and regulatory fines. Furthermore, third-party vendors, financial technology partners and cloud service providers add to the supply chain risks (Banik, 2022). Financial institutions are subject to vulnerabilities in external systems, and attacks are becoming more frequent, making it increasingly important for them to have vendor risk management and continuous monitoring in place.

Table 1: Growth of digital banking users and digital transactions in Pakistan (2021-2024), highlighting the rise in mobile banking, internet banking, and digital payment channels.

Indicator	2021	2022	2023	2024
Mobile Banking Users (Millions)	11.9	13.5	16.0	18.6
Internet Banking Users (Millions)	6.9	8.2	11.0	13.8
Digital Transactions (Billions)	3.0	3.8	4.7	6.4

Sources: Compiled from State Bank of Pakistan (SBP) Payment Systems Reports and Annual Payment Systems Reports. Mobile banking users reached 16 million and internet banking users reached 11 million by the end of 2023. In FY2023, digital transactions grew from 4.7 billion to 6.4 billion in FY2024 (Associated Press of Pakistan, 2024).

C. Regulatory Frameworks and Cybersecurity Capacity

In response to these emerging cyber threats, regulators have developed cybersecurity frameworks to enhance cybersecurity resilience. SBP has published guidelines on cybersecurity for Governance, Risk Management and Incident Reporting (State Bank of Pakistan, 2026). Certain international standards, such as ISO/IEC 27001, offer a structured framework to manage information security risks and put in place effective controls (Culot et al., 2021). Likewise, the NIST Cybersecurity Framework is composed of five main functions (Identify, Protect, Detect, Respond, Recover) that enhance organizational resilience (Mahn, 2018). The Basel Committee on Banking Supervision further stresses the importance of the concepts of governance, business continuity planning and cyber-resilience as integral parts of operational risk management.

However, there is a shortage of cybersecurity experts in Pakistan. The increasing need for cybersecurity skills is outpacing the number of professionals available to fill the positions, making it harder for organizations to bolster their security systems and respond to cybersecurity incidents. In this regard, enhancement of cyber security education, professional certifications and awareness programs are important measures to enhance the cyber security resiliency of the financial sector in Pakistan.

III. RESEARCH METHODOLOGY

The design of this study is qualitative using secondary data analysis approach. To explore the issues of cybersecurity threats, regulatory environment and new risks in the financial sector of Pakistan, a qualitative approach has been adopted. The study uses secondary data sources such as literature review and authoritative reports rather than primary data collection methods like surveys or interviews to gain a deeper understanding of the subject.

The data were collected from trusted sources such as publications, cybersecurity guidelines of State Bank of Pakistan (SBP), World Bank, International Monetary Fund (IMF), ISO/IEC 27001 standard and the NIST Cybersecurity Framework. Banking cybersecurity-

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related peer-reviewed journal articles and industry reports were also examined.

Thematic analysis was used for analysis of data, which aimed at showing the patterns and themes that occurred more than once. The analysis highlighted the threats in the cyber space, the regulatory measures, technological weaknesses and shortage of manpower, and categorized the major factors influencing the cybersecurity capability of financial institutions in Pakistan.

IV. FINDINGS

Theme 1: Rapid Digitalization Increases Attack Surface

The literature analysis shows that financial services' digitalization has considerably increased the attack surface of financial institutions. Adoption of internet, mobile banking applications, fintech services, cloud computing and digital payment systems have enhanced efficiency and financial inclusion, but have also heightened cyber security risks. The World Bank (2021) noted that the increasing interdependence of financial systems opens up new opportunities for hackers. Likewise, IMF states that the rise in usage of digital technologies has raised cyber risk exposure in the global financial sector (International Monetary Fund Secretary's Department, 2024). Digital banking platforms and Raast instant payment system have driven digital transactions and customer engagement in Pakistan. But with these advances come more complex financial infrastructure challenges. Aldasoro et al. (2020) state that the more digital institutions are integrated, the more vulnerabilities they have, especially if they use more digital channels in combination with third-party service providers. The results indicate that digital transformation is a driver of innovation and financial inclusion, but also introduces new cybersecurity issues that demand ongoing monitoring, risk analysis, and security technology investments. As such, cyber security should be a part of any digital transformation phase to guarantee the security and stability of Pakistan's financial system.

Theme 2: Phishing is the most prevalent threat.

All the reviewed literature agrees that one of the major cyber security threat that is faced by financial institutions is phishing. Phishing attacks rely on the human element, using e-mail, text messages, telephone calls and fake Web sites to trick victims into disclosing personal information like their passwords, account numbers and banking information. Phishing is still one of the main ways that cybercriminals can access financial systems, according to the NIST Cybersecurity Framework (2023). World Economic Forum also notes that social engineering attacks are growing in number because they are based on the vulnerabilities of humans, not technology (Jurgens & Dal Cin, 2025). The rise in digital banking has created an increasingly big customer base in Pakistan that has fallen victim to phishing.

The State Bank of Pakistan has issued several warnings to financial institutions and their customers regarding communications that purport to be from banks and payment service providers (State Bank of Pakistan, 2026). In addition, the literature indicates that human error continues to be one of the major causes of cybersecurity breach incidents in the financial industry (World Bank, 2021). The results show that phishing attacks can be overcome if technological security measures are not applied. Instead, ongoing customer awareness campaigns, employee training and development initiatives, multi-factor authentication solutions, and proactive threat detection systems are needed to mitigate the risk of successful attacks.

Theme 3: Regulatory Improvements Are Strengthening Security

The results show that regulatory efforts have contributed significantly to boost the security of the financial sector in cyber space. The importance of cybersecurity to operational resilience and financial stability is becoming a priority for financial regulators around the world. The State Bank of Pakistan (SBP) has issued guidelines and cyber risk management frameworks for financial institutions in Pakistan, which mandate the creation of governance frameworks, risk management systems, and incident response procedures (State Bank of Pakistan, 2026). ISO/IEC 27001 and the NIST Cybersecurity Framework are international frameworks that offer a structured way of identifying, managing and reducing cybersecurity risks. Organizations with a risk-based cybersecurity program are more likely to identify, respond to, and recover from cyber incidents (NIST, 2023).

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In the same way, the Basel Committee on Banking Supervision is stressing on cyber resilience with robust governance, business continuity planning and operational risk management (Gržeta et al., 2023). The literature indicates that the standards are correlated with the increase of an organization's readiness and fostering a culture of cybersecurity awareness. Moreover, regulatory supervision fosters the adoption of international best practices and investments in financial institutions' cybersecurity infrastructure. The results show that although cyber threats continue to grow and change, the regulatory environment is helping to increase security measures and resilience in the financial sector.

Theme 4: Lack of Cybersecurity Experts.

One recurring theme in the literature is the lack of qualified cybersecurity professionals. With the growth of the sophistication of cyber-attacks, organization's need individuals who are capable of carrying out threat analysis, handling security operations and responding to cyber incidents. But jobs in cybersecurity still outnumber the number of qualified candidates. According to the World Economic Forum Jurgens & Dal Cin (2025), the cybersecurity skills gap remains one of the top challenges to cyber-resilience around the world. Likewise, the World Bank (2021) highlights that developing countries have heightened problems in building cybersecurity capacity as a result of low educational resources and professional training opportunities.

Digital banking and fintech services are booming in Pakistan, creating a demand for cybersecurity experts, but many firms are facing difficulties in finding and keeping skilled workers. SBP has also recognized the importance of increasing investments in cyber security awareness, training and workforce development, to bolster the growing digital financial landscape (State Bank of Pakistan, 2026). The results show that a lack of staff can have a negative impact on an organization's ability to employ sophisticated security measures, detect threats, and react appropriately to a cyber-incident. To meet this challenge, it is essential to work together among the government, education, and industry to create cybersecurity education programs, certifications, and ongoing training efforts to build the nation's cybersecurity skills.

V. DISCUSSION

The results provide insights into the intricate dynamics between digital transformation and cybersecurity threat in the financial industry of Pakistan. While digital banking services offer unparalleled convenience for the customer and enhanced financial opportunities, they have also opened up more potential entry points for cyberattacks. This finding aligns with worldwide research which has found digitalisation to be one of the key drivers of the growth of cyber risk exposure in the financial industry.

The results also highlight the ongoing and persistent nature of phishing attacks. Past research indicates that technological security measures are not enough if human factors are not. Employee training, education of customers and awareness programs, and cybersecurity education are, therefore, critical to minimizing the impact of social engineering attacks.

The State Bank of Pakistan's regulations have been beneficial in enhancing the governance and management of cyber risks. Compliance of local regulations with internationally agreed upon standards like ISO 27001 and NIST Cybersecurity Framework reflects a step towards improved cybersecurity resilience. However, implementation of the effective type is still a challenge, especially for the institutions that lack in technical resources.

The analysis of international best practices shows that many advanced financial systems have put significant efforts into building their cybersecurity skills, improving their threat intelligence functions and ongoing security monitoring. Similar measures can be beneficial for the financial sector in Pakistan. To achieve long-term cyber resilience and ensure the trust in digital financial services, the cybersecurity skills shortage must be addressed and investments in contemporary security technologies must be ramped up.

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Fig.2: Cyber Risk Management Cycle (NIST, 2023)

VI. RESULTS

According to the findings of this study, cybersecurity has emerged as a key issue for the financial industry in Pakistan, as digitalization and cyber threats are growing. Financial institutions are exposed to many threats, such as phishing attacks, ransomware attacks, data breaches, internal threats, and risks posed by third-party service providers.

The results indicate that phishing is still the top threat as it relies on human behavior and is continuing to impact customers and financial institutions. Another significant threat is ransomware attacks, as they can disrupt the operations and lead to significant financial losses. Data breaches may expose customer-sensitive data and harm the reputation of the organization, and insider threats may be associated with the unauthorized entry into the system and the misuse of sensitive information.

Table 2: Prominent Cybersecurity Challenges

Challenge	Impact	Risk Level
Phishing	Financial Fraud	High
Ransomware	Service Disruption	High
Data Breaches	Information Loss	High
Skill shortage	Unauthorized access	Medium

The results also indicate that the State bank of Pakistan's regulatory measures and implementation of global cybersecurity guidelines have enhanced cybersecurity governance. But obstacles like low cyber security skills and different degrees of cyber readiness within the sector persist in the sector's overall cyber resilience.

VII. CONCLUSIONS

The present study focused on analyzing key cyber security issues of Pakistan financial sector in the midst of digital transformation. The results show that digital banking, fintech services and electronic payment systems, whilst enhancing financial inclusion and the efficiency of financial operations, have also heightened risks of cyber-attacks. Risks are largely similar to those of other types of risks, such as phishing attacks, ransomware, data breaches, insider threats, third party vulnerabilities, etc. To safeguard financial assets, build customer trust, and ensure financial stability, it is crucial to have an effective cybersecurity governance framework supported by regulatory frameworks like SBP guidelines, ISO 27001, and NIST Cybersecurity Framework.

VIII. FUTURE WORK

Further studies on the new cybersecurity technologies should be conducted which can enhance the resilience of the financial system in Pakistan. Topics of interest include the use of Artificial Intelligence and Machine Learning in fraud detection, threat intelligence, and automated responses, and block chain-based security solutions. The risks of cybersecurity in fintech companies and digital payment service providers should be further explored. A quantitative study of the banks and financial institutions might be able to measure the level of cybersecurity maturity, analyze the current level of security controls, and suggest on-the-ground strategies for enhancing the sector's security.

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Influence of Social Media Marketing on Business Performance Among Clothing SMEs in Dar Es Salaam City, Tanzania

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Abstract *— This study investigated the effect of social media marketing on business performance among clothing SMEs in Dar es Salaam, Tanzania, as well as the mediating role of online social network relationships. A quantitative approach and an explanatory research design were employed. Using systematic sampling, 363 respondents were selected from a population of 3,952 clothing SMEs. Data were collected through structured questionnaires, and regression analyses were conducted on 357 valid observations. Three regression models were estimated: one assessing the total effect, one incorporating the mediator, and one examining the direct effect in the presence of the mediator. Social media marketing exhibited a positive association with business performance ($B = 0.933$, $p < 0.001$) and with online social network relationships ($B = 0.847$, $p < 0.001$). In the final model, both social media marketing ($B = 0.710$) and online social network relationships ($B = 0.264$) remained statistically significant predictors (both $p < 0.001$), jointly accounting for 89.1% of the variance in business performance. The reduction in the marketing coefficient indicated partial mediation, although formal confirmation would require testing the indirect effect. The study concludes that social media marketing and online social network relationships enhance the business performance of SMEs. It recommends that clothing SMEs intensify product promotion, customer communication, and relationship management via social media, while systematically monitoring enquiries, orders, and repeat purchases.*

Keywords *— **Social Media Marketing, Business Performance, Clothing SMEs, Online Social Network Relationships***

I. INTRODUCTION

Social media has become a major point of interaction between clothing enterprises and their customers (Silvano & Mbogo, 2022). By using photographs, short videos, customer reviews and direct messages, retailers display available inventory, describe product attributes and respond to enquiries before customers visit physical outlets or place orders (Silvano & Mbogo, 2022). The magnitude of this opportunity is illustrated by global statistics. At the beginning of 2026, there were approximately 5.24 billion social media user identities worldwide, representing 63.9% of the global population and an increase of 4.1% over the preceding year (Search Engine Land, 2026). In parallel, 50.0% of adult social media users reported using social platforms to learn about brands and view their content (Kemp, 2025a). These statistics underscore the significance of social platforms as channels for product and service discovery and for business communication.

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Social media marketing is particularly suitable for clothing SMEs because it enables firms to present designs, colour variations, prices and new arrivals while maintaining direct contact with prospective buyers (Romano, 2023). For instance, a clothing retailer can post a new collection on Instagram, respond to questions about sizes through direct messages and share customer feedback to encourage subsequent purchases (Titilayo & Samour, 2025). Such activities assist SMEs in attracting customers beyond their immediate trading areas. Their contribution to business performance is consequential for the broader economy. According to the World Bank (2025), SMEs account for approximately nine out of ten businesses and more than 50% of employment in developing markets. Understanding how these enterprises can increase sales and sustain customer relationships therefore has implications for business continuity, employment and household income.

In Tanzania, the size of the online audience provides a basis for examining the effect of social media marketing on clothing businesses. Kemp (2025b) reported approximately 20.2 million internet users in 2025, representing 29.1% of the population. In addition, the country had 6.75 million social media user identities, an increase of 1.1 million, or 19.5%, since early 2024. These identities may include multiple accounts belonging to the same individual. Meta's advertising tools further estimated potential advertising audiences of 6.75 million for Facebook and 3.70 million for Instagram in Tanzania. Although advertising audiences do not necessarily represent actual buyers, these figures indicate opportunities for clothing SMEs to showcase products and establish contact with potential customers (Kemp, 2025b).

However, the mere availability of social media platforms does not determine whether their use enhances business performance. Related evidence from Tanzania is provided by Silvano and Mbogo (2022), who examined women's clothing stores in Nyamagana District. Their findings indicated a positive relationship between Facebook marketing and sales performance ($\beta = 0.199$, $p < 0.020$), suggesting that social media supports clothing retail activities. Nonetheless, their study concentrated on women's clothing stores in a single district, limiting the generalisability of the results to clothing SMEs in other locations. More recently, Mushi (2024) analysed questionnaire data from 335 SMEs in Mbeya City using partial least squares structural equation modelling (SEM) and identified significant relationships between digital marketing strategies and SME performance, including sales growth, market share and market development. However, by examining multiple digital marketing strategies collectively, that study provides limited evidence regarding the specific contribution of social media marketing among clothing SMEs in Dar es Salaam City.

The present study draws on Social Network Theory to investigate how business ties formed and sustained through social media are related to performance. Granovetter (1973) explains how social ties provide access to information and contacts beyond an individual's immediate circle. Applied to clothing businesses, this perspective suggests that shared product posts, customer recommendations and ongoing interactions connect retailers with new buyers and encourage repeat purchases. These constitute potential mechanisms through which social media marketing may improve business performance, rather than outcomes that can be inferred from platform use alone. Accordingly, the current study examines the influence of social media marketing on business performance among clothing SMEs in Dar es Salaam City, Tanzania.

II. LITERATURE REVIEW

2.1 Theoretical Review

This study employed Diffusion of Innovation Theory (DOI) and Social Network Theory (SNT) to explain the influence of social media marketing on the performance of clothing small and medium-sized enterprises (SMEs) in Dar es Salaam City, Tanzania. DOI, originally formulated by Rogers (1962) and refined in subsequent editions, explicates how innovations diffuse through communication channels within a social system over time. Rogers (2003) delineates five stages in the innovation-decision process: knowledge, persuasion, decision, implementation, and confirmation. The likelihood of adoption is partly determined by an innovation's perceived relative advantage, compatibility, complexity, trialability, and observability.

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Applied to the present study, owners of clothing SMEs may adopt social media marketing when they perceive it as advantageous for attracting clients, congruent with their business activities, and feasible given their existing skills and resources. For example, a retailer may initially post photographs of clothing items on Instagram, evaluate customer enquiries and orders, and then decide whether to sustain and expand such activities. DOI thus provides a framework for explaining variation in both the adoption and continued use of social media marketing. Nevertheless, adoption in itself does not necessarily result in improved SME performance; the study therefore examines whether the use of social media marketing contributes to enhanced business outcomes.

Social Network Theory (SNT) elucidates how relational structures and patterns of connections influence access to information, resources, and opportunities (Borgatti & Halgin, 2011). It directs analytical attention to actors, the ties among them, and their positions within a network. In the present study, clothing SMEs, their clients, and other business contacts constitute the actors, while their connections via social media constitute the ties. Product sharing, customer referrals, comments, and direct messages represent potential pathways through which information disseminates to prospective consumers. Granovetter's (1973) concept of weak ties further suggests that connections beyond familiar customers expose businesses to new audiences and opportunities. For instance, when a client shares a clothing retailer's post, the retailer's products are introduced to individuals outside the existing customer base. Repeated interactions help to build trust and may stimulate additional purchases. Accordingly, SNT provides a conceptual basis for examining how relationships maintained through social media contribute to sales growth, customer retention, and market expansion among clothing SMEs in Dar es Salaam.

2.2 Empirical Review

This section provides a review of prior empirical studies that have examined the influence of social media marketing on business performance. For example, Ellyawati *et al*. (2024) in Indonesia investigated the effect of social media marketing on the performance of SMEs. Their study was guided by the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and Diffusion of Innovation (DOI) Theory. A quantitative approach and survey research design were employed, involving a sample of 291 micro, small, and medium enterprises (MSMEs) located in Surakarta. Structural Equation Modeling (SEM) results indicated that social media marketing is associated with improved business performance, particularly through increased sales, market share, and enhanced customer relations. However, a contextual gap exists because the study was conducted in Indonesia, whereas the present study focuses on clothing SMEs in Dar es Salaam. A theoretical gap is also evident, as their research relied on TAM, UTAUT, and DOI Theory, while the current study is grounded in Social Network Theory (SNT) in conjunction with Diffusion of Innovation Theory. SNT is important because it elucidates how connections and interactions between SMEs and customers on social media contribute to expanding customer reach and increasing sales. DOI Theory, in turn, explains how social media marketing tools are adopted and diffused among SMEs over time. The combined application of these two theories provides a more comprehensive understanding by explaining both the adoption of social media marketing by SMEs and the role of network relationships in enhancing its effectiveness, which is more suitable for clothing SMEs in Dar es Salaam.

Kikawa *et al*. (2022) in Uganda examined the relationship between social media marketing and SME performance. Their research employed a quantitative approach and involved 152 business units. The findings indicated that compatibility and perceived ease of use positively influence the adoption of social media marketing, while age and gender strengthen SME performance. The study recommended the adoption of user-friendly social media tools and the promotion of digital adoption among SMEs. Nevertheless, it presents a methodological gap due to its emphasis on moderating effects and a contextual gap because it was conducted in Uganda rather than among clothing SMEs in Dar es Salaam, Tanzania.

Hanif *et al*. (2024) in Ghana investigated the influence of social media marketing on SME performance in the Wa Municipality. The findings showed that social

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media marketing is associated with improved SME performance through enhanced brand recognition, customer engagement, and business growth. Although this study is relevant to the present research, it leaves a contextual gap because it focused on SMEs in Ghana rather than clothing SMEs in Dar es Salaam. It also presents a theoretical gap, as it relied on TAM, whereas the current study is anchored in Social Network Theory and Diffusion of Innovation Theory.

Silvano and Mbogo (2022) examined the impact of social media marketing on the sales performance of small businesses, concentrating on women's clothing stores in Nyamagana District, Tanzania. Their study revealed that Facebook and Instagram exert a significant positive impact on sales performance, whereas Twitter shows no direct relationship with sales performance. While their research focused on women's clothing stores in Nyamagana District, the present study concentrates on clothing store businesses in the Dar es Salaam City Council, Tanzania.

Similarly, Nganga (2022) identified a weak positive relationship between social media marketing and SME performance in Kenya, thereby creating a contextual gap because the study was conducted outside Tanzania. Likewise, Gontur *et al*. (2023) reported a positive relationship between social media marketing and SME performance in Nigeria, using a relatively small sample of 130 SMEs, which limits the generalizability of the findings.

In the Tanzanian context, Kishimbo *et al*. (2025) found that social media marketing enhances SME performance and that strategic capabilities reinforce this relationship. However, their study was conducted at the national level and was guided by Uses and Gratification Theory (UGT) and the Resource-Based View (RBV), thereby leaving both contextual and theoretical gaps. The present study addresses these gaps by focusing on clothing SMEs in Dar es Salaam and employing Social Network Theory and Diffusion of Innovation Theory to explain how social media marketing influences business performance.

In a related Tanzanian study, Njunwa (2024) examined the influence of social media marketing on the business performance of supermarkets in Dar es Salaam. Regression analysis results indicated that social media marketing is associated with improved SME business performance. The study recommended that managers refine their social media strategies, utilize data more effectively, and maintain an active online presence to increase market share and competitiveness.

Although previous studies consistently demonstrate a positive relationship between social media marketing and SME performance, the majority of these investigations have been conducted outside Tanzania (Nganga, 2022; Gontur *et al*., 2023; Kishimbo *et al*., 2025).

Existing studies have mostly used theories for instance the Resource-Based View and Uses and Gratification Theory, which clarify internal resources and user behaviour but give inadequate attention to innovation adoption and online network relationships. Also, numerous studies depend on small samples and used different sectors, limiting the applicability of their findings. This study fills these contextual, methodological and theoretical gaps by examine clothing SMEs in Dar es Salaam using a larger sample and join in the DOI and SNT to describe ON how social media marketing have effect on business performance.

2.3 Conceptual Framework

Figure 1 presents the conceptual framework illustrating the relationship between the predictors of social media marketing and the dependent variable, namely the business performance of SMEs. Online social network relationships are incorporated as a mediating variable, as they embody the principles of Social Network Theory and elucidate the mechanism through which social media marketing influences business performance. The model depicted in Figure 1 posits that social media marketing affects SMEs' business performance both directly and indirectly via online social network relationships. The direction and magnitude of these relationships are estimated using regression coefficients (Gujarati & Porter, 2009; Wooldridge, 2016). This analytical approach is consistent with Social Network Theory, which emphasizes the significance of networks and relationships in enhancing business performance (Scott, 2017).

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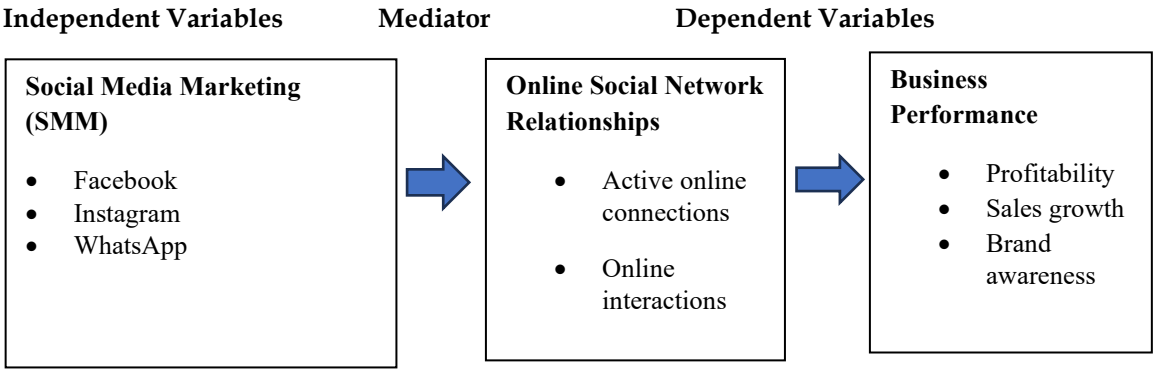


Fig.2: Conceptual Framework

III. RESEARCH METHODOLOGY

This study was conducted within the jurisdiction of the Dar es Salaam City Council, which hosts the highest concentration of small and medium enterprises (SMEs) in Tanzania, totaling 204,312 SMEs, and thereby constituted the empirical setting for the investigation (NBS, 2024). The study adopted a quantitative research approach to assess both the magnitude and direction of the influence of social media marketing on SMEs' business performance through the application of a simple linear regression model (Saunders *et al.*, 2019). Furthermore, an explanatory research design was employed to examine the causal relationship between social media marketing and SMEs' business performance by testing hypotheses to generate evidence-based conclusions for decision-making (Creswell & Creswell, 2018).

Given the known population of 3,952 clothing SMEs in Dar es Salaam City Council (DCC, 2025), Yamane's (1967) formula was applied at a 5% margin of error, yielding a sample size of 363 respondents. The study used systematic sampling, in which a sampling frame compiled from relevant business registers was used to select eligible SMEs. After randomly selecting the initial sampling unit, the study selected subsequent units at a predetermined sampling interval until it reached the required sample size. This procedure provided a systematic and transparent approach to respondent selection and helped minimise subjective selection, thereby supporting the credibility of the study findings (Creswell & Creswell, 2018; Saunders *et al.*, 2019). Primary data were collected using closed-ended questionnaires.

Simple linear regression was utilized to examine the influence of social media marketing on the dependent variable of SMEs' business performance while holding other factors constant (Gujarati & Porter, 2009). This model is appropriate for determining the individual contribution and statistical significance of each variable, as well as identifying the factors that exert the strongest effect on SMEs' business performance (Wooldridge, 2016; Hair *et al.*, 2020). Given that the study incorporated a mediating relationship, mediation analysis was conducted using hierarchical regression in accordance with the procedures proposed by Baron and Kenny (1986), complemented by the bootstrap approach recommended by Hayes (2022). The analysis was implemented through three sequential regression models.

Equation 1: Effect of Social Media Marketing on the SMEs business performance **(Total Effect)**

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon \quad \text{..... (1)}$$

where:

Y= Business Performance

X_1= Social Media Marketing

β_0= Constant

ε= Error term

Equation 2: Effect of Social Media Marketing on the Mediating Variable

$$M = \beta_0 + \beta_1 X_1 + \varepsilon \quad \text{..... ..... (2)}$$

where:

M= Mediating variable (online network relationships)

This model determines whether the independent variables significantly influence the mediator of online network relationships)

Equation 3: Mediation Model

$$Y = \beta_0 + \beta_1 X_1 + \beta_4 M + \varepsilon \text{..... (3)}$$

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The third model estimates both the direct effects of the independent variables and their indirect effects operating through the mediator. Mediation is evaluated by testing whether each indirect effect, defined as the product of the predictor-to-mediator coefficient and the mediator-to-outcome coefficient, differs significantly from zero, preferably using bootstrap confidence intervals. A statistically significant indirect effect in conjunction with a statistically significant direct effect is interpreted as evidence of partial mediation. When the indirect effect is statistically significant, and the direct effect is not, the results indicate indirect-only mediation, commonly referred to as complete mediation. A reduction in the magnitude of the direct coefficient alone is insufficient to establish mediation.

The assumptions underlying regression analysis were examined to ensure the validity of estimation and inference. Multicollinearity was assessed using the Variance Inflation Factor (VIF), with values exceeding 10 indicating substantial multicollinearity. Homoscedasticity was evaluated to determine whether the error terms exhibit constant variance, whereas normality tests were applied to assess the distribution of residuals. Autocorrelation was examined using the Durbin–Watson statistic, with values close to 2 indicating the absence of first-order autocorrelation (Gujarati & Porter, 2009; Wooldridge, 2016).

IV. FINDINGS

This section presents the principal empirical results obtained through the application of a linear regression model. Given the inclusion of a mediating variable, hierarchical linear regression was identified as the appropriate analytical approach. Accordingly, the hierarchical regression analysis was conducted using three models to examine both the direct effect of social media marketing on business performance and the mediating role of online social network relationships among clothing SMEs. The model was therefore estimated in three sequential regression stages, as follows:

4.1 Direct Effects of Social Media Marketing on Business Performance (Equation 1)

The first regression model assesses whether social media marketing exerts a statistically significant influence on SMEs' business performance. The primary objective is to determine whether the social media marketing strategy significantly predicts business performance.

$$BP = \beta_0 + \beta_1 SMM + \varepsilon \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

where BP denotes SMEs' business performance (dependent variable), SMM denotes social media marketing, β_0 is the intercept, β_1 is the regression coefficient, and ε represents the error term.

The results presented in the table indicate that social media marketing has a positive and statistically significant association with the business performance of clothing SMEs in Dar es Salaam (B = 0.933, SE = 0.019, β = 0.933, t = 48.904, $p < 0.001$). The findings indicate that a one-unit increase in social media marketing is associated with a 0.933-unit increase in business performance. The standardized coefficient shows that a one-standard-deviation increase in social media marketing is associated with a 0.933-standard-deviation increase in business performance. The intercept was statistically insignificant (B = 0.001, p = 0.965). These results support the rejection of the null hypothesis that social media marketing has no significant relationship with business performance.

Table 1: Coefficient for Model 1

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	**Std. Error**	**Beta**		
1	(Constant)	.001	.019		.044	.965
	Social Media Marketing	.933	.019	.933	48.904	.000
a. Dependent Variable: Business Performance						

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4.2 Effects of Social Media Marketing on the Mediating Variable (Model 2)

The second equation presents the finding that social media marketing has a significant effect on the mediating variable, namely online social network relationships. The purpose of this test is to determine whether social media marketing is associated with an increase in online social network relationships. Accordingly, the existence of a statistically significant relationship constitutes one of the necessary conditions for establishing mediation.

$$OSNR = \beta_0 + \beta_1 SMM + \varepsilon \quad \text{..... (5)}$$

The results reported in Table 2 indicate that social media marketing exhibits a positive and statistically significant relationship with online social network relationships among clothing SMEs in Dar es Salaam (B = 0.847, SE = 0.028, β = 0.846, t = 29.923, p < 0.001). This finding implies that a one-unit increase in social media marketing is associated with a 0.847-unit increase in online social network relationships. The standardized coefficient indicates that a one-standard-deviation increase in social media marketing corresponds to a 0.846-standard-deviation increase in online social network relationships. Consequently, the null hypothesis positing no significant relationship between social media marketing and online social network relationships is rejected.

Table 2: Coefficient for Model 2

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	**Std. Error**	**Beta**		
1	(Constant)	.001	.028		.020	.984
	Social Media Marketing	.847	.028	.846	29.923	.000
a. Dependent Variable: Online Social Network Relationships						

4.3 Mediation Model (Model 3)

The final model incorporates both the predictor and the mediator variables to assess whether online social network relationships mediate the relationship between social media marketing and business performance. Accordingly, this study compares the regression coefficients (β_1) from Model 1 and Model 3. Mediation is present if the coefficients decrease after the mediator is introduced while online social network relationships (OSNR) remain statistically significant. If the coefficients remain significant but are reduced in magnitude, this indicates partial mediation. Conversely, if the coefficients become non-significant, this implies full mediation.

$$BP = \beta_0 + \beta_1 SEM + \beta_4 OSNR + \varepsilon \quad \text{..... (6)}$$

Model 3 includes social media marketing and online social network relationships as predictors of SMEs' performance. The results in Table 3 indicate that social media marketing remains positively and significantly associated with SMEs' business performance after controlling for online social network relationships (B = 0.710, SE = 0.033, β = 0.709, t = 21.502, p < 0.001). In addition, the findings show that online social network relationships exhibit a positive and statistically significant association with SMEs' business performance when social media marketing is held constant (B = 0.264, SE = 0.033, β = 0.264, t = 8.011, p < 0.001). Thus, a one-unit increase in social media marketing is associated with a 0.710-unit increase in business performance, whereas a one-unit increase in online social network relationships is associated with a 0.264-unit increase in business performance. The standardized coefficients demonstrate that social media marketing has a stronger relationship with SMEs' business performance than online social network relationships.

In comparison with Model 1, the coefficient for social media marketing decreases from B = 0.933 (β = 0.933) to B = 0.710 (β = 0.709), while remaining statistically significant. Together with the significant relationship between social media marketing and online social network relationships in Model 2 (B = 0.847, p < 0.001), this pattern is consistent with partial mediation.

Consequently, the study concludes that social media marketing is positively and significantly associated with SMEs' business performance among clothing SMEs in Dar es Salaam. Online social network relationships also contribute significantly to business

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performance. The reduction, but continued statistical significance, of the social media marketing coefficient after inclusion of the mediator indicates partial mediation.

Table 3: Mediation Model (Model 3)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.001	.018		.039	.969
	Social Media Marketing	.710	.033	.709	21.502	.000
	Online Social Network Relationships	.264	.033	.264	8.011	.000
a. Dependent Variable: Business Performance						

4.4 Regression Assumptions

4.4.1 Residual Normality Assumption

Residual normality was evaluated using a histogram and a Normal P–P plot. This assumption concerns whether the differences between observed and predicted values follow a normal distribution and supports hypothesis tests and confidence intervals, mainly in small samples (Osborne, 2013). Figure 2 displays residuals centred around zero in an approximately symmetric, bell-shaped distribution, while Figure 3 shows points closely following the diagonal line. These patterns suggest that the residual normality assumption was reasonably satisfied.

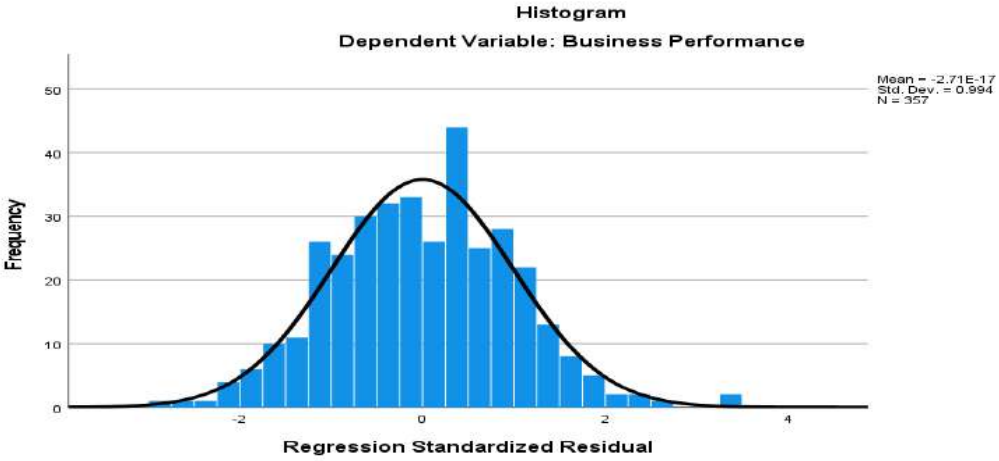


Fig.2: Histogram

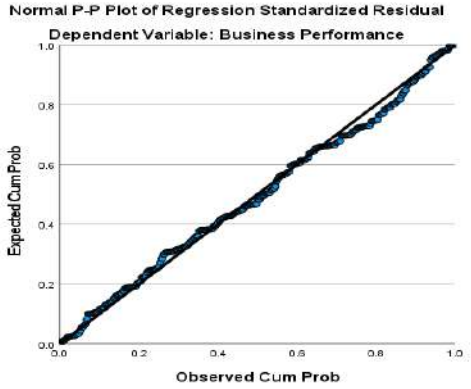


Fig.3: Normal P-P Plot

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Similarly, Table 4 shows outcome of Kolmogorov-Smirnova and Shapiro-Wilk normality tests. Finding exposed that Shapiro-Wilk test associated with p_value of 0.831 while Shapiro-Wilk has p_value of is 0.200. Table 4.11 we obtain the p-values lager than 0.05, this shows that at the 0.05 level of significance, thus study reject the null hypothesis of normality (Kwak, 2023). Thus, study conclude that, the standardized residuals are normally distributed.

Table 4: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Unstandardized Residual	.053	357	.200*	.896	357	.831
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

4.4.2 Heteroscedasticity

This subsection presents the valuation of homoscedasticity, which assumes that regression residuals have constant variance across levels of the independent variables (Ocaña & Zumbo, 2019). Figure 4 demonstrates randomly scattered residuals with a fairly consistent spread and no clear pattern; this implies that the assumption was rationally satisfied. This supports the use of conventional standard errors for hypothesis tests and confidence intervals.

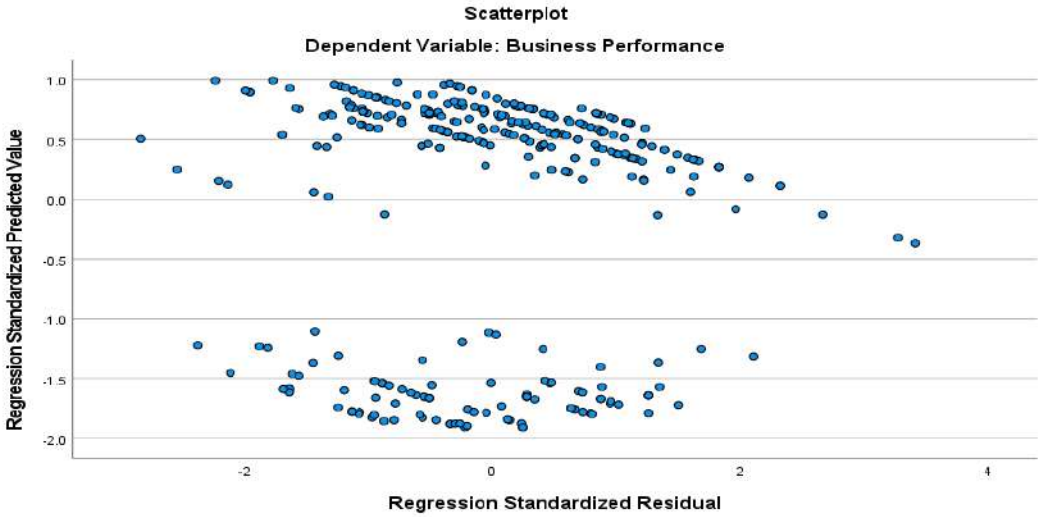


Fig.4: Scatter Plot

4.4.3 Multicollinearity

Multicollinearity occurs when predictors are highly correlated, making their individual relationships with the dependent variable difficult to estimate precisely (Shrestha, 2020). It was assessed using tolerance and the Variance Inflation Factor (VIF), with tolerance below 0.20 and VIF above 5 showing potential concerns. Table 5 shows that social media marketing and online social network relationships each had a tolerance of 0.284 and a VIF of 3.522. These values fall within the stated limits; this implies there is no serious multicollinearity.

Table 5: Multicollinearity

Variables	Tolerance	VIF
Social Media Marketing	.284	3.522
Online Social Network Relationships	.284	3.522

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4.4.4 Autocorrelation

Autocorrelation refers to correlation among regression error terms, violating the assumption that residuals are independent (Chaudhary *et al.*, 2023). The presence of autocorrelation contributes to biased standard errors and unreliable statistical inferences (Gujarati & Porter, 2009). In the current study, the Durbin–Watson test was applied to evaluate autocorrelation (Chen, 2016). A value close to 2 specifies no autocorrelation (Wooldridge, 2010). As shown in Table 6, the Durbin–Watson statistic was 1.8, which implies that the residuals are independent and the regression results are reliable.

4.4.5 Model Summary

This subsection shows the regression model summary revealed in Table 6. The model has a correlation coefficient of R = 0.944, which implies a strong positive connection among the predictor variables (online social network relationships and social media marketing) and business performance. The R Square value of 0.890 shows that online social network relationships and social media marketing jointly account for 89.0% of the variation in business performance.

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.944a	.891	.890	.33183522	1.801
a. Predictors: (Constant), Online Social Network Relationships, Social Media Marketing					
b. Dependent Variable: Business Performance					

4.4.6 Analysis of Variance (ANOVA)

The ANOVA was conducted to evaluate the overall model significance. As presented in Table 7, the model has an F-statistic of 144067 and a p-value of 0.000; this implies the model is statistically significant. This finding shows that social media marketing and online social network relationships jointly have a significant effect on SMEs' business performance. Therefore, the regression model is suitable for explaining variations in SMEs' business performance.

Table 7: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	317.279	2	158.640	1440.677	.000b
	Residual	38.981	354	.110		
	Total	356.260	356			
a. Dependent Variable: Business Performance						
b. Predictors: (Constant), Online Social Network Relationships, Social Media Marketing						

V. DISCUSSION OF FINDINGS

This section discusses findings. The findings showed that social media marketing had the strongest positive and statistically significant effect on business performance. Therefore, the null hypothesis was rejected, and the alternative hypothesis was accepted. The study concludes that social media marketing positively and significantly influences the business performance of clothing SMEs in Dar es Salaam. Moreover, the findings show that, among all the predictors in the model, social media marketing contributes the greatest effect, highlighting its importance as the primary digital marketing tool for clothing SMEs in Dar es Salaam. This result is consistent with the operational practices of numerous SMEs, which use Instagram, Facebook, TikTok and WhatsApp Business to show new clothing collections, advertise promotional offers, interact with customers and receive orders. For instance, a boutique in Kariakoo that posts new fashion arrivals on Instagram

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and responds on time to inquiries through WhatsApp is likely to attract more customers, increase sales and increase profitability. Thus, the findings indicate that continuous investment in social media marketing offers clothing SMEs a competitive advantage in attracting and retaining customers.

Finding consistence with Ellyawati *et al*. (2024) from Surakarta, Indonesia exhibited that social media marketing had a significant positive effect on business performance, particularly in increasing sales, market share and customer relations. Likewise, findings align with Kikawa *et al*. (2022) from Uganda exposed that compatibility and perceived ease of use positively influenced the adoption of social media marketing, and age and gender also had a positive moderating impact on SME performance. Moreover, the findings align with Hanif *et al*. (2024) from Ghana, who showed that social media marketing improved SME performance by strengthening brand recognition, customer engagement and business growth. Similarly, Silvano and Mbogo (2022) from Nyamagana District indicated that Facebook and Instagram had a significant effect on sales performance, whereas Twitter had no direct effect.

In addition, Nganga (2022) from Kenya revealed a weak positive correlation between social media marketing and SME performance. Moreover, a study conducted by Gontur *et al*. (2023) in Ghana showed that social media marketing correlates positively with SME performance. Similarly, Kishimbo *et al*. (2025) from Tanzania exposed that social media marketing is associated with the increase SMEs business performance while social media strategic capabilities positively moderated that relationship. Moreover, Njunwa (2024) from Tanzania revealed that social media performance is associated with increase SMEs business performance, with the model explaining 86.6% of the changes in performance.

Moreover, the results of the current research align with the assumptions of the Diffusion of Innovations theory clarifies that businesses that use innovative technologies and communication channels are times more likely to gain competitive advantages and increase business performance. Social media marketing stands as one of the most widely adopted digital marketing innovations since it enables businesses to communicate directly with customers, promote products at fairly low cost and respond fast to changing market demands. The finding that social media marketing has the strongest positive and significant effect on business performance among clothing SMEs in Dar es Salaam supports the central proposition of the Diffusion of Innovation Theory that successful adoption of innovation increases business outcomes. Clothing SMEs that successfully integrate social media platforms into their marketing activities are able to reach larger audiences, increase their customer relationships, increase brand visibility and increase sales, eventually improving business performance compared with SMEs that depend on traditional marketing approaches.

The findings are supported by numerous previous studies that have established the positive influence of social media marketing on SME performance. For example, Tajvidi and Karami (2021) found that social media capabilities significantly increase firm performance by enhancing customer engagement, simplifying knowledge sharing and strengthening marketing capabilities. Similarly, Chatterjee and Kar (2020) described that the actual use of social media marketing increases firms' responsiveness, customer interaction and competitive advantage; this is associated with increased business performance. Similarly, Dwivedi *et al*. (2021) concluded that digital marketing innovations, mainly social media platforms, permit businesses to enlarge market range, increase customer relationships and firms' growth. Thus, the present findings confirm that clothing SMEs that actively adopt social media marketing attain advanced business performance through enhanced customer achievement, increased sales opportunities and stronger market competitiveness.

VI. CONCLUSION

This study exposed that social media marketing has no significant influence on business performance among clothing SMEs in Dar es Salaam, this study rejects the null hypothesis and accepts the alternative hypothesis. Social media marketing was revealed as the strongest predictor of business performance among all variables contained within the model. This finding confirms that constant use of social media platforms associated with advantages of facilitated the promotion of products, increase the instant

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communication with customers especially located different regions of Tanzania.

VII. RECOMMENDATION

This section presents the recommendation based on the findings of this study. Clothing SMEs should increase their investment in digital marketing activities to increase business performance. Since social media marketing has been shown to have the strongest effect on SME performance, SME owners are required to make greater use of platforms, for instance, Instagram, Facebook, TikTok and WhatsApp Business to encourage products, communicate with customers, and receive orders. Similarly, businesses are recommended to develop strong digital marketing plans, often monitor client engagement and assess the effectiveness of their online marketing activities to increase the SMEs' sales and client satisfaction.

VIII. AREAS FOR FURTHER STUDIES

The current research examined the influence of social media marketing on business performance among clothing SMEs in Dar es Salaam, with online social network relationships as a mediating variable. This study was limited to clothing SMEs in Dar es Salaam and used a quantitative research approach and an explanatory research design. Future studies should be conducted in other sectors and regions of Tanzania and consider comparative or longitudinal research designs to determine whether the findings are consistent across different contexts and over time.

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Cultural Competence and Practice Readiness of Filipino Internationally Educated Nurses in the U.S. Healthcare System: A Descriptive Comparative-Correlational Study

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Abstract *— The study contributes quantitative evidence on the interaction between cultural competence and practice readiness among Filipino IENs in the U.S. healthcare system in transition to practice. Filipino IENs are recognized for their solid clinical foundation, compassionate nature, and flexibility, but the literature has described challenges Filipino IENs may encounter during transition to U.S. practice. The aim of this study was to determine their level of cultural competence, readiness for independent practice, and to investigate the significant differences between demographic and professional characteristics and the relationship between cultural competence and readiness for practice. This study employed a descriptive comparative-correlational design. Data were collected using two validated instruments: the Cultural Competence Assessment Instrument (CCAI) and the Casey-Fink Readiness to Practice Survey. Proportional stratified sampling was used, and 101 Filipino Internationally Educated Nurses (IENs) participated. Descriptive statistics, Mann-Whitney U and Kruskal-Wallis H tests with Dunn's post hoc comparisons, and Spearman's rank-order correlation were used to analyze the data. Findings showed that participants had moderate levels of cultural competence in awareness, knowledge, skills, and organizational support domains. Most respondents scored within the Competent/Emerging Adaptation range for practice readiness, suggesting a relatively stable level of preparedness for U.S. clinical practice. Cultural competence differed only by support system, and practice readiness differed only by Philippine language group, current position, and years in current position; all other profile variables showed no significant differences. Correlation results indicated a statistically significant, albeit weak, positive relationship between Cultural Awareness and Knowledge and clinical problem solving, learning activities, and overall practice readiness, but no relationship with confidence and skill performance. Conversely, Cultural Skills and Organizational Support were not significantly associated with any of the readiness domains. The study findings suggest that Filipino IENs enter U.S. practice with solid clinical foundations and developing cultural competence. They require structured support to enhance cultural awareness, system familiarity, and early confidence. Results indicate that readiness was weak but significantly associated with cultural awareness/knowledge, and not with cultural skills or organizational support. Based on these findings, a 12-week transition program was proposed to support cultural competence and transition to U.S. practice. This program offers a structured, literature-aligned approach that may support Filipino IENs during transition to U.S. practice.*

Keywords *— **Cultural Competence, Practice Readiness, U.S. Healthcare System, Transition Experience, Clinical Problem-Solving, Learning Engagement, Professional Integration, Cultural***

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Awareness and Knowledge, Workforce Adaptation, Transcultural Nursing, Migration and Nursing Workforce

I. INTRODUCTION

The Philippines has long been acknowledged as one of the major producers of internationally educated nurses (IENs) globally. Filipino nurses who earned their BSN degrees in the Philippines relocate to high-income countries such as the United States, the United Kingdom, or Canada, hoping for better opportunities. The healthcare systems of these wealthy nations welcome Filipino IENs to address persistent labor shortages. The nursing skills they use in their daily routine help ease the current nursing issues, particularly understaffing. These nurses are allowed to practice their nursing skills anywhere around the world. Almost 20% of the world's nursing workforce is in the United States (World Health Organization, State of the World's Nursing Report: United States of America, 2020). Of the 4.3 million U.S.-registered nurses (RN) (American Nurses Association, Nurses in Workforce, accessed July 2023), 6–8% are IENs and more than half are Philippine-educated nurses (PENs) (Smiley et al., 2018). Registered Nurses trained in the Philippines make up 1 out of 20 RNs in the U.S. and continue to be the largest group of foreign-trained nurses today. (Yoshioka et al., 2021) They are among the most established healthcare workers across the United States and are recognized as some of the most skilled and caring nurses in most of the facilities where they work. These nurses have been recognized for their work ethic, competent nursing skills, and caring attitude. Their didactic training from their home country, both in the academe and real work settings, gave them the knowledge, skills, and overall experience that they need to provide high-quality patient care. Filipino IENs are excellent health care workers, possessing a bachelor's degree and honed nursing skills that they have acquired back in their home country.

Internationally Educated Nurses (IENs) have the potential to alleviate labor shortages, but they remain underutilized (Harun & Walton-Roberts, 2022). Despite a multitude of recognitions, Filipino IEN's continue to encounter challenges regarding their integration into the U.S. healthcare system, which potentially affects their overall performance as trusted healthcare workers.

From 2002–2021, only 45.8% of 177,730 Philippine-educated nurses passed the NCLEX-RN. Initial nursing licensure and the nursing workplace were significantly associated with passing. PENs comprise more than half of IENs in the U.S. workforce. (Montegrico et. al 2025). In the state-level statistical analysis, such as Texas, 32,623 foreign-educated nurses are employed, and 56% of them are Filipino, making the Philippines the leading source of internationally educated nursing workers in the state (Texas Board of Nursing, 2021). Some sources point out that rural hospitals are hiring Filipino nurses from the Philippines to fill ongoing staffing gaps. PBS NewsHour reports that Filipino IENs make up a large portion of the long-term staff in many North Dakota hospitals, highlighting their vital role in sustaining rural healthcare services (Nawaz, 2022).

Cultural competence is an essential factor in the successful adaptation of Filipino IENs into the U.S. healthcare system, and it has implications for how they interact with diverse patient populations and work in multidisciplinary teams. Also, closely related to readiness for practice is their ability to adapt to U.S. cultural norms and clinical practice and to provide safe and effective care in a new clinical setting. The lack of adequate support for these two constructs may be a potential threat to the job performance of Filipino IENs, which may ultimately affect patient outcomes. Although Filipino nurses are internationally trained and widely recognized for their professionalism and compassionate care, these strengths do not eliminate the challenges of transitioning into a different healthcare system. Lin (2014) and Xu (2020) noted that limited familiarity with U.S. hospital protocols, communication styles, and organizational expectations may affect Filipino IENs' confidence and clinical performance during the early days, weeks, and months of employment. While the experiences of Filipino IENs have been explored in several qualitative studies, most existing research relies on interviews and narrative accounts to describe their

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transition into the U.S. healthcare system. These studies provide valuable insights, but only a limited number of studies measure each variable cohesively. The relationship between cultural competence and practice readiness, which is useful to bridge the gaps in Filipino IENs' integration into the U.S. workforce, is a defining gap in most of the quantitative studies. Quantitative studies using validated and structured instruments to measure these variables are limited but are still emerging these days.

This study will evaluate their cultural competence when interacting with diverse populations and their readiness to work as nurses in the U.S. healthcare system. Studying the relationship and differences among Filipino IENS in terms of their cultural competence and practice readiness using a descriptive correlational-comparative design, specifically descriptive comparative and descriptive correlational designs, will pave the way for employers, stakeholders, administrators, nursing leaders, and interdisciplinary teams to acquire useful information and structured guidance to support the needs of their employees. The production of a Transcultural Transition Programs Guide will help Filipino Internationally Educated Nurses (IENs) adjust to their new jobs more easily.

Objectives of the Study

This study aimed to determine the cultural competence and practice readiness of Filipino Internationally Educated Nurses in the U.S. healthcare system. Specifically, the study sought to determine if there is a significant difference in the levels of cultural competence of Filipino Internationally Educated Nurses in Hospital A when grouped according to socio-demographic profile. It also aimed to determine whether there is a significant difference in the levels of practice readiness of Filipino Internationally Educated Nurses in Hospital A when grouped according to socio-demographic profile. Furthermore, it aimed to determine if there is a significant relationship between the levels of cultural competence and the level of practice readiness of Filipino Internationally Educated Nurses in Hospital A.

II. METHODOLOGY

The study used a descriptive-quantitative design that is aligned with examining the cultural competence and practice readiness of the Filipino Internationally Educated Nurses. Specifically, the design used correlational and comparative components and involved collecting numerical data to describe and explore relationships between these two variables. A descriptive-quantitative design with correlational and comparative elements is appropriate for this study because it allows for the measurement and analysis of the relationship between these key factors: cultural competence and practice readiness, which are associated with Filipino IENs' adaptation to the U.S. healthcare system (Grove, Gray, & Burns, 2019). The combination of these designs allows the researcher to compare and correlate the occurrences of the variables when grouped according to the respondents' demographic profile, and also investigate relationships and differences between the Filipino IENs' cultural competence and practice readiness (Polit & Beck, 2021).

The study was conducted in a selected hospital in the United States, specifically in the Midwest region (hereafter referred to as "Hospital A"). Hospital A is a facility scattered across different parts of the state of North Dakota and other neighboring states. It is composed of various facilities, whether tertiary or secondary hospitals, clinics, hospices, assisted-living facilities, or nursing homes. Hospital A in Fargo, North Dakota, is composed of 3 divided campuses.

The study used a stratification strategy based on service characteristics that differentiated the three campuses of the participating hospital system. Campus A is a specialist acute care campus providing specific clinical services within the system overall. Campus B is a secondary care campus, providing general inpatient treatment and secondary-level services. Campus C is classified as a referral site of Hospital A at the tertiary level, where advanced specialized care and high-complexity services are provided. Stratified random sampling was purposely used in Campuses A, B, and C because of these compelling reasons, which reflected their heterogeneity in terms of structure and function.

The target population for this study includes all Filipino internationally educated nurses currently employed as registered nurses across the three campuses of Hospital A at the time of data collection. The sampling frame was developed using the most

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recent de-identified roster of Filipino nurses provided by Hospital A's Human Resources department and verified by Nursing Administration. Only nurses who met the inclusion criteria, such as those who were Filipino-educated and trained, currently employed as a registered nurse, and with at least three months of clinical experience at Hospital A, were included. The study excluded nurses on long-term leave or those in administrative positions only, as they would not be providing direct patient care; therefore, the sample was representative of those in clinical practice. The complete population consisted of 136 Filipino nurses distributed across the three campuses: Campus A (38), Campus B (22), and Campus C (76). The sample size of 101 was obtained with the Raosoft calculator for a finite population of 136 at a 95% confidence level, 5% margin of error, and 50% response distribution, and was divided proportionally among the three campuses with a stratified sampling calculator.

This study employs a basic IV-DV model (Independent Variable-Dependent Variable Model), which links the two key variables, cultural competence and practice readiness. The Cultural Competence Conceptual Model of Balcazar et al. (2009) was determined as the guiding framework for this study because it provides an empirically grounded, behavior-based understanding of cultural competence that directly corresponds to the realities of Filipino internationally educated nurses (IENs) transitioning into the U.S. healthcare system. The study utilizes an integrated practice-centered paradigm that corresponds to the lived experiences of the Filipino IENs and realities in U.S. healthcare. It uses the Cultural Competency Conceptual Model developed by Balcazar et. al. (2009) in three domains: Awareness/Knowledge, Organizational Support, and Skills. This development was made to explore the cultural competency of various healthcare workers among their diverse patients. Benner's Novice to Expert Model highlights the Filipino IENs' practice readiness in transitioning to the U.S. healthcare workforce. Based on her framework, nursing competence is a developmental process influenced by experience and circumstance (Benner,1984). The approach sets out five levels: novice, advanced beginner, competent, proficient, and expert. Nurses move through these phases as they gain clinical experience and comprehension of the problem. Both models are anchored to Balcazar et al. (2009) Cultural Competence Assessment Instrument (CCAI) and Casey Fink's (2024) Readiness to Practice Survey. The Cultural Competence Assessment Instrument (CCAI) (Balcázar et al., 2009) is relevant to this study because it assesses cognitive (awareness/knowledge), behavioral (skills), and organizational support aspects of cultural competence that Filipino IENs should demonstrate in U.S. clinical environments. On the other hand, the Casey-Fink Readiness for Practice Survey (Casey-Fink, 2024) takes a similar developmental approach to the subject. The questionnaire evaluates clinical judgment, confidence, communication, and role transition, which are all significant indicators of growth of healthcare professionals from the novice to expert continuum.

The ethical clearance was processed by the Institutional Review Board of Wesleyan University after submission of essential documents. The study was approved by the WU-P University Research Ethics Committee on July 3, 2026. No data, including pilot data, were collected before this approval; the pilot test was conducted on July 6, 2026, and the main data collection ran from July 22 to August 28, 2026. The next process was the actual distribution of the research questionnaires to the Filipino IENs. Surveys from these research instruments were circulated electronically among Filipino IENs in Hospital A by means of personal or work emails, social media accounts, and professional connections for the participants' convenience. Technology was of great importance in distributing the Google Form survey electronically, and it was more accessible for Filipino IENs to respond using their mobile phones.

The collected data were stored on a password-protected computer and in an encrypted cloud storage service only accessible to the principal investigator. The data were securely stored according to ethical research guidelines for possible follow-up studies or audits. The data destruction software protected sensitive information, and to protect the privacy of respondents, all data will be permanently deleted and destroyed five years after data collection is completed.

All results were obtained from the targeted respondents from each stratum of Hospital A, and the data were encoded in SPSS. Because the sample exceeded 50, the one-sample Kolmogorov–Smirnov (K-S) test was used to check the distribution of the scale scores only; the categorical sociodemographic variables were not tested for normality, because normality does not apply to categorical data.

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Data were presented as frequency and percentage distributions by the sociodemographic profile of Filipino IENs, including age, sex, marital status, U.S. experience, education, work status, migration history, language competence, cultural background, continuing education, and support systems. To assess levels of cultural competence and preparation for practice, means and standard deviations were calculated for each dimension. Although Likert scales are ordinal, means and standard deviations are widely accepted in nursing research to summarize multi-item scales. The constructs were measured by a multi-item Likert scale that consists of the CCAI domains of cultural awareness/knowledge, cultural skill, and organizational support. These allowed the study to present a clear and interpretable picture of the cultural competence and practice readiness of Filipino IENs. This also includes consistency and differences detection within the group. Spearman's rank-order correlation was used to examine the relationships between the cultural competence domains and the readiness subscales. The Mann–Whitney U test was used for profile variables with two groups and the Kruskal–Wallis H test for those with three or more groups; results are reported with their degrees of freedom (number of groups minus one). When a Kruskal–Wallis test was significant, Dunn's rank-based post hoc test with Bonferroni adjustment was used to identify which groups differed. All tests used the .05 level of significance. These analytic procedures were chosen to fit the level of measurement and the distribution of the data. After measuring, correlating, and comparing the two variables as per the respondents' socio-demographic data, the study aims to create a 12-Week Transition Program that the institution may utilize that will support Filipino Internationally Educated Nurses in their adaptation to the U.S. healthcare system.

The study was conducted in accordance with the ethical standards for the protection of the dignity and rights of Filipino internationally educated nurses (IENs) who migrated to the U.S. in the Midwest and were working in a certain hospital system. Because the group of respondents was 101 healthcare professionals at most and was identifiable, further safeguards were taken to maintain strict anonymity. Before data collection, Institutional Review Board (IRB) permission was provided by the Wesleyan University ethical review board to ensure that all methods were in accordance with ethical guidelines for research involving human subjects. The respondents' involvement in the study was entirely voluntary, and they were asked to sign an informed consent form. Given the enhanced identifiability of the sample, all responses were anonymized, de-identified, and aggregated. No individual-level data, such as unit assignment, shift, or employment, were disclosed. Data were stored in encrypted, password-protected files accessible only to the principal investigator, so as to maintain confidentiality and to prevent unauthorized access. There were also explicit safeguards to protect participants and eliminate any possibility of coercion or retaliation. The respondents' involvement in the study did not affect their job, their annual performance reviews, or their relationships with colleagues at work when designing the study. The researcher maintained transparency throughout the study to avoid conflicts of interest. Permission was obtained for the intellectual property rights of the original authors of the selected adopted research instruments. The procedures used in the study guaranteed that throughout the entire research process, all of the participants were respected, protected, and appreciated collectively. This included voluntary participation, anonymity of the small target population of Filipino IENs, secure data handling, mitigation of conflicts of interest, and assurance of non-retaliation.

III. RESULTS AND DISCUSSION

This section presents, analyzes, and interprets findings on the cultural competence and practice readiness of Filipino Internationally Educated Nurses working in Hospital A. These findings include assessing the differences between both variables and the Filipino IENs' sociodemographic profile, correlating both variables to determine relationships, and the production of the 12-week Transition Program to aid Filipino IENs in their transition to the U.S. healthcare system.

Table 1.A: Socio-demographic variables of Filipino IENs: Personal profile (n=101)

Frequency and percentage distribution of Filipino IENs' personal demographic profile

Variable	Category	Frequency	Percentage

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Gender	Male	28	27.72
	Female	71	70.30
	Non-binary or Gender Fluid	0	0.00
	Prefer not to disclose	2	1.98
Age	Early adulthood (18–29 years)	6	5.94
	Early middle adulthood (30–39 years)	76	75.25
	Middle adulthood (40–49 years)	13	12.87
	Late adulthood (50 years and above)	6	5.94
Marital status	Single	40	39.60
	Married	59	58.42
	Separated	2	1.98
	Widowed	0	0.00
Languages spoken other than English	Yes	86	85.15
	No	15	14.85
Specific Philippine language groups	Northern Philippine / Luzon	45	44.55
	Central Philippine / Visayas	34	33.66
	Southern Philippine / Mindanao	10	9.90
	Prefer not to disclose	12	11.88
Race/Ethnicity	Luzon ethnic group	42	41.58
	Visayas ethnic group	48	47.52
	Mindanao ethnic group	10	9.90
	Prefer not to disclose	1	0.99
Support systems in the U.S.	Immediate family in the U.S.	54	53.47
	Friends and co-workers	40	39.60
	Faith-based or community groups	0	0.00
	No available support systems	7	6.93

Gender was chosen as part of the socio-demographic profile because of its cultural and identity factor that affects how Filipino IENs communicate and interact culturally in the US healthcare setting. Gender describes how people see themselves and how they express themselves in social and cultural contexts. This strongly influences professional behavior and perceptions of readiness in clinical practice. It is more appropriate for a study about cultural competence, since it is part of the broader understanding that cultural identity is shaped not only by ethnicity and region, but also by the way in which individuals experience and express their gender in social contexts.

Most Filipino IENs in this survey were female, a reflection of the long-standing reality of Philippine nursing, where women have historically comprised much of the nursing workforce. Although this demographic pattern shaped the composition of the sample, the statistical analysis showed no significant difference in cultural competence by gender ($p = 0.136$). Gender therefore serves as meaningful background context, but it did not influence cultural competence or practice readiness in this study. None of the respondents identified as non-binary, which simply reflects the responses provided in this sample, while some were not prepared to reveal their gender. This emphasized the individual nature of identity and the need to safeguard their privacy and personal boundaries in research, especially in cross-culturally diverse populations. The high number of female respondents is consistent with the statement of Nazareno et al. (2021) that "the majority of nurses in the United States are women and one out of every twenty registered nurses in this nation are trained in the Philippines". A limitation was the absence of other

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gender identities; hence, experiences beyond traditional gender categories were not represented in the dataset.

The age groups in this study are based on Jean Piaget's definitions of adulthood. She talks about the ongoing development of cognition and social-emotional functioning during adulthood. Early adulthood between ages 18-29 years is a time for exploration at work. Early middle adulthood, between ages 30-39 years, is a time of greater stability. Middle adulthood, ages 40-49 years, is a period of greater mastery, and Late adulthood, ages 50 and up, is characterized by accumulated experience. The study can apply Piaget's adult developmental brackets to place respondents' insights within meaningful transitions in life stages. The majority of respondents were 30–39 years old, a distribution frequently noted in literature on Filipino nurse migration. However, age did not significantly relate to cultural competence ($p = 0.873$) or practice readiness ($p = 0.676$). Age therefore describes the demographic profile of the group but does not explain differences in competence or readiness. This age pattern is consistent with findings from studies that find Filipino nurses generally migrate after a few years of professional experience, often during the mid-career stage. The lower number of young respondents is a reflection of the demographics of this sample. The reasons behind the age-related migration trends were not studied in this research. Similarly, the relative minority of the late-adulthood respondents reflects the age distribution and does not indicate underlying factors affecting migration at older ages. The overall sample was mostly mid-career nurses, in line with Bieski's (2022) comment that "IENs are often mid-career movers, often after having gained considerable clinical experience in their home country." This age distribution is consistent with general descriptions of Filipino nurses who tend to migrate in mid-career phases.

Married respondents were slightly more common, but marital status was not significantly associated with cultural competence ($p = 0.128$) or practice readiness ($p = 0.982$). In the current study, marital status was used as a descriptive variable and not as a variable influencing readiness or competence. The proportion of married and single respondents reflects the diverse personal backgrounds of Filipino IENs entering U.S. practice, and does not suggest differences in cultural competence or readiness outcomes. A small proportion of respondents reported being separated, which simply forms part of the demographic profile captured in this sample.

Filipino IENs in this study joined the U.S. workforce either married or single. Married nurses were slightly overrepresented. These personal profiles of the respondents illustrate the diversified life contexts of Filipino IENs since they migrated to the United States. Some balance family responsibilities and their marriage, while others pursue individual career advancement as single individuals. Masselink and Lee (2020) noted in their study that "many Filipino nurses base their decisions to migrate to improve family economic mobility." In this study, marital status provided background context but was not directly related to cultural competence or practice readiness. For example, some of the Filipino IENs know another language or dialect such as Tagalog, Bisaya, Ilonggo, or Kapampangan while providing care. This is a reflection of the multilingual character commonly described among Filipino IENs. Alvarez (2020) noted that a large number of nurses are multilingual or multi-dialectal, a feature that has been linked in the literature with more communication between different patient groups. In contrast, a smaller group of respondents did not use other languages in care, which simply reflects variation in linguistic backgrounds within the sample. Overall, the trend showed that Filipino IENs were highly multilingual, consistent with the linguistic diversity widely noted in the literature.

Most Filipino IENs in this study who spoke languages from the Northern Philippine language group (e.g., Tagalog or Ilocano) were dominant language speakers, since many originated from Luzon, the country's most populous region and a common starting point for nursing graduates. Some participants described themselves as bilingual and reported that their second-language English proficiency supported more comfortable communication with the diverse patient population they served in the United States. Only a small portion of the sample spoke languages from the Mindanao group (e.g., Maranao or Maguindanao), a trend that aligns with broader migration patterns described in the literature.

Nevertheless, the data showed the diversity of linguistic backgrounds despite these variations, as more than 85 percent of Filipino IENs spoke at least

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one Philippine language or dialect. Multilingual IENs were commonly described as prepared to communicate effectively, more trusted by patients, and having fewer misunderstandings (Xu & He, 2019). Most respondents spoke at least one Philippine language in addition to English, reflecting the multilingual nature of Filipino nursing. However, language use ($p = 0.453$) and language group ($p = 0.462$) showed no significant relationship with cultural competence. Multilingualism remains an important descriptive characteristic, but it was not associated with differences in cultural competence. Practice readiness, however, differed by Philippine language group (Table 8.A).

The race/ethnicity categories in this study are based on the three major ethnolinguistic regions of the Philippines: Luzon, Visayas, and Mindanao. Filipino nurses' understanding of community, communication, and interpersonal relationships is shaped by these regional identities, which have deep cultural histories, languages, and social norms. Although Filipino IENs share a common strong national cultural identity, their regional backgrounds often influence subtle factors of their worldview, caregiving values, and interaction styles. The inclusion of such categories enables the study to recognize the cultural richness and diversity within the Filipino nursing workforce and also acknowledges that ethnicity can be personal and sensitive, as indicated by the option Prefer not to answer. This bracketing allows the researchers to place the respondents' experiences within the larger cultural landscape that shapes their competence and preparedness for practice in U.S. healthcare settings. The ethnic group composition in this sample was consistent with wider migration patterns from Luzon, Visayas, and Mindanao. However, ethnicity was not significantly associated with cultural competence ($p = 0.583$). Thus, ethnic background enriches the demographic profile but does not indicate disparities in cultural competence.

This coincides with the long-term tendencies for the Philippine nursing workforce, where the Visayas region has traditionally been a source of many migrant nurses and is home to many nursing schools. Mindanao respondents made up the smallest ethnolinguistic group in the sample. This was consistent with national migration patterns, where there were fewer nurses from Mindanao, a region with fewer respondents represented in this sample. Masselink and Lee (2020) stated that "regional variation is observed in the migratory tendencies of Filipino nurses, with the majority from Luzon and the Visayas and a sizable but lesser population from Mindanao."

The Luzon, Visayas, and Mindanao groups together illustrated the range of cultural backgrounds represented among Filipino IENs entering U.S. employment. This variety offered a contextual foundation to appreciate the diverse cultural origins of Filipino IENs entering U.S. practice.

The only personal component that emerged significantly associated with cultural competence was support systems ($p = 0.015$). Those respondents who relied on friends or co-workers were rated to have higher cultural competence scores than those without support systems. This means that respondents with interpersonal support had better levels of cultural competence scores, which aligns with literature describing strong family interdependence in Filipino culture. Masselink and Lee (2020) noted in their study that most of the Filipino nurses are more likely to seek migration to Western countries, such as the United States, if they have a support system through family networks, finances, and emotional support from their friends abroad.

Interestingly, although Filipino society is strongly religious, none of the respondents mentioned church-based or community organizations as their major support system. The absence of church-based or community organizations as support systems simply reflects the responses in this sample. A modest but significant proportion of respondents said that they had no support system. Support systems were significantly associated with cultural competence, but not with readiness.

Overall, Filipino IENs in this research depended largely on interpersonal sources of support, notably family and colleagues. These patterns offered background, but the research found no clear relationship between the kind of support system and cultural competency or preparation for practice.

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Table 1.B: Professional Profile of Filipino IENs (n=101)

Frequency and percentage distribution of Filipino IENs' professional demographic profile

Variable	Category	Frequency	Percentage
Highest level of education	Diploma/Nursing vocational certificate	0	0.00
	Bachelor of Science in Nursing (BSN)	94	93.07
	Master's in Nursing (MSN, MS, MN)	7	6.93
	PhD	0	0.00
Current position/employment status	Volunteer/Student nurse/Nurse resident	0	0.00
	LPN/ADN (Licensed Practical Nurse/Associate Degree Nurse/Certified RN)	0	0.00
	BSN (Professional RN)	98	97.03
	Prefer not to disclose	3	2.97
Previous non-nursing degree or health care experience	Yes	13	12.87
	No	88	87.13
Years in current position	< 2 years	15	14.85
	3–5 years	16	15.84
	6–10 years	23	22.77
	> 10 years	47	46.53
Work-related hours earned	1–200 hours	10	9.90
	201–300 hours	13	12.87
	301–400 hours	7	6.93
	400 hours	71	70.30
Current area/unit of practice	Adult medical–surgical	38	37.62
	Adult ICU	8	7.92
	Step-down	0	0.00
	Behavioral health (adult/adolescent)	3	2.97
	Float pool	2	1.98
	Labor & delivery	0	0.00
	Mom/Baby/Post-partum	4	3.96
	Pediatric medical–surgical	8	7.92
	Pediatric ICU	4	3.96
	NICU	6	5.94
	OR–Perioperative	9	8.91
	PACU	8	7.92

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	Pre-operative	0	0.00
	Emergency department	8	7.92
	Urgent care	1	0.99
	Outpatient/Ambulatory clinic	2	1.98
	Home care agency	0	0.00
	Skilled nursing facility	0	0.00
	Rehabilitation	0	0.00
	School nurse	0	0.00
Continuing education/training	Self-directed learning	19	18.81
	Workplace-based training or mentorship	62	61.39
	Confident based on past work experience	9	8.91
	No training received/Open to training	11	10.89
Cultural competency training received	Self-directed learning	14	13.86
	Workplace-based training or mentorship	58	57.43
	Certified in cultural competency	4	3.96
	No training received	25	24.75
Type of cultural competency training	Learned during fieldwork	29	28.71
	Self-reading	4	3.96
	Learned through interdisciplinary interaction	46	45.54
	No formal training	22	21.78
Top 3 populations seen most often *(multiple response)*	White	88	Rank 1
	African American/Black	87	Rank 2
	Asian	83	Rank 3
	Hispanic/Latino	23	Rank 4
	Native American/Alaska Native	18	Rank 5
	Hawaiian/Pacific Islander	6	Rank 6

Although most respondents held a BSN, educational level did not significantly relate to cultural competence ($p = 0.789$) or practice readiness ($p = 0.883$). Education level therefore describes the academic background of the group but does not explain differences in competence or readiness. BSN preparation is the national standard in the Philippines, providing the academic background common among Filipino IENs. Dahl et al. (2021) noted that "Filipino-trained nurses reported that their BSN programs are rigorous, but the standards of proficiencies that were taught do not always meet those of the host nation." The U.S. healthcare system was becoming more demanding of BSN-prepared nurses, which correlates with the need for international migration. The high BSN rate is reflective of the typical educational background of Filipino IENs who enter U.S. practice. All respondents qualified for the national standard for BSN common to Filipino nursing graduates. Some Filipino nurses who migrated to the U.S. did not have a doctoral-level degree in nursing, but some pursued it after

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establishing stable professions abroad. The Filipino IEN labor trend is often highly BSN-prepared, with less graduate education and good academic foundational preparation. This reflects the educational background of the respondents being BSN-dominant.

In the **"current position/employment status,"** most of the Filipino IENs in this study were licensed Registered Professional Nurses. This finding is consistent with the long-standing trend that most Filipino nurses migrated to the U.S. to work as professional RNs. Masselink & Lee (2020) noted, "Filipino nurses rarely enter U.S. employment in lower-tier nursing occupations; instead, their migration has typically been aimed at RN positions. This aligns with migration patterns that typically have Filipino nurses entering the U.S. workforce as RNs. In contrast, none of the respondents worked as LPNs, ADNs, or in trainee positions. This was consistent with migration patterns that suggest Filipino nurses rarely enter the U.S. workforce in non-RN positions. This is consistent with literature on migration of Filipino nurses into RN roles.

Some respondents had non-nursing degrees in the past, but this variable was not significantly associated with cultural competence ($p = 0.689$) or readiness ($p = 0.308$). Previous education gives more depth to the demographic profile but does not address differences in competence. "Many Filipino nurses pursue nursing immediately after secondary education, and this forms a single-track professional identity shaped entirely by nursing training," asserted Ortiga (2018). This reflects long-standing Philippine educational patterns where nursing is pursued immediately after high school, and families encourage nursing as a stable global career. On the other hand, a small number of respondents reported possessing non-nursing degrees or health care experience in the past, indicating diverse educational backgrounds among a minority of respondents. The overall migration trend of Filipino IENs in the U.S. workforce indicates that most Filipino IENs are single-career individuals, and the minority of the group have other professional backgrounds. This pattern results in the prevalence of single-track nursing careers among Filipino IENs, some of whom had other professional backgrounds.

Years in current position were not significantly related to cultural competence ($p = .383$), and nurses with less than two years in their current position reported lower practice readiness than those with more than 10 years (Table 8.B). This implies that readiness develops meaningfully within the framework of sustained exposure to U.S. practice. This is reflective of the longer tenure of many respondents, consistent with longer employment in U.S. practice settings. "The Filipino nurses have long been a steady part of the U.S. nursing workforce, often staying in their jobs for long stretches of time, due to strong professional commitment and integration in the workplace" (Nazareno et al., 2021). By contrast, the shorter tenure of some respondents merely reflects the early stage of employment in U.S. practice. Overall, the spread showed a gradual increase in tenure, with the majority of respondents working in positions for 6+ years. This suggested good retention and alignment with the practice expectations, with continuing exposure to the US healthcare system.

The work-related hours of Filipino IENs were not significantly associated with their cultural competency ratings ($p=0.480$), nor with their readiness scores ($p=0.217$). Hours were reflective of clinical exposure, but did not predict competence or preparedness in this sample. The data set of Area/Unit of Current Practice revealed distinct patterns of concentration, diversity of specialty, and migration-related placement among Filipino IENs.

Adult medical–surgical was the most common work setting for Filipino IENs (close to one-third of Filipino nurses in Hospital A). This finding was consistent with international migration trends, where Med–Surg units represented the entry point for internationally educated nurses.

A broad clinical environment is linked to the current clinical skill set of internationally educated nurses. Internationally educated nurses often enter a broad clinical environment. Filipino IENs are typically placed in medical-surgical units to start their US clinical transition, as these units offer wide patient exposure, allow a gradual cultural transition, and help establish practice readiness.

Xu et al. (2019). In contrast, special areas, such as Step-Down, Labor & Delivery, Pre-operative, Home Care, Skilled Nursing Facility, and Rehabilitation, have 0% representation. This absence simply reflects the distribution of units represented in this dataset and Filipino nurses' preference for acute care environments that match their training. Across the dataset, Filipino IENs were widely distributed across

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high-acuity and procedural units, including Adult and Pediatric ICU, NICU, OR/ PACU, and Emergency Department. This reflects the distribution of respondents across high-acuity units.

Many respondents participated in workplace-based training, but training type did not significantly relate to cultural competence ($p = 0.058$; $p = 0.499$; $p = 0.548$). Training patterns describe how Filipino IENs engage with professional development, but they did not explain differences in cultural competence. Xu, Y., & He, Z. (2019) stated that "IENs' cultural competence, communication skills, and practice readiness are commonly supported through mentoring and organized workplace training." This only reflected the emphasis placed by U.S. healthcare organizations on standardized onboarding, competency-based practices, and ongoing professional development—areas in which Filipino IENs are actively engaged. In contrast, a small group relied solely on previous experience, while most engaged in workplace-based training. In addition, a few Filipino IENs relied solely on their previous work experience without any training, but they were willing to engage in such programs. The overall pattern showed that Filipino IENs rely primarily on workplace-based training, supplemented by self-directed learning, with very few depending solely on experience. This reflected a workforce that participated in workplace-based training among most respondents.

The "Cultural competency trainings/education" data showed that over half of Filipino IENs take advantage of workplace-based cultural competency training, which includes diversity and inclusion modules, cultural sensitivity workshops, mentorship from senior nurses, unit-based cultural communication coaching, and organizational competency requirements. "Structured workplace training is consistent with cultural competency, communication skills, and practice preparedness of globally trained nurses, as per Xu et al. (2019). This reflects the types of cultural competency training reported by respondents, yearly competencies, and team-based learning in U.S. healthcare.

The lowest-ranked category of Filipino IENs was the cultural competence certification. This shows that although certification programs may not be easily available, organizations may be unwilling to pay for formal credentials, and cultural competence is mostly learned informally, not through standardized certification. This indicates that a formal certification in cultural competence was rare in this sample.

The results for the variable "Type of cultural competency training" showed that Filipino IENs developed cultural competency through interactions with coworkers at work. Gaining cultural awareness through everyday contact with diverse colleagues, exposure to alternative clinical viewpoints, informal mentoring and peer learning, and workplace interactions learned through real interaction, and impacted by workplace culture rather than formal teaching in terms of multidisciplinary cooperation was frequently mentioned by respondents.

Most of the respondents answered that they had not received any formal training in cultural competence. "Cultural competency is often learned in the daily contacts with colleagues and patients, not in formal training" (Xu & He, 2019). This is consistent with the training patterns reported in this dataset and the reliance on informal learning reported in this sample. A minority engaged in self-directed learning about culture (e.g., reading cultural competence literature, online programs, independent study). Thus, Filipino IENs were more interested in experiential learning, as opposed to formal or self-directed cultural learning. In general, the trend showed that Filipino IENs mainly acquired cultural competence through involvement in the workplace, clinical fieldwork, experiential learning, and multidisciplinary cooperation. Formal certification and formal training are still not widely recognized.

For the diverse population that Filipino nurses work with, the data showed that Filipino IENs most frequently care for White, African American/Black, and Asian patients, dominating the clinical exposure profile, indicating frequent care for racially diverse patient groups: "Filipino nurses' cultural competence is shaped by their frequent interactions with racially diverse patient populations, including White, African American, and Asian communities." According to Yoshioka et al. (2021). This aligns with literature describing Filipino nurses' exposure to diverse patient groups. In contrast, Hawaiian/Pacific Islander and Native American/Alaska Native populations appear far less frequently, which means limited representation is cared for by the Filipino IENs. The general trend meant that the data showed Filipino IENs consistently care for racially diverse groups, especially White, African American/Black, and Asian

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patients, which reflects the diversity of patient populations encountered in this sample.

Table 2: Level of cultural competence of Filipino IENs based on CCAI domains (n = 101)

Mean and standard deviation of Filipino IENs' cultural awareness/knowledge, cultural skills, and organizational support

Variable	Category	Frequency	Percentage	Mean	Standard deviation
Cultural awareness/knowledge	—	—	—	31.81	6.22
	8–23 (Low awareness/knowledge)	1	0.99	—	—
	24–37 (Developing awareness/knowledge)	59	58.42	—	—
	38–48 (High awareness/knowledge)	41	40.59	—	—
Cultural skills	—	—	—	31.06	6.27
	8–23 (Low skill)	10	9.90	—	—
	24–37 (Developing skill)	56	55.45	—	—
	38–48 (High skill)	35	34.65	—	—
Organizational support	—	—	—	30.31	5.99
	8–23 (Low support)	7	6.93	—	—
	24–37 (Developing support)	84	83.17	—	—
	38–48 (High support)	10	9.90	—	—
Overall cultural competence	—	—	—	93.20	16.86
	24–71 (Culturally incompetent/high risk)	6	5.94	—	—
	72–111 (Culturally aware/developing)	83	82.18	—	—
	112–144 (Culturally competent/proficient)	12	11.88	—	—

Cultural Awareness and Knowledge

The only domain of cultural competence that **was statistically significantly associated with the practice readiness variables was Cultural Awareness/Knowledge (ρ =.242–.229, p < .05)**. This trend indicated that, compared to skills and organizational structures, the awareness/knowledge category was the only cultural dimension that was somewhat related to readiness among Filipino IENs. Most of the Filipino IENs in the sample reported intermediate levels of cultural awareness, showing that they are aware of cultural differences and are learning U.S. cultural norms, but have not yet achieved advanced understanding. This developmental stage is an initial step in the trajectory of Filipino IENs' adaptation to U.S. healthcare practice that involves a process of cultural differences detection, learning about patient needs, and reflection on their own cross-cultural communication and relational skills. These findings are consistent with literature on Filipino IENs developing cultural awareness over time as they are immersed in new clinical environments with changing communication styles and changing patient expectations. Their scores

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also reflected curiosity and willingness to learn, qualities often reported in studies of Filipino IENs who are moving into new health care systems. The only low score in this domain is a consequence of individual variation and shows that a lack of familiarity with U.S. culture is not common within this group, although it is present.

With a mean score of 31.81, the interpretation that Filipino IENs are currently working on the acquisition of cultural awareness during their transitional experience in the U.S. workforce is supported. The moderate mean and relatively low standard deviation suggested that the construct of cultural awareness/knowledge is relatively stable in this sample, and that most of the Filipino nurses cluster around similar levels of awareness. The variability, however, shows that cultural awareness is defined by individual differences such as background, prior experience with other cultures, and personal learning trajectories. Overall, these findings characterize Filipino IENs as culturally competent practitioners who are developing their cultural competence in practice in U.S. practice settings.

Cultural Skills

The majority of Filipino IENs at Hospital A had acquired cultural skills to effectively communicate and adapt to the U.S. workforce, but they were still undergoing the process of learning culturally responsive behaviors. It showed that Filipino IENs are engaged in the development of practical skills for culturally sensitive care. The scores are indicators of Filipino IENs' development of cultural skills. However, not all Filipino IENs in Hospital A can utilize cultural skills. In the sample, there is a variation in the level of cultural skills. This pointed to the need for more support for some Filipino IENs, particularly for people who are new to the US healthcare system or who have minimal expertise with culturally diverse environments.

The Filipino IENs in this sample had a moderate level of cultural competency with an average score of 31.06, which suggested that Filipino IENs were learning cultural skills with low levels of awareness. There was a large range and a standard deviation of 6.27, which indicated that although many nurses had similar levels of cultural competence, the patterns of cultural skill development were associated with individual background and experience. Overall, the data indicate that Filipino IENs came to U.S. health care practice with a foundation of cultural sensitivity. These emergent skills mirror the moderate cultural skill scores in this dataset.

Organizational Support

Most Filipino IENs in Hospital A reported having moderate organizational support in most of the U.S. institutions, through the availability of some cultural resources some Filipino IENs described it as sporadic and informal. Most of them have peer support available; some considered having training, while others are lucky to have supportive nursing leadership. However, they reported that organizational processes such as onboarding programs, cultural competence training, or transition paths did not meet their needs. The variation in the sample is reflected in the low organizational support reported by some respondents. Although they state that they may not have institutional backing, systems of documentation, norms of communication, or cultural subtleties, this mean score of 30.31 was still within the Developing Support range. This is consistent with the assumption that generally Filipino IENs saw the workplace as somewhat helpful, although in the emerging stage. Organizational support had an average variability of 5.99 standard deviations. There was a significant variance in the organizational assistance provided among institutions overall.

Overall Cultural Competence of Filipino IENs

Findings indicated that Filipino IENs' cultural competence was generally developing in the CCAI domains. The Cultural Awareness and Knowledge (M = 31.81, SD = 6.22) measure also revealed that Filipino IENs had a strong basis of cultural sensitivity and were working to enhance their ability to apply this awareness/knowledge in clinical practice. Both showed majority clustering in developing categories for Cultural Skills (M = 31.06, SD = 6.27), suggesting moderate but emerging cultural capability. This domain relates to self-reported cultural skill levels of respondents, such as developing culturally sensitive care plans, communicating effectively in cross-cultural situations, and practicing cultural humility.

However, a few Filipino IENs expressed that there is a need for more support for some Filipino IENs, especially those who are new to the U.S. healthcare system or have limited exposure to culturally diverse environments. Organizational Support (M = 30.31, SD

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= 5.99) was most heavily concentrated in one category, suggesting the presence of institutional cultural resources that are not evenly distributed.

Overall Cultural Competence (M = 93.20, SD = 16.86) suggested that most of the Filipino IENs were in the culturally aware/developing range, and only 11.88% reached proficient levels. This suggested that Filipino IENs who entered the U.S. healthcare system and work in this new healthcare environment possessed adequate cultural awareness and developing skills for culturally competent practice. These developmental skills correspond to working in multicultural clinical settings and demonstrate the levels of cultural competence displayed in this population. Ongoing mentoring, formal education, and favorable workplace cultures may support their cultural competency and readiness for safe and successful practice. Findings of this study on the cultural competency levels of Filipino IENs across the CCAI areas were supported by recent studies.

Some research results on the cultural evolution of Filipino IENs are similar to the findings characterized by Xu and He (2019), as they continuously enhance their cultural awareness. These studies revealed how immersion in the work context and everyday interaction with a varied patient group boosted nurses' cultural awareness. These experiences taught them how to discern cultural subtleties, how to adapt to diverse ways of communication, and how to be attentive to the needs of patients from other cultures. The results showed that cultural competencies are not quickly acquired but developed through experience, collaborative partnerships with peers, and structured mentoring consistent with the studies of Dahl et al. (2021).

Finally, the perception of developing organizational support mirrors findings by Masselink and Lee (2020), Primeau et al. (2022), and Casey-Fink (2024), which highlight that institutional support for IENs is often present but inconsistent; this highlights that organizational support for IENs can vary across settings. Collectively, these recent studies are consistent with the present findings, which align with literature describing Filipino IENs as having developing cultural competence shaped by workplace experiences and evolving cultural competence shaped by lived experiences, workplace interactions, and organizational environments."

Table 3: Levels of practice readiness based on Casey-Fink readiness subgroups (n = 101)

Mean and standard deviation of Filipino IENs' readiness for professional nursing practice

Variable	Category	Frequency	Percentage	Mean	Standard deviation
Clinical problem-solving	—	—	—	18.06	2.60
	5–11 (Advance Beginner/ High transition risk)	1	0.99	—	—
	12–19 (Competent/Emerging adaptation)	45	44.55	—	—
	20–25 (Proficient/Globally ready)	55	54.46	—	—
Learning activities	—	—	—	18.50	2.11
	5–11 (Advance Beginner /High transition risk)	1	0.99	—	—
	12–19 (Competent/Emerging adaptation)	48	47.52	—	—
	20–25 (Proficient/Globally ready)	52	51.49	—	—
Practice readiness	—	—	—	18.20	2.43
	5–11 (Advance Beginner /High transition risk)	3	2.97	—	—

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	12–19 (Competent/Emerging adaptation)	46	45.54	—	—
	20–25 (Proficient/Globally ready)	52	51.49	—	—
Confidence and skill performance	—	—	—	19.32	3.53
	5–11 (Advanced Beginner /High transition risk)	4	3.96	—	—
	12–19 (Competent/Emerging adaptation)	44	43.56	—	—
	20–25 (Proficient/Globally ready)	53	52.48	—	—
Overall readiness for professional nursing practice	—	—	—	74.10	8.70
	20–47 (Advance Beginner /High transition risk)	1	0.99	—	—
	48–79 (Competent/Emerging adaptation)	64	63.37	—	—
	80–100 (Proficient/Globally ready)	36	35.64	—	—

Clinical Problem-Solving

Most of the Filipino IENs had the capacity to solve challenges in the workplace, indicating high clinical reasoning and decision-making abilities. This was reflected in the category Proficient/Globally Ready at 54.46%. This was in accordance with the findings of Nazareno et al. (2021), who discovered that Filipino nurses had good clinical judgment related to years of experience in high-acuity settings in hospitals in the Philippines and the Middle East.

Several Filipino IENs demonstrated strong clinical judgment consistent with literature relating to Filipino nurses' significant clinical backgrounds. These nurses felt confident in their ability to assess the patient's health, anticipate possible problems, and coordinate care. These clinical skills were consistent with norms of nursing practice worldwide and facilitated a seamless transition to practice in the U.S. In contrast, there was only one different response recorded, which suggested that some Filipino IENs may require particular assistance throughout the transition phase to the U.S. This low score pertains to individual variance in the dataset. This highlighted the need to provide a systematic onboarding process and mentoring that targets essential clinical skills for Filipino IENs when they begin working in the United States.

The mean score for the Competent/Emerging Adaptation category was 18.06, which implied that Filipino IENs scored at a moderate to high level. This means that Filipino nurses are able to overcome the challenges at work even with early integration into the U.S. workforce. The lower variation of standard deviation of 2.60 showed that Filipino IENs had similar skills in clinical reasoning and decision-making in their work as health care providers. This is consistent with the findings of Primeau et al. (2022) that immigrant nurses have clinical reasoning skills because of their standardized training in their countries of origin and similar cultural norms that may indicate hard work and competence.

The results in this data meant that Filipino IENs were equipped to employ clinical judgment and problem-solving abilities while they work in the U.S. healthcare system. The ratings showed that the Filipino respondents were capable of clinical problem-solving so long as they continue to receive structured training and mentorship while they work.

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Learning Activities

In the data, almost half of the Filipino IENs working at Hospital A were utilizing continuous learning practices through positive learning, flexibility, and engagement. It showed that many respondents were engaged in the learning activities available to them, and these scores reflected both positive learning and consistent learning engagement within the sample, showing that nurses learned freely and used new experiences across a broad spectrum of clinical conditions. This context was supported by the findings of Dahl et al. (2021). Their study found that Filipino nurses are motivated learners and seek mentorship, are open to self-directed learning and reflective practice to adapt to the U.S. healthcare system.

The low variance of learning engagement (SD = 2.11) was consistent with the findings of Xu & He (2019) that IENs have stable learning motivation when they transition to new practice settings. There were still some groups of Filipino IENs who needed some coaching to improve opportunities for learning engagement. This low score reflected the variability within the sample. The existence of this minority only proves that there is a need for training programs that are readily accessible, supportive mentorship from the nursing leadership, and culturally appropriate onboarding training. The mean score in the category of Competent/Emerging Adaptation suggested that Filipino IENs are engaged in learning and are ready for ongoing progression as a group. The standard deviation shows the least variety; most of the respondents had similar levels of learning desire and adaptability.

The data set generally suggested that Filipino IENs enter the U.S. healthcare system with sufficient levels of learning engagement. Filipino IENs' continued engagement in learning activities and their ability to work within complex multicultural clinical environments were reflected in the learning engagement scores. The ongoing teachings, structured training, and positive corporate cultures were consistent with better engagement and overall readiness for safe, effective practice. This was consistent with Casey Fink (2024); their study emphasized that readiness of healthcare professionals improves with time in their role, their familiarization with U.S. documentation standards, and interdisciplinary collaboration.

Practice Readiness

Recent empirical evidence suggested that more than 50% of Filipino IENs were ready to practice independently with good clinical judgment, flexibility, and communication skills. Nazareno et al. (2021) revealed that Filipino nurses consistently demonstrate high-acuity clinical judgment because of their vast experience in Philippine and Middle Eastern hospitals. Alvarez (2020) stated that nurses' culturally based patient-centered care helps them develop excellent assessment and decision-making skills. These findings align with literature describing Filipino nurses' clinical backgrounds and addressing the various requirements of patients in U.S. clinical settings. Global IEN research supported the presence of a small subgroup that required additional transition assistance. This is aligned with the idea that "Newly immigrated nurses with limited recent clinical experience may face some initial challenges and may benefit from structured onboarding, coaching, and culturally responsive mentoring", based on the findings of Primeau et al. (2022). **The average score of 18.20 was also in the Competent/Emerging Adaptation range. This was consistent with the proposition that Filipino IENs, as a group, were well positioned for successful integration into U.S. practice**. The small SD = 2.43 indicated that the respondents' preparedness and confidence levels were fairly consistent. These findings were consistent with the literature at large, suggesting Filipino IENs brought to the U.S. healthcare system strong clinical skills, flexibility, and cultural sensitivity (Masselink & Lee, 2020; Casey-Fink, 2024).

The majority of Filipino IENs were in the Competent/Emerging-Adaptation range of practice preparedness. A smaller group of Filipino IENs were in the Proficient/Globally Ready range of practice preparedness. This group of nurses was considered well-prepared healthcare professionals from the start of their employment and is continually growing through experience. Continuous mentorship, organizational support, and professional development will be crucial for their readiness to provide quality patient care, and this reflects their readiness in the long run.

Confidence & Skill Performance

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The Filipino IENs rated their confidence and ability in performing skills as "high", reflecting high confidence scores among respondents. This tendency was strongly supported by recent studies. Most participants reported high levels of confidence in their ability to perform skills related to assessment, intervention, patient management, and interdisciplinary communication. This corresponded to the findings of Nazareno et al. (2021), who found that Filipino nurses were often recruited for complex clinical roles in U.S. hospitals due to their strong technical skills and adaptability. Filipino nurses' culturally based patient-centered care and long-standing experience at the bedside were associated with high confidence in clinical decision-making and communication, similar to Alvarez (2020), according to the study. Competency in this domain reflects respondents' self-reported confidence in skill performance and commitment to providing safe, effective, and culturally appropriate care.

A small group of Filipino IENs in the dataset showed that they still need to acquire more skills training to be more inclined toward the nature of the work environment in the U.S. This is in line with the findings of Primeau et al. (2022), who stated that for immigrant nurses with limited recent clinical exposure, immersion in structured onboarding, supportive preceptorship, and culturally responsive training programs will be immensely beneficial.

Filipino IENs were generally confident and competent, as indicated by their mean score of 19.32 in the results, which is below the Competent/Emerging Adaptation level. The scores had moderate dispersion (SD=3.53), which showed that the individual working environment and previous experiences of the nurses still played a role in the development of confidence. This is consistent with the study of Omeri et al. (2019), who showed that migrant nurses' confidence was related to experience, learning, and a supportive team atmosphere. Overall, results showed Filipino IENs are entering the U.S. health care system with well-developed clinical abilities and rising confidence, as shown by high confidence and skill performance levels in this group.

As Casey-Fink et al. (2024) found in their study, there are factors that contribute to the nurses' preparedness to practice, such as continuous mentoring and support from the organization even after the orientation phase. This boosted the trust of Filipino IENs and aligned with high-quality patient treatment. This created confidence in the Filipino IENs and was in line with high-quality patient care.

Readiness for Professional Nursing Practice

The Competent/Emerging Adaptation was considered to be the most prominent category in this data at 63.37%. It showed that most Filipino IENs possessed competence to practice in the United States. As Dahl et al. (2021) stated, they described Filipino immigrant nurses as having strong baseline competencies and a high motivation to learn; their competent clinical judgment, growing independence, and comfort with U.S. standards of documentation and communication indicate a similar adjustment. Likewise, Masselink and Lee (2020) showed that Filipino nurses' previous overseas experience and cultural adaptability were consistent with literature describing Filipino nurses' diverse clinical backgrounds.

The capacity of nurses to adapt to various patient groups and multidisciplinary teams is aligned with the work of Nazareno et al. (2021), who highlighted the flexibility and excellent clinical work of Filipino nurses working in U.S. hospitals.

The Advance Beginner /High Transition Risk category had a small number of respondents at 0.99%. This result was consistent with other literature on Filipino nurses' clinical experience, which suggests that Filipino IENs tend to have a low transition risk. This is the same as Xu and He (2019), who noted that internationally trained nurses who migrated to the U.S. with high baseline abilities or had little and recent clinical experience still needed specific assistance when they started working in a new system. The results highlight the continued need for culturally appropriate onboarding, mentoring, and transition programs for Filipino IENs. These supports are not optional; they are important mechanisms within the workplace that allow nurses to increase their competencies while ensuring that their learning environment is representative of cultural appropriateness. In line with this, higher practice preparedness was connected with knowledge of the U.S. system, namely documentation requirements and team-based care procedures (Casey-Fink, 2024).

The Filipino IENs' mean scores in the research were high in the Competent/Emerging Adaptation category, suggesting a fairly consistent level of preparation and a strong pattern of global practice

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competence. The standard deviation of 8.70 is moderate and shows that there is a meaningful variance in the group. This meant that the Filipino IENs came from different demographic and vocational backgrounds.

This conclusion is similar to Primeau et al. (2022), which revealed that the confidence and preparation of an immigrant nurse during transition is significantly affected by their work environment and personal life experiences. Therefore, training is not the only influence on preparedness, but also the situation in which the nurses work and the support received. Results highlighted strengths of the Filipino IEN workforce, including strong clinical judgment, adaptability, and cultural sensitivity to the U.S. health care system. Readiness scores fell in the Competent/Emerging Adaptation group.

Table 4.A: Significant Difference in the Cultural Competence of Filipino IENs According to Personal Demographic Profile (n = 101)

Variable	Category	n	Mean Rank	H (df) / U	p (Asymp. Sig.)
Gender	Male	28	60.16	3.99 (2)	0.136
	Female	71	47.23		
	Prefer not to disclose	2	56.50		
Age	Early adulthood (18–29)	6	47.75	0.699 (3)	0.873
	Early middle adulthood (30–39)	76	51.36		
	Middle adulthood (40–49)	13	47.04		
	Late adulthood (50+)	6	58.33		
Marital Status	Single	40	44.43	4.115 (2)	0.128
	Married	59	54.70		
	Separated	2	73.25		
Speaks language(s)/dialects other than English	Yes	86	50.09	566.50	0.453
	No	15	56.23		
Type of Philippine language/dialect spoken	Northern/Luzon	45	49.68	2.57 (3)	0.462
	Central/Visayas	34	54.12		
	Southern/Mindanao	10	39.25		
	Prefer not to disclose	12	56.92		
Race/Ethnicity	Luzon Ethnic Group	42	49.77	1.95 (3)	0.583
	Visayas Ethnic Group	48	53.45		
	Mindanao Ethnic Group	10	42.1		

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	Prefer not to disclose	1	74		
Do you have any support systems while working in the U.S.?	Immediate family in the U.S.	54	49.92	8.443 (2)	0.015
	Friends and Co-workers	40	57.39		
	No available Support Systems	7	22.86		
Post hoc: Dunn's test (Bonferroni-adjusted) Friends and co-workers vs. No support systems z = 2.88, adj. p = .012*					

The Kruskal–Wallis and Mann–Whitney U tests showed no statistically significant differences in the cultural competence of Filipino IENs across the personal profile variables (gender: p = 0.136; age: p = 0.873; marital status: p = 0.128; speaking other languages other than English: p = 0.453; Philippine language group: p = 0.462; and ethnolinguistic background: p = 0.583). Cultural competence remained stable across demographic groups, considering that mean rankings were different across categories, but these variances were not sufficiently large to reach statistical significance. This showed that demographic determinants were not strongly related to differences in cultural competence. **The only personal characteristic that showed a statistically significant difference in cultural competence scores was the presence of support systems, H(2) = 8.443, p = .015.** Dunn's post hoc test showed that Filipino IENs whose support system was friends and co-workers had significantly higher mean ranks (57.39) than those without support systems (22.86; z = 2.88, Bonferroni-adjusted p = .012). The difference between those with immediate family and those without support systems was not significant after adjustment (z = 2.30, adj. p = .065), and only seven respondents reported no support system. This highlighted peer support and social integration as situational and relational factors associated with higher cultural competence scores in this sample.

The finding was consistent with the studies of Nazareno et al. (2021), who found that Filipino nurses' cultural competency was more closely related to workplace realities and systemic variables, rather than demographic characteristics, thus consistent with this trend. Likewise, Alvarez (2020) noted that cultural competency among Filipino nurses has been associated with workplace experiences rather than demographic characteristics. These studies were consistent with the finding that Filipino IENs' cultural competency did not differ substantially by demographic factors.

The finding was in line with previous studies which have highlighted the relevance of peer support and social integration in cultural adaptation. Xu & He (2019) described peer interactions as an important context for cultural learning among internationally educated nurses. Likewise, Dahl et al. (2021) found that teamwork and collegiality were observed among Filipino nurses in foreign healthcare settings. In a more recent study, Primeau et al. (2022) noted that peer support is associated with positive cultural experiences among immigrant health care workers.

Table 4.B: *Significant Difference in the Cultural Competence of Filipino IENs According to Professional Demographic Profile (n = 101)*

Professional Profile Variable	Category	n	Mean Rank	H (df) / U	Asymp. Sig.
Highest Level of Education	Bachelor of Science in Nursing (BSN)	94	50.79	309	0.789

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	Master of Science in Nursing (MSN)	7	53.86		
Current Position / Employment Status	BSN (Professional RN)	98	50.09	57.5	0.073
	Prefer not to disclose	3	80.83		
Previous Non-Nursing Degree or Healthcare Experience	Yes	13	53.50	0.16 (1)	0.689
	No	88	50.05		
Years in Current Position	< 2 years	15	57.30	3.054 (3)	0.383
	3–5 years	16	40.78		
	6–10 years	23	54.87		
	>10 years	47	50.57		
Work-Related Hours (Recent Experience)	1–200 hours	10	59.55	2.471 (3)	0.48
	201–300 hours	13	40.81		
	301–400 hours	7	50.50		
	400 hours	71	51.71		
Continuing Education / Training	Self-directed learning	19	55.05	7.482 (3)	0.058
	Workplace-based training or mentorship	62	49.19		
	Feels confident with past work experiences	9	33.89		
	No training / open to training	11	68.23		
Cultural Competency-Related Training	Self-directed learning	14	51.50	2.369 (3)	0.499
	Workplace-based training or mentorship	58	50.07		
	Certified in cultural competency	4	32.38		
	No training received	25	55.86		
Type of Cultural Competency Training Received	Fieldwork experience in school	29	46.60	2.12 (3)	0.548
	Self-reading	4	68.25		
	Interdisciplinary workplace interactions	46	52.21		
	No formal training	22	51.14		

Also, none of the professional profile variables showed any statistically significant differences in cultural competence. There were no significant differences between the groups for highest educational attainment ($p = 0.789$), current employment status ($p = 0.073$), prior non-nursing or health care experience ($p = 0.689$), years in current position ($p = 0.383$), work-related hours ($p = 0.480$),

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continuing education or training (p = 0.058), cultural competency-related training (p = 0.499), and types of cultural competency training received (p = 0.548) with p-values greater than 0.05. Though the mean ranks were higher in some categories (e.g., MSN-prepared nurses, > 10 years of experience, self-directed learning), these differences were not statistically significant. Thus, professional background, level of education, work experience, and exposure to training were not strongly related to differences in cultural competence of Filipino IENs. The non-significance of all professional variables implied that cultural competence did not vary according to professional credentials or work history but rather aligns with literature suggesting that cultural competence is shaped by contextual and relational factors. The Filipino IENs generally had a stable cultural competence across their professional profiles, which aligns with literature indicating that cultural competence is often associated with contextual experiences rather than professional qualifications. This mirrored the findings of Xu and He (2019), who found that cultural competence among internationally educated nurses is more closely related to contextual and relational factors, such as workplace integration and social support, than to formal education or years of experience. Similarly, Dahl et al. (2021) reported that Filipino immigrant nurses gained cultural competence through lived experience, personal relationships, and workplace immersion rather than from formal professional training. The study by Masselink and Lee (2020) found that Filipino nurses' cultural adaptation did not differ according to prior degrees or clinical tenure, but rather by their migration experiences and organizational culture. These studies suggested that professional background alone did not show a significant relationship with cultural competence but rather was consistent with studies suggesting that cultural competence is influenced by contextual and experiential factors. The non-significant p-values for all professional variables suggested that Filipino IENs have a stable cultural competence regardless of their professional profile. This was consistent with the relevance of workplace support and cultural exposure compared with formal qualifications.

Table 5.A: Significant Difference in the Practice Readiness of Filipino IENs According to Personal Profile (n = 101)

Personal Profile Variable	Category	n	Mean Rank	H (df) / U	Asymp. Sig.
Gender	Male	28	44.54	1.979 (2)	0.372
	Female	71	53.64		
	Prefer not to disclose	2	47.75		
Age	Early adulthood (18–29)	6	62.08	1.529 (3)	0.676
	Early middle adulthood (30–39)	76	50.64		
	Middle adulthood (40–49)	13	52.35		
	Late adulthood (50+)	6	41.58		
Marital Status	Single	40	51.59	0.035 (2)	0.982
	Married	59	50.55		
	Separated	2	52.50		
Language Use	Yes	86	50.09	566.5	0.453
	No	15	53.23		
Philippine Language Group	Northern/Luzon	45	50.43	8.616 (3)	0.035*
	Central/Visayas	34	56.60		
	Southern/Mindanao	10	26.95		
	Prefer not to disclose	12	57.29		
Race/Ethnicity	Luzon	42	48.02	6.343 (3)	0.096
	Visayas	48	57.33		

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	Mindanao	10	33.40		
	Prefer not to disclose	1	48.00		
Support Systems	Immediate family in the U.S.	54	50.19	0.358 (2)	0.836
	Friends and co-workers	40	51.00		
	No support systems	7	57.21		

Note. H = Kruskal-Wallis statistic with degrees of freedom in brackets; two-group variables report the Mann-Whitney U statistic. Post hoc for Philippine language group (Dunn's test, Bonferroni-adjusted): Central/Visayas vs. Southern/Mindanao, z = 2.81, adj. p =.030; all other pairings non-significant; Groups with extremely few members (e.g., "Prefer not to disclose", n = 1–2) make the comparisons less stable.

The statistical analysis showed no significant difference in the practice readiness of Filipino IENs by gender, H(2) = 1.979, p = .372; age, H(3) = 1.529, p = .676; marital status, H(2) = 0.035, p = .982; speaking languages other than English, U = 566.5, p = .453; ethnolinguistic background, H(3) = 6.343, p = .096; or support systems, H(2) = 0.358, p = .836. Practice readiness differed significantly by Philippine language group, H(3) = 8.616, p = .035. Dunn's post hoc test showed that respondents who spoke Central Philippine (Visayas) languages had higher readiness mean ranks (56.60) than those who spoke Southern Philippine (Mindanao) languages (26.95; z = 2.81, Bonferroni-adjusted p = .030); no other pair differed significantly after adjustment. Because only 10 respondents spoke Mindanao languages, this result should be interpreted with caution.

Apart from the language-group difference, the mean ranks varied only slightly across categories (e.g., early adulthood scoring higher), and these variations did not reach statistical significance.

These findings were consistent with Dahl et al. (2021), who found that Filipino immigrant nurses' preparedness for practice was described in the literature as being associated with workplace experiences rather than demographic characteristics than to demographic characteristics. Similarly, Primeau et al. (2022) observed that contextual and organizational variables were noted in connection with practice preparedness among immigrant healthcare personnel, although age, gender, or ethnicity did not.

Therefore, apart from the Philippine language group, the personal profile variables did not show significant differences in the practice readiness of Filipino IENs.

Table 5.B: Significant Difference in the Practice Readiness of Filipino IENs According to Professional Profile (n = 101)

Professional Profile Variable	Category	n	Mean Rank	H (df) / U	Asymp. Sig.
Highest Level of Education	BSN	94	50.88	318	0.883
	MSN	7	52.27		
Current Position / Employment Status	**BSN (Professional RN)**	**98**	**52.38**	**11.5**	**0.007***
	Prefer not to disclose	3	5.83		
Previous Non-Nursing Degree or Healthcare Experience	Yes	13	42.88	466.5	0.308
	No	88	52.20		
Years in Current Position	**< 2 years**	**15**	**31.57**	**8.898 (3)**	**0.031***
	3–5 years	16	55.00		
	6–10 years	23	49.07		
	>10 years	47	56.79		

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Post hoc: Dunn's test (Bonferroni-adjusted)	< 2 years vs. 6–10 years	—	z = 1.80	—	adj. p = .432
	< 2 years vs. >10 years	—	z = 2.90	—	adj. p = .022*
	3–5 years vs. >10 years	—	z = 0.21	—	adj. p = 1.000
Work-Related Hours	1–200 hours	10	33.55	4.447 (3)	0.217
	201–300 hours	13	47.73		
	301–400 hours	7	53.43		
	400 hours	71	53.82		
Continuing Education / Training	Self-directed learning	19	46.58	3.762 (3)	0.288
	Workplace-based training or mentorship	62	55.04		
	Confident with past work experiences	9	47.83		
	No training / open to training	11	38.45		
Cultural Competency-Related Training	Self-directed learning	14	55.96	5.906 (3)	0.116
	Workplace-based training or mentorship	58	48.30		
	Certified in cultural competency	4	83.38		
	No training received	25	49.30		
Type of Cultural Competency Training	Fieldwork experience in school	29	48.34	0.451 (3)	0.930
	Self-reading	4	49.25		
	Interdisciplinary workplace interactions	46	51.57		
	No formal training	22	53.64		

In contrast, the analysis revealed that two professional profile variables were statistically significantly different in practice readiness. **A Mann-Whitney U test revealed a significant difference between those who identified as BSN (Professional RN) and those who preferred not to disclose their employment status, U = 11.50, z = –2.71, p =.007, with professional RNs having a dramatically higher mean rank (52.38) than those who did not disclose (5.83)**. The study did not measure professional identity or involvement in RN roles. It only measured employment status categories. **A Kruskal-Wallis H test also indicated a significant difference between tenure groups, H(3) = 8.898, p = .031. Dunn's post hoc test with Bonferroni adjustment showed that nurses with less than 2 years in their current position had lower readiness mean ranks (31.57) than those with more than 10 years (56.79; z = 2.90, adj. p = .022). No other pair differed significantly after adjustment, including < 2 years vs. 6–10 years (adj. p = .432) and 3–5 years vs.**

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> 10 years (adj. p = 1.000). Only three respondents preferred not to disclose their position, so the position result rests on a very small group and should be interpreted with caution.

These results are strongly supported by Casey-Fink (2024), Omeri et al. (2019), and Xu & He (2019), who listed clinical tenure, familiarity with unit workflow, and sustained immersion in the host healthcare system as factors described in the literature as relevant to practice readiness. Together, these results indicated that while demographic factors did not influence readiness, employment status and tenure in their current position were associated with higher readiness scores among Filipino IENs.

Across all demographic and professional variables, only four showed significant differences:

- Support systems → cultural competence (p = 0.015)
- Current RN position → readiness (p = 0.007)
- Years in current position → readiness (p = 0.031)
- Philippine language group → readiness (p = 0.035)

All other variables showed no significant differences.

Table 6: Relationship Between Cultural Competence and Practice Readiness Among Filipino IENs (n = 101)

Cultural Competence Dimension	Practice Readiness Component	Spearman's ρ	p-value (2-tailed)
CAKnow	PRClinical	.242*	.015
	PRLearning	.229*	.021
	PRPractice	.222*	.026
	PRConfidence	.015	.880
CASkill	PRClinical	.093	.355
	PRLearning	.086	.392
	PRPractice	.032	.749
	PRConfidence	.000	.999
CAOrgSupp	PRClinical	.116	.249
	PRLearning	.110	.274
	PRPractice	.050	.618
	PRConfidence	.027	.791

Using Spearman Rank-Order Correlation analysis, this study found that Cultural Awareness/Knowledge showed weak but significant correlations with readiness components. Some literature suggested that this relationship may vary across settings, indicating that awareness contributes to readiness but is not sufficient on its own. There was a small but statistically significant positive association between Cultural Awareness and Knowledge (CAKnow) and Clinical Problem-Solving, Learning Activities, and Practice Readiness.

Findings showed that Filipino IENs with high ratings in cultural awareness/knowledge also scored highest in clinical reasoning, learning engagement, and readiness in various components of readiness in this sample. This is consistent with the study results of Xu and He (2019) that foreign nurses who learned cultural awareness early in the transition had greater cognitive flexibility and clinical judgment.

Moreover, Dahl et al. (2021) found a significant association between cultural learning (e.g., communication norms, patient expectations, confidence in clinical decision-making). The results confirmed that cultural awareness is somehow connected to components of preparation in this sample and to what they need to know to perform in the U.S. system.

Based on the findings, CAKnow was not correlated with Confidence and Skill Performance. Some literature states that "confidence has been described in

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prior literature as more closely associated with clinical experience than cultural knowledge. Filipino IENs are known to have a perceived clinical foundation, and Nazareno et al. (2021) found that Filipino nurses often enter U.S. hospitals with high technical competence and strong self-assurance. Cultural awareness may be related to how the respondents think and adapt, but the confidence comes from the hands-on work they have mastered.

In terms of Cultural Skills and Organizational Support, these two were not significantly correlated with any readiness domain. This means that neither directly predicted readiness scores in this sample. These scores reflect variation in cultural skills and perceived organizational support within the sample, but these did not correspond directly with higher readiness scores. This is congruent with the findings of Primeau et al. (2022), who stated that immigrant nurses often displayed their readiness to work and their individual resilience, with clinical experience before practice.

Also, Masselink and Lee (2020) spoke on Filipino nurses' flexibility even in the absence of official support mechanisms. Collectively, these findings provided compelling insight that the cultural competence domain most associated with practice readiness was cultural awareness, rather than cultural skills or organizational support. The data presented show that higher cultural awareness scores are more strongly associated with higher scores on readiness components such as problem solving, learning engagement, and adaptation of Filipino IENs in U.S. practice.

These associations align with literature describing the value of cultural orientation in supporting IENs. To summarize, the data supported the notion that these findings align with literature describing Filipino IENs as having strong clinical backgrounds and that higher readiness scores were observed alongside higher cultural awareness. This was a hopeful and empowering finding that aligns with literature describing Filipino nurses' strong engagement in learning and adaptation.

Although the presented study revealed a weak but statistically significant relationship between CAKnow and Clinical Problem-Solving, Learning Activities, and Practice Readiness, recent literature suggests that this relationship may not always be valid and may be overshadowed by other factors. Most studies stated that cultural awareness is not significantly associated with nurses' preparation or overall work performance. This is particularly true with the globally trained nurses who have just started working in the most complex U.S. institutions.

In the study conducted by Primeau et al. (2022), they found that immigrant nurses' practice preparedness and confidence were more correlated with organizational support, workload conditions, and team dynamics than with cultural awareness. Even nurses with a high level of cultural awareness are challenged in unsupportive conditions. This implied that awareness is necessary but not sufficient.

Filipino nurses often had a high level of cultural knowledge (Masselink and Lee, 2020); however, they had difficulty in practice preparation due to systemic issues such as paperwork, communication, and institutional expectations. Their findings from scholars challenge the assumption that cultural awareness leads to preparedness and emphasize the significance of structural and organizational factors.

Some studies, like those by Nazareno et al. (2021), have suggested that cultural awareness might be related to increased sensitivity in the structure of workplace dynamics. Findings indicated that cultural understanding may be a resource for emotional work rather than a prerequisite and that awareness does not always align with the readiness outcomes across studies. Moreover, cultural awareness was not a predictor of confidence, but rather confidence was more closely associated with clinical experience, mentoring, and knowledge of U.S. (Dahl et al., 2021). The processes, similar to the result that CAKnow was not correlated with Confidence and Skill Performance.

Statement of the Problem # 7

Development of a Transition Program for Filipino IENs

Summary of the Program Contents

The Enhanced 12-Week Transition Program for Filipino Internationally Educated Nurses (IENs) is an evidence-informed proposal developed from the patterns identified in the study of 101 Filipino IENs in the U.S. healthcare system. It is intended for newly hired Filipino IENs or those in the first 12 months of practice in the U.S. The program is designed to foster safe, culturally responsive clinical practice, professional integration, confidence, well-being, and

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retention through a strengths-based, competency-based approach.

1. Program Rationale and Evidence Base

The program responds to the findings that indicated that cultural awareness, cultural skills, and organizational support were generally developing and that overall practice readiness was largely in the Competent/Emerging Adaptation range. Cultural Awareness/Knowledge correlated weakly but significantly with readiness. Cultural orientation was introduced as an early program focus. It is a contributing factor, not a predictor. The findings do not suggest clinical deficiencies of Filipino IENs. Rather, the findings support the need to assist nurses in localizing their current competence to U.S. health care systems, communication patterns, documentation, safety expectations, and workplace culture.

The program further integrates cultural competence with experiential learning, as cultural awareness had weak positive associations with clinical problem-solving, learning activities, and overall practice readiness, but was not significantly associated with confidence/skill performance

2. Program Goal and Objectives

The overall goal is to prepare Filipino IENs to practice safely, competently, confidently, and culturally responsively while supporting their integration into the U.S. nursing workforce. Specific objectives include improving cultural awareness, achieving at least 80% U.S.-specific knowledge proficiency, applying U.S. standards, completing 80 hours of supervised preceptorship, improving confidence and well-being, developing a Personal Professional Integration Plan (PPIP), and maintaining mentor/peer support through six months.

3. Three-Module Program Framework

The 12-week program is organized into three major modules:

- **Module 1 – Cultural Awareness and U.S. Healthcare Orientation (Weeks 1–3):** cultural humility, self-awareness, communication, autonomy, patient-centered care, bias awareness, and U.S. healthcare workflow.
- **Module 2 – Clinical Practice Readiness and Integration (Weeks 4–8):** EHR, documentation, patient safety, clinical reasoning, medication safety, scope of practice, legal/ethical practice, interprofessional communication, simulation, and supervised clinical practice.
- **Module 3 – Professional Integration and Wellbeing (Weeks 9–12):** self-confidence, assertiveness, professional identity, resilience, employment rights, discrimination awareness, career development, mentoring, ongoing support.

4. 12-Week Implementation

The weekly program progresses with baseline evaluation and cultural basis, clinical localization, and simulation. Confidence and resilience building continue with supervised clinical integration. The curriculum ends with professional integration and transition planning. Specific learning activities, clinical applications, outputs/assessments, and persons accountable for each week.

5. Preceptorship and Mentoring

Week 6-8 Preceptorship and Mentoring Weeks. A minimum of 80 hours of organized, supervised clinical/preceptorship experience. Preceptorship involves increasing patient assignments, direct observation, record review, drug safety observation, communication and clinical reasoning feedback, and documentation of competence. At completion, mentors are expected to give professional, relational, confidence-building, career and transition assistance for up to six months.

6. Personnel and Resources

Implementation Program Coordinator, Unit Leader/Supervisor, Clinical Educator or Preceptors, Mentored Pharmacist, Informatics Team, HR/Employee Support, Wellbeing Staff, Simulation Staff, Evaluation. Resources needed: Classrooms; simulation facilities; EHR training facilities; clinical units LMS; Clinical/simulation materials; Assessment tools; mentoring and wellbeing resources.

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7. Monitoring and Evaluation

The program is assessed by an integrated assessment matrix which includes cultural competence, practice readiness, clinical/system knowledge, clinical competency, EHR competency, drug safety, communication, confidence, wellness, professional integration, and retention. Assessments are at baseline, implementation, 12 weeks, and 6 months. Program Requirements: ≥80% knowledge competence; ≥90% medication safety performance with no significant errors; completion of critical safety skills; 80 hours of supervised practice; ≥85% retention at 6 months; results of the study are not program requirements.

8. Remediation and Organizational Support

Those participants who do not initially meet competency criteria are offered targeted remediation rather than being automatically labeled as unsuccessful. Interventions included: additional instruction, simulation, supervised practice, EHR coaching, medication-safety practice, communication coaching, mentoring, wellbeing referral, and PPIP revision. Program Responsibility: Organizational Support. Aspects of organizational support include structured onboarding, assignment of mentors and preceptors, regular feedback, workplace integration, communication support, workplace-rights orientation, wellbeing resources, escalation pathways, career support, and post-program mentoring.

9. Completion and Six-Month Follow-Up

The 12-week requirements completed: supervised clinical hours obtained; documentation of skills; critical safety competencies; US-specific knowledge assessment; cultural awareness portfolio; PPIP post-assessment; exit evaluation; Continuing Mentor/Peer support established.

Follow-up for 6 months will be performed on retention, professional integration, mentoring, wellness, career development, organizational support, and overall program effectiveness.

10. Expected Outputs and Outcomes

Cultural Awareness Portfolio includes expected CCAI and Casey-Fink Profile outputs: Demonstration of Clinical Competence, Evaluation of U.S. Specific Knowledge, EHR Competency, Evidence for Medication Safety, PPIP Wellbeing Assessment, Six-Month Follow-Up, Preceptor Review Report. They are designed to result in increased cultural awareness, practice preparation, U.S. specific knowledge, documentation and medication safety, clinical performance, professional development, transition aid, and retention.

11. Budget and Sustainability

The estimated budget is $ 29,920 for a batch of 10 participants or around $ 2,992 per participant (including 10% contingency). Sustainability is embedded within the program through integration into the institution's routine IEN onboarding and professional development program that includes a cadre of trained mentors/preceptors, annual review of the curriculum, updated simulation and LMS resources, annual budgeting, outcome tracking, support for alumni, and continuous quality improvement.

ENHANCED 12-WEEK TRANSITION PROGRAM FOR FILIPINO INTERNATIONALLY EDUCATED NURSES (IENs)

Enhancing Cultural Competence, U.S.-Specific Practice Readiness, Professional Integration, and Retention

Evidence-Informed Program Output based on the findings from the Study:

Cultural Competence and Practice Readiness of Filipino Internationally Educated Nurses in the U.S. Healthcare System: A Descriptive Comparative-Correlational Study

PROGRAM OVERVIEW

The Enhanced 12-Week Transition Program for Filipino Internationally Educated Nurses (IENs) is a planned transition program for newly employed Filipino IENs, or those who are within their first 12 months of practice in the United States. The program seeks to foster safe, culturally sensitive, U.S.-specific clinical practice and professional integration via a strengths-based, competency-based, experiential, mentored, and organization-supported approach.

It will be executed over 12 weeks, with a follow-up of professional integration and retention over 6 months. The curriculum has five primary components: cultural orientation, U.S.-specific clinical practice, and professional integration via a strengths-based, competency-based, experiential, mentored, and organization-supported approach. The program is 12 weeks and is followed by a six-month professional

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integration and retention follow-up. The program consists of five major components: cultural orientation, U.S.-specific clinical practice readiness, supervised preceptorship, professional integration, and wellbeing and retention support. A key requirement is the completion of at least 80 hours of organized supervised clinical/preceptorship experience during Weeks 6 – 8. The program progress is assessed by baseline assessment, formative and weekly monitoring, mid-program competence assessment, and Week 12 post-program assessment, with ongoing evaluation at six months. The expected deliverables are documented competence records, Cultural Awareness Portfolio, preceptor evaluation, Personal Professional Integration Plan (PPIP), post-program assessment findings, and a six-month follow-up report.

PROGRAM RATIONALE AND EVIDENCE BASE

The program was designed based on the research results of 101 globally trained Filipino nurses. Results showed cultural competence was typically emerging, and practice readiness was largely in the Competent/Emerging Adaptation category. Importantly, the data do not support clinical characterization of Filipino IENs as inadequate. The curriculum is not designed to train nurses in new competence, but to adapt current competence to U.S. systems, communication patterns, documentation practices, safety requirements, and workplace culture.

Table 7: Evidence-to-Program Alignment

Study Finding	Program Need	Program Response
Cultural Awareness and Knowledge was developing (M=31.81, SD=6.22); 58.42% were developing and 40.59% high	Early transition requires deliberate cultural orientation	Cultural humility, bias awareness, autonomy, U.S. communication, patient-centered care, and reflective activities
Cultural Skills were developing (M=31.06, SD=6.27)	Cultural knowledge needs to be translated into observable practice	Role-play, simulation, clinical application, feedback, and interprofessional communication
Organizational Support was developing (M=30.31, SD=5.99), with variability in perceived support	Transition support should be structured rather than dependent on informal workplace learning.	Formal mentor/preceptor assignment, onboarding pathway, feedback schedule, referral and escalation mechanisms
Overall Practice Readiness was M=74.10 (SD=8.70); 63.37% were Competent/Emerging Adaptation	Most participants require refinement and integration rather than basic nursing remediation.	U.S.-specific EHR, safety, clinical reasoning, medication, legal/ethical, and workflow training
Clinical Problem-Solving was M=18.06; 54.46% were Proficient/Globally Ready.	Existing clinical strengths should be retained while decision-making is localized	Case-based reasoning, simulation, prioritization, escalation, and supervised practice
Years in current position and current position/employment status were associated with readiness.	Experience within the U.S. system contributes to readiness	Protected preceptorship, progressive responsibility, mentor contact, and structured feedback
CAKnow had weak positive associations with Clinical Problem-Solving (ρ=.242), Learning Activities (ρ=.229), and Practice Readiness (ρ=.222)	Cultural awareness should be integrated with experiential learning	Early cultural orientation followed by simulation, preceptorship, reflection, and feedback
CAKnow was not significantly associated with Confidence/Skill Performance (ρ=.015)	Cultural orientation alone is insufficient for confidence and skill development.	Experiential learning, supervised practice, mentoring, assertiveness training, and organizational support

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Transition stress and workplace/social connection are important integration concerns.	Retention requires more than clinical competence.	Wellbeing support, resilience, workplace-rights orientation, peer support, career planning, and alumni linkage

Statistically, CAKnow was favorably linked with Clinical Problem-Solving, Learning Activities, and overall Practice Readiness, but not with Confidence/Skill Performance at a weak but significant level. The program thus deliberately blends cultural orientation, hands-on experience, and organizational support, rather than relying on cultural competency as the main predictor of preparation.

PROGRAM GOAL AND OBJECTIVES

General Goal

The program's aim is to prepare Filipino IENs to practice in a safe, competent, confident, and culturally responsive manner, enabling them to successfully integrate into the U.S. nursing workforce.

Specific Objectives

By the end of the 12-week program, participants will be able to:

[1]. Demonstrate improved cultural awareness and knowledge through pre- and post-program assessment.
[2]. Demonstrate at least 80% proficiency on a U.S.-specific clinical and healthcare-systems knowledge assessment.
[3]. Apply U.S.-specific standards in documentation, medication safety, patient autonomy, communication, scope of practice, and safety reporting.
[4]. Complete at least 80 hours of supervised clinical/preceptorship experience with documented competency feedback.
[5]. Demonstrate improvement in confidence related to clinical role performance and patient assignment management.
[6]. Develop a Personal Professional Integration Plan (PPIP) covering career goals, mentoring, professional development, support systems, and self-care.
[7]. Demonstrate measurable improvement in transition wellbeing using an institution-approved validated measure.
[8]. Maintain connection with a mentor or peer-support mechanism after program completion and participate in six-month retention monitoring.

These objectives retain the original program's measurable outcomes while avoiding claims that are unsupported by the study.

PROGRAM FRAMEWORK

The program integrates the study's cultural competence dimensions—Awareness/Knowledge, Skills, and Organizational Support—with a developmental view of competence and the Casey-Fink practice-readiness domains used in the study. The progression is:

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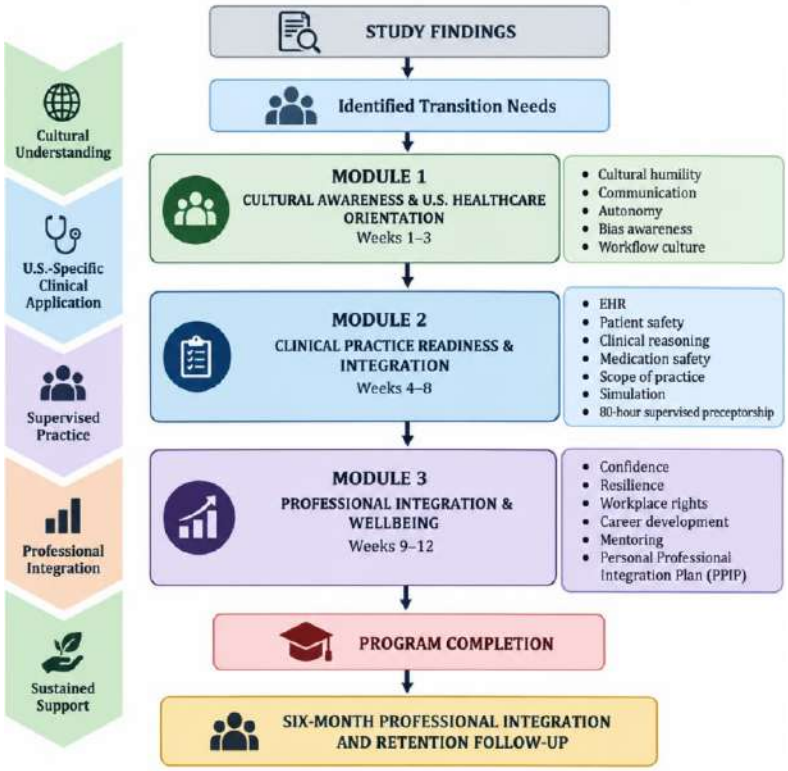


Figure 1.

The three-module framework is directly consistent with the original program structure.

12-WEEK PROGRAM IMPLEMENTATION PLAN

This table should replace the separate detailed weekly sections in the original document. It contains the information needed for implementation without repeating the same information in several places.

Table 8: 12-Week Program Implementation Plan

Week	Learning Focus	Key Activities	Clinical/Application	Output/Assessment	Lead
1	Program Orientation & Baseline Assessment	Program briefing; CCAI; Casey-Fink; transition expectations	Individual transition-needs mapping	Baseline cultural competence/readiness profile	Program Coordinator, Cultural Educator
2	Cultural Humility & Self-Awareness	Bias-awareness activities; reflective journaling; guided discussion	Culture-related communication cases	Reflection journal; bias-awareness worksheet	Cultural Educator, Mentor
3	U.S. Communication, Autonomy & Workflow Culture	Communication micro-lectures; Filipino–U.S. scenarios; autonomy cases	Handoff, patient teaching, assertive communication	Cultural Awareness Portfolio	Educator, Preceptor

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4	U.S. Clinical Systems & Patient Safety	EHR orientation; documentation; safety reporting; delegation	EHR/documentation simulation	Documentation competency checklist	Clinical Educator, Informatics Staff
5	Clinical Reasoning Under U.S. Standards	Case-based reasoning; simulation; debriefing	Prioritization, escalation, clinical judgment	Simulation performance rubric	Clinical Educator, Simulation Team
6	Medication Safety & Scope of Practice	Medication reconciliation; error prevention; legal/ethical practice	Medication administration and safety simulation	Medication Safety Checklist	Pharmacist, Educator, Preceptor
7	Interprofessional Communication	SBAR; closed-loop communication; conflict/feedback practice	Interprofessional simulation	Communication rubric	Interprofessional Team, Preceptor
8	Supervised Preceptorship Consolidation	Guided clinical practice; reflection	Progressive patient assignments under supervision	Preceptor evaluation; competency checklist	Preceptor, Unit Leader
9	Confidence, Assertiveness & Professional Identity	Assertiveness workshop; role-play; feedback	Workplace communication scenarios	Confidence assessment	Mentor, Educator
10	Transition Stress, Resilience & Workplace Rights	Wellness; resilience; discrimination awareness	Support and escalation pathway mapping	Wellbeing assessment; personal support map	HR, Wellbeing Staff, Mentor
11	Career Development & Professional Integration	Career planning; continuing education; leadership opportunities	Mentor conference	Draft PPIP	Mentor, Nurse Leader
12	Program Consolidation & Sustained Support	Post-tests; portfolio presentation; peer debrief; alumni linkage	Final competency review and transition planning	Final PPIP; post-assessment; exit evaluation	Program Coordinator, Evaluator

The weekly content, activities, facilitators, and outputs are based on the original program's 12-week plan.

Module 1: Cultural Awareness and U.S. Healthcare Orientation

Weeks 1–3

This module establishes the cultural and professional foundation of the program. It addresses cultural humility, self-awareness, communication, patient

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autonomy, patient-centered care, bias awareness, and U.S. healthcare workflow.

The emphasis is not on replacing Filipino professional identity but on helping participants recognize differences in expectations and adapt appropriately to the U.S. healthcare environment.

Major outputs:

- Baseline CCAI and Casey-Fink profile
- Individual transition-needs map
- Reflection journal
- Cultural Awareness Portfolio

The need for this module is supported by the study's finding that CAKnow was developing and showed weak positive relationships with several readiness-related domains.

Module 2: Clinical Practice Readiness and Integration

Weeks 4–8

This module translates existing nursing competence into U.S.-specific practice. It focuses on EHR use, documentation, safety reporting, clinical reasoning, medication safety, scope of practice, legal/ethical practice, interprofessional communication, and supervised clinical practice.

The program intentionally adopts a **strengths-based approach** because overall readiness was relatively strong and many participants were already in the Competent/Emerging Adaptation range.

Major outputs:

- EHR competency checklist
- Clinical reasoning/simulation assessment
- Medication safety checklist
- Communication rubric
- Clinical Competency Checklist
- Preceptor evaluation

Module 3: Professional Integration and Wellbeing

Weeks 9–12

This module extends transition beyond technical competence. It addresses confidence, assertiveness, professional identity, transition stress, resilience, workplace rights, discrimination awareness, career development, mentoring, and long-term professional support.

This component is especially noteworthy given that this study discovered a significant association between CAKnow and Confidence/Skill Performance. Therefore, Confidence and integration into the profession have to be cultivated not just by cultural education but also by experiential learning, mentorship, organizational support, and continual workplace participation.

Major outputs:

- Confidence assessment
- Personal support map
- Personal Professional Integration Plan
- Mentor continuity plan
- Final program assessment

PRECEPTORSHIP AND MENTORING SYSTEM

A. Supervised Preceptorship

Participants will complete a minimum of 80 hours of structured supervised clinical/preceptorship experience in Weeks 6-8.

The 80 hours should not be construed to mean that they occur only in Week 8. These are the total minimum supervised clinical hours required during the specified preceptorship period.

Preceptorship includes:

- Progressive patient assignments
- Direct observation and supervision
- U.S.-specific workflow application
- Documentation review
- Medication-safety observation
- Communication feedback
- Clinical reasoning feedback
- Daily/regular competency documentation
- Final preceptor evaluation

The 80-hour requirement is a program implementation standard, not a statistical finding of the thesis.

B. Mentoring

Mentors provide:

- Weekly professional support
- Confidence-building

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- Reflection and transition conversations and discussions
- Support with workplace communication
- Career-development guidance
- PPIP development
- Assistance during transition difficulties
- Continuity for up to six months after completion

The mentor and preceptor roles should be separate. The preceptor is primarily responsible for assessing clinical performance and the mentor for providing professional, relational, and transition support.

PROGRAM PERSONNEL AND RESOURCES

Table 9: Personnel Responsibilities

Personnel	Primary Responsibility
Program Coordinator	Overall coordination, scheduling, documentation, communication, evaluation
Cultural Educator	Cultural humility, communication, autonomy, bias-awareness training
Clinical Educator	Simulation, clinical skills, competency assessment, remediation
Preceptor	Supervised clinical practice, feedback, competency documentation
Mentor	Professional and psychosocial support, confidence-building, PPIP
Unit Leader/Supervisor	Performance review, unit integration, escalation
Pharmacist	Medication safety and medication-related education
Informatics Staff	EHR training and documentation competency
Simulation Team	Simulation setup, facilitation, and debriefing
HR/Employee Support	Workplace rights, discrimination concerns, retention, and organizational support
Wellbeing Staff	Wellbeing assessment, resilience, stress-management support
Evaluator	Program-level evaluation and reporting

These roles are based on the personnel structure in the original program.

Table 10: Required Resources

Category	Required Resources
Facilities	Classroom, simulation laboratory, EHR training environment, clinical unit, LMS
Clinical Materials	Simulation supplies, mock medications, PPE, IV supplies
Learning Materials	Manuals, case studies, worksheets, communication scripts
Assessment	CCAI, Casey-Fink, knowledge assessment, competency checklists, wellbeing measure
Documentation	Reflection journals, Cultural Awareness Portfolio, PPIP
Support	Mentor/preceptor system, HR resources, wellbeing resources
Technology	EHR sandbox/training environment, LMS

The original program identifies these facilities and materials as necessary for implementation.

MONITORING AND EVALUATION (Target Outcomes)

The evaluation should be presented in **one consolidated matrix**, rather than having separate lengthy sections for baseline, formative, mid-program, post-test, feedback, and follow-up.

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Table 11: Program Monitoring and Evaluation Matrix

Outcome	Indicator/Instrument	Timing	Target/Success Criterion	Response if Not Met
Cultural competence	CCAI	Weeks 1 & 12	Improvement from baseline	Cultural coaching; targeted reflection; mentoring
Practice readiness	Casey-Fink Readiness Survey	Weeks 1 & 12	Improvement/no decline in critical domains	Additional supervised practice; simulation
Clinical/system knowledge	U.S.-specific knowledge assessment	Weeks 4 & 12	≥80%	Remediation and retesting
Clinical competency	Clinical Competency Checklist	Weeks 5–8	100% of critical safety items completed	Additional supervision/simulation
EHR competency	EHR Documentation Checklist	Week 4	100% accuracy on critical items	Repeat EHR simulation/coaching
Medication safety	Medication Safety Checklist	Week 6	≥90%; no critical errors	Repeat simulation and supervised medication practice
Communication	SBAR/closed-loop rubric	Week 7	Meets competency level	Communication drills/coaching
Confidence	Confidence/Skill Performance Scale	Weeks 1, 8 & 12	Improvement from baseline	Additional simulation/assertiveness coaching
Wellbeing	Validated wellbeing measure	Weeks 1 & 12	Measurable improvement; ≥20% reduction only where instrument/scoring supports this interpretation	Wellbeing referral and resilience coaching
Professional integration	PPIP review	Weeks 11–12	100% completed PPIP	Additional mentoring/revision
Retention	HR retention follow-up	6 months	≥85% program benchmark	Follow-up support/alumni mentoring

The measures and timings of the original program form the basis of the evaluation matrix.

Important distinction

The following are **program standards,** not findings of the thesis:

- ≥80% knowledge proficiency
- ≥90% medication-safety performance
- 100% completion of critical safety competencies
- ≥80 supervised preceptorship hours
- ≥20% stress reduction where the instrument permits such interpretation
- ≥85% six-month retention

The original program calls these thresholds evidence-informed program standards, not study findings.

Key Performance Indicators

<u>KPI Category 1 – Development of cultural competency</u>

- Improvement in Cultural Awareness : ≥20% increase in CCAI Cultural Awareness scores from baseline to Week 12.
- Cultural Skills Application: ≥ 80% demonstration of culturally responsive

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communication in simulation and supervised practice.
- Cultural Humility Engagement: 100% completion of Cultural Awareness Portfolio with reflective entries.

KPI Category 2 – U.S. Specific Practice Readiness

- Knowledge proficiency: ≥80% on assessment of US-specific knowledge (documentation, workflow, safety, communication).
- EHR Competency: 100% completion of EHR training modules and ≥90% accuracy on EHR competency check.
- Medication safety performance: ≥90% medication safety performance – zero critical errors
- Critical Safety Competencies: 100% completion of required safety competencies (falls, infection control, high alert meds).

KPI Category 3: Clinical Integration & Performance

- Supervised Clinical Hours – Minimum of 80 Hours to be completed during Weeks 6-8.
- Clinical Reasoning Performance: ≥80% competency on case-based reasoning and simulation scenarios.
- Communication & Interprofessional Collaboration: ≥80% rating on preceptor evaluation of communication clarity, SBAR utilization, and teamwork.

KPI Category 4: Professional Integration & Wellbeing

- Confidence Improvement >15% increase in Casey-Fink confidence measures from baseline to Week 12.
- Professional Identity Development: 100% PPIP (Personal Professional Integration Plan) completed.
- Wellbeing & Resilience: Week 12 evaluation: ≥80% positive wellbeing rating.

KPI Category 5: Program Retention/Completion

- Completion Rate: 95% or more of Week 12 requirements.
- Six-Month Retention: ≥85% of Filipino IENs retained at 6-month follow-up
- Mentoring Engagement:>90% participation in mentor check-ins for 6 months post-program period.
- KPI Category 6: Organizational Support & Sustainability
- Quality of Preceptor/Mentor Feedback — ≥80% satisfaction rating from preceptors and mentors on program structure and support.
- Participant Satisfaction: Satisfaction rate of exit evaluation ≥85%.
- Program Sustainability: Completed annual curriculum review, maintained mentor pool at 90%+ staffing

IMPLEMENTATION AND SUPPORT FLOW

The detailed procedure parts of the original program can be summarized in the following figure.

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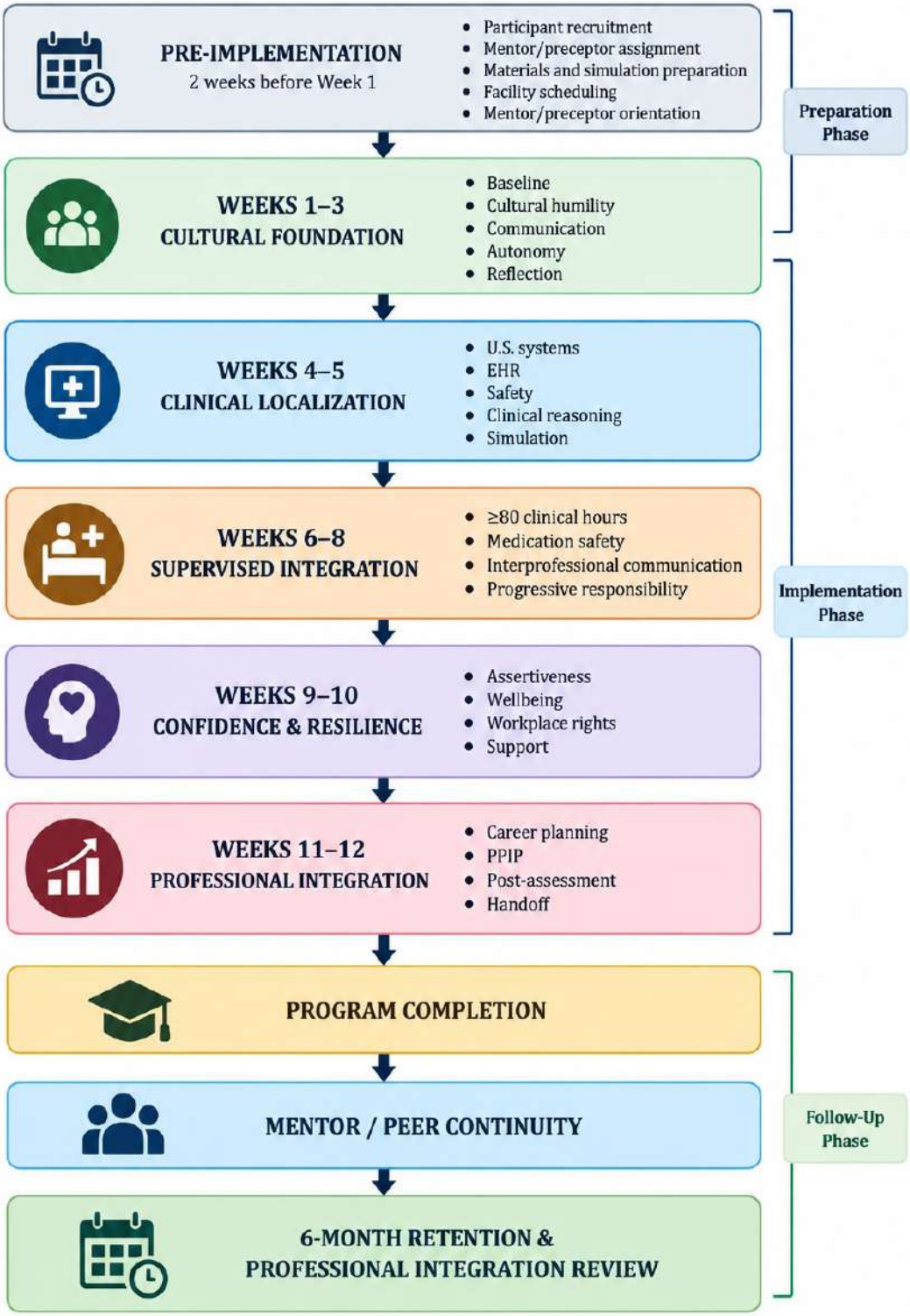


Fig.2: Program Implementation Flow

This summarizes the original implementation techniques and flow, but keeps all the important steps.

REMEDIATION AND SUPPORT MECHANISM

Participants who do not meet the required standards of competence should not be automatically marked as unsuccessful. The program should offer a systematic, structured path to remediation.

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Table 12: Remediation Pathway

Identified Concern	Initial Intervention	If Concern Persists
Knowledge deficit	Review module and retest	Additional U.S.-specific instruction
Clinical skill deficit	Repeat simulation	Additional supervised practice
EHR/documentation deficit	Repeat EHR simulation	One-to-one informatics coaching
Medication-safety concern	Repeat medication simulation	Additional supervised medication practice
Communication difficulty	Communication drills	Mentor/educator coaching
Confidence concern	Simulation and assertiveness coaching	Extended mentoring
Transition stress	Wellbeing consultation and resilience activities	Referral to appropriate support services
Professional integration concern	Mentor conference	PPIP revision and nurse-leader support

The original program includes additional simulation, 40–80 hours of extended preceptorship, one-to-one coaching, repeated evaluations, and referral to HR, wellness professionals, or nurse leaders when challenges arise.

ORGANIZATIONAL SUPPORT AND PROFESSIONAL INTEGRATION

A major improvement in the revised program is that support from the organization is viewed as a responsibility of the program rather than the individual participant. **The study reported Organizational Support development (M=30.31, SD=5.99)** with variability in perceived support. The program thus creates formalized mechanisms for onboarding, supervision, communication, and integration into the workplace.

Table 13: Organizational Support Mechanisms

Mechanism	Program Action
Structured onboarding	Standardized IEN onboarding checklist
Mentor assignment	Mentor assigned at program initiation
Preceptor assignment	Preceptor assigned before clinical integration
Feedback	Weekly mentor feedback and structured preceptor feedback
Workplace integration	Unit introduction, team participation, peer support
Communication support	SBAR, closed-loop communication, conflict-management coaching
Workplace rights	HR orientation and reporting pathways
Wellbeing	Access to wellbeing and stress-management resources
Escalation	Clearly defined clinical, safety, communication, and workplace pathways
Career integration	Nurse-leader and mentor support for career planning
Post-program support	Alumni/mentor linkage and six-month follow-up

The original model included particularly structured onboarding, mentor/preceptor referral, workplace integration, communication support, supervisor input assignment pathways, and organizational responsibility.

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PROGRAM COMPLETION CRITERIA

The following must be recorded before completion of the program: Completion of the 12-week program requirements.

[1]. Completion of criteria for the 12-week program.
[2]. Completion of a minimum of 80 hours of supervised clinical/preceptorship experience.
[3]. Completion of required U.S.-specific knowledge assessment.
[4]. Completion of critical safety competencies.
[5]. Completion of the Cultural Awareness Portfolio.
[6]. Completion of the PPIP.
[7]. Completion of Week 12 post-program assessments.
[8]. Participation in the exit evaluation.
[9]. Establishment of a continuing mentor/peer-support pathway.

Completion should not be interpreted as replacing state licensure, credentialing, institutional onboarding, scope-of-practice requirements, or other regulatory requirements.

SIX-MONTH FOLLOW-UP

The program does not end at Week 12. A six-month follow-up should determine whether transition gains are sustained.

Table 14: Six-Month Follow-Up

Area	Follow-Up Activity
Retention	Verify employment status
Professional integration	Assess workplace adjustment and role integration.
Mentoring	Mentor follow-up
Wellbeing	Reassess transition/wellbeing concerns
Career development	Review and update PPIP.
Organizational support	HR/supervisor review
Program effectiveness	Consolidate retention and integration findings.

The original program specifies retention checking, professional integration assessment, mentor follow-up, and HR review at six months.

EXPECTED PROGRAM OUTPUTS AND OUTCOMES

Table 15: Expected Outputs and Outcomes

Expected Outputs	Expected Short-/Intermediate Outcomes
Baseline and post-program CCAI profile	Improved cultural awareness
Baseline and post-program Casey-Fink profile	Improved practice readiness
Cultural Awareness Portfolio	Better understanding of U.S. healthcare expectations
Reflection records	Greater reflective practice
Clinical Competency Checklist	Documented clinical competency
U.S.-specific knowledge assessment	Improved U.S.-specific knowledge
EHR competency evidence	Safer documentation
Medication-safety evidence	Safer medication practice
Preceptor evaluation	Improved supervised clinical performance
PPIP	Clear professional development pathway
Wellbeing assessment	Improved transition support

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Six-month follow-up report	Evidence of retention and professional integration

The original program identifies these same outputs, including CCAI, Casey-Fink, portfolio, competency documentation, PPIP, wellbeing assessment, and six-month follow-up.

PROGRAM BUDGET

Assumption: The budget is presented for a 10-participant batch, consistent with the original budget document. Costs are estimates and should be replaced with actual institutional costs before implementation.

Program Budget

Budget Category	Estimated Cost
Facilitator/Educator Fees	$6,000
Preceptor/Mentor Support	$8,000
Simulation Laboratory Use	$4,500
Simulation Supplies	$2,000
EHR Training and Access	$1,200
Instructional Materials	$1,000
Printing and Documentation	$300
Assessment Materials	$500
Online Learning Platform	$1,500
Certificates and Recognition	$200
Administrative Costs	$2,000
Subtotal	**$27,200**
Contingency (10%)	**$2,720**

SUSTAINABILITY PLAN

The program should be integrated into the institution's regular IEN onboarding and professional-development system rather than implemented as a one-time project.

Table 16: Sustainability Strategies

Area	Sustainability Action
Institutional	Integrate program into standard IEN onboarding.
Human Resources	Maintain a trained mentor/preceptor pool.
Curriculum	Conduct annual curriculum review
Simulation	Update clinical scenarios regularly.
Technology	Maintain EHR training and LMS resources.
Financial	Establish an annual program budget.
Data	Track CCAI, readiness, competency, integration, and retention outcomes
Professional Support	Maintain alumni and peer-support networks
Quality Improvement	Use evaluation findings to revise the program annually.

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The original sustainability plan provides recommendations for institutional integration yearly.

PROGRAM GOVERNANCE

The Program Coordinator should serve as the primary point of both responsibility and accountability.

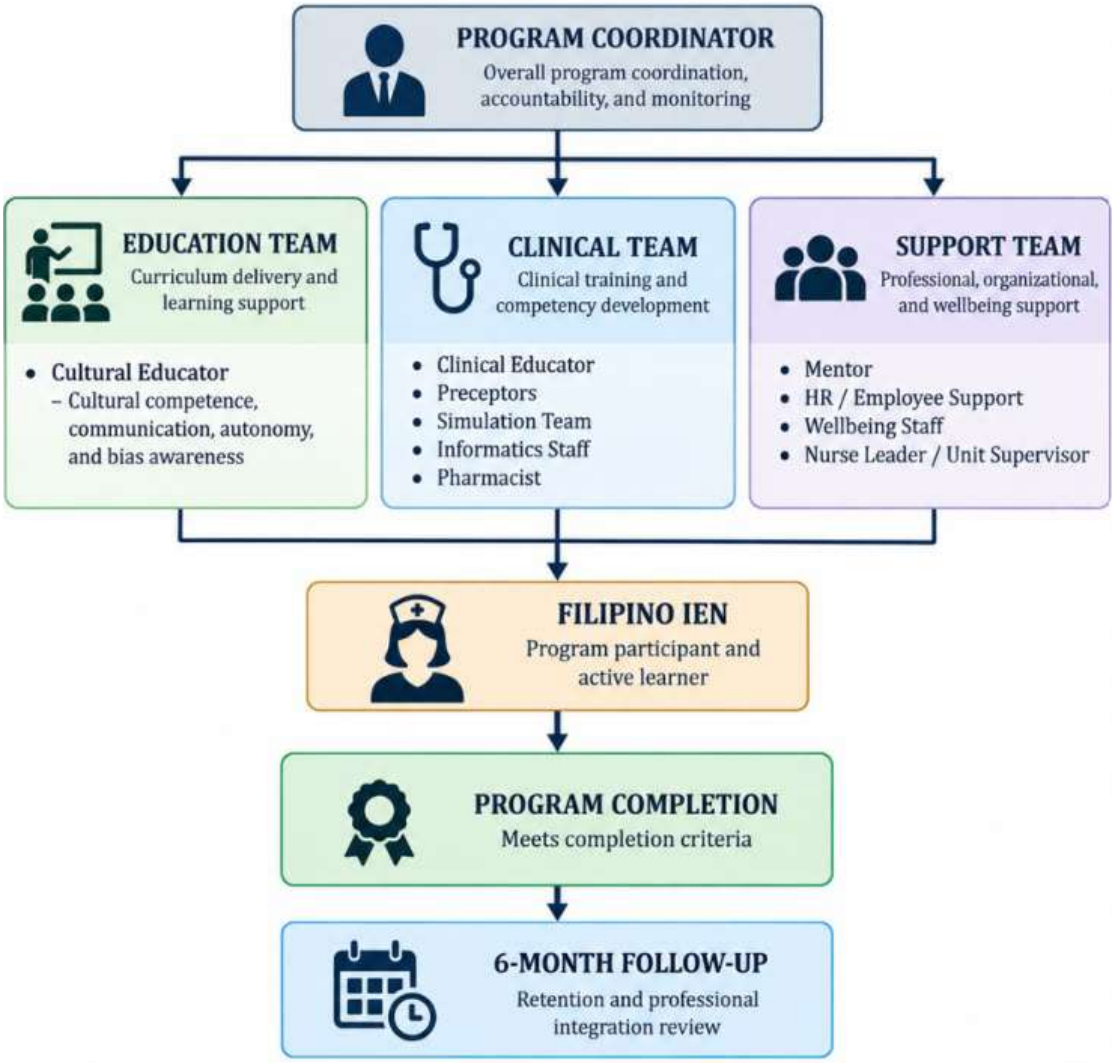


Fig.3: Program Governance Structure

This structure clarifies accountability without requiring separate lengthy sections for every personnel group.

PROGRAM IMPLEMENTATION CONDITIONS

This program is a proposal for implementation. It should be adapted to:

- relevant state nursing regulations;
- institutional policies;
- scope-of-practice requirements;
- certification and licensing standards;
- institutional EHR procedures;
- medication-administration policies;
- patient-safety procedures;
- approved assessment instruments;
- available simulation resources; and
- actual institutional staffing and budget.

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The original program explicitly states that its empirical findings come from the thesis while the program itself is an implementation proposal that must be adapted to applicable regulations, institutional policies, scope-of-practice requirements, and validated instruments.

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Development of Business Model using B2B Pasa-Buy

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Abstract *— This study developed a Business-to-Business (B2B) Pasa-Buy Business Model designed to enhance the sustainability, efficiency, and customer satisfaction of social commerce operations in Cabanatuan City, Philippines. Specifically, it examined consumer behavior, transaction preferences, technology integration, logistics practices, customer satisfaction, communication, trust, and operational factors influencing B2B pasa-buy transactions. A quantitative descriptive-correlational research design was employed. Data were collected from 67 consumers and B2B pasa-buy operators through a researcher-made survey questionnaire. Respondents were selected using simple random sampling from registered businesses identified through the Department of Trade and Industry (DTI). The reliability of the instrument was established using Cronbach's Alpha, which yielded reliability coefficients ranging from acceptable to excellent. The findings revealed that e-commerce platforms such as Shopee, Lazada, and TikTok Shop were the most preferred checkout methods, while TikTok and Facebook served as the primary channels for customer engagement and platform access. Product quality, customization options, supplier reviews, trust in the seller, competitive pricing, and shipping efficiency significantly influenced consumers' purchasing decisions. Results further showed that reliable logistics systems, accurate estimated time of arrival (ETA), secure payment methods, and effective communication contributed to customer satisfaction and repeat transactions. However, concerns regarding pricing transparency, communication reliability, and product satisfaction remained challenges affecting long-term sustainability. Based on the findings, a Hybrid Digital B2B Pasa-Buy Business Model was developed, integrating e-commerce platforms, social media marketing, customer relationship management, reliable supplier networks, secure payment systems, and logistics partnerships. The model was concluded to be a viable framework for improving operational performance, customer trust, and business sustainability in the B2B pasa-buy industry.*

Keywords *— **B2B Pasa-Buy, Social Commerce, E-Commerce, Customer Trust, Business Model Development***

I. INTRODUCTION

The pandemic made Pasa-buy popular with customers in some Southeast Asian countries. In this approach, individuals functioned as brokers who purchased things from other areas for customers. B2B e-commerce platforms allowed buyers and suppliers to engage with each other and access products and services in an effective and accessible way. The quality of the platform in online B2B markets was important to ensure successful exchange interactions and transaction results (Heikinheimo et al., 2023).

The online shopping decision of consumers in the Philippines was increasingly impacted by reviews, recommendations, and opinions expressed on social networking platforms such as Facebook, TikTok, and Instagram. Before they made a purchase, consumers often turned to reviews because they wanted to know how others had experienced a product or service.

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Digital media marketing, such as social media, internet marketing, and other online channels, was an effective method to spread product information, enhance brand awareness, and boost sales (Zahara et al., 2023).

Entrepreneurship continued to grow into the Philippine market, but the innovation and discovery were indigenous. These innovations offered consumers a greater choice of products and services and led to a healthy competition among businesses selling similar products (Gil-Gomez et al., 2020).

Filipinos are increasingly shopping online through social commerce platforms. Facebook and Instagram are becoming important channels for engaging with consumers and helping business thrive. The rapid growth of digital commerce made the Philippines one of the prominent e-commerce markets in Southeast Asia (Bonina et al., 2021). The key avenues for doing business transactions are online marketplaces and e-commerce platforms. Although there are a lot of studies on consumer buying behavior, there is a lack of studies that focus on procurement people in B2B e-marketplaces. These platforms made it easier to find suppliers, compare prices and buy products, however, the studies on B2B purchasing behavior were still limited (Tian, 2022).

The growing popularity of pasa-buy services in the Philippines has not been accompanied by much scholarly research examining this emergent business model, particularly in terms of its structure, operations and long-term viability. Previous research has mostly focused on the effects of the COVID-19 outbreak on informal buying behaviors. This resulted in a lack of knowledge of how pasa-buy services could develop into a codified B2B business model. There was little evidence, for instance, about supplier connections, distribution systems, customer service approaches and the legal, economic and technological issues encountered when expanding up. Addressing these gaps can provide significant insights for entrepreneurs and enrich the understanding of consumer behavior, social commerce and online purchase behavior.

This study aims to better understand the practice of pasa-buy, in which Filipinos residing or traveling abroad buy things for consumers in the Philippines. Specifically, it aimed to explore the variables driving consumers' usage of pasa-buy services, the importance of trust in these transactions, the problems encountered, and the extent to which social media and messaging applications contribute to the growth of informal commerce. Through this investigation, the study aimed to give a greater knowledge of how pasa-buy services functioned and how they impacted Filipino consumers in terms of convenience, trust, and online buying behavior.

II. THEORETICAL FRAMEWORK

This study combined consumer behavior theory with Product, Service, Process, Marketing, and Technological Innovation concepts. It stated that a variety of elements influenced consumers' choices. Both internal and external factors affecting consumers were considered responsible for these issues. In this scenario, consumers received information from the market through word-of-mouth (WoM) or digital media. Consumers then evaluated these factors using available information sources before making decisions. As a result, customers or consumers determined which information sources and types of information to use, as well as which products to purchase or not. SMEs considered this approach when developing innovative marketing strategies, particularly in the area of promotions. SMEs then utilized their creativity to communicate various information through different media channels (Kulkov et al., 2023).

This study aimed to explore the common problems encountered by B2B pasa-buy operators, identify the characteristics that influenced successful transactions, and provide solutions to improve process management and customer trust. By addressing these issues, the study sought to provide insights that could assist organizations in adopting a more systematic and efficient approach to the pasa-buy model.

This process analyzed and reexamined the information obtained by consumers to support decision-making. This served as the theoretical framework of the study, as shown in Figure 1.

The study presented two forms of advertising, namely digital media and word-of-mouth (WoM). However, there was no assurance that either medium effectively marketed goods or services. This situation was also applicable to customers in developed countries, where a significant proportion of the population used advanced technology. Nevertheless, some customers continued to rely on word-of-mouth communication,

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even in developed countries. A gap in knowledge existed regarding whether these media, with their diverse attributes, were effective in disseminating information, particularly in marketing SME products and services to consume

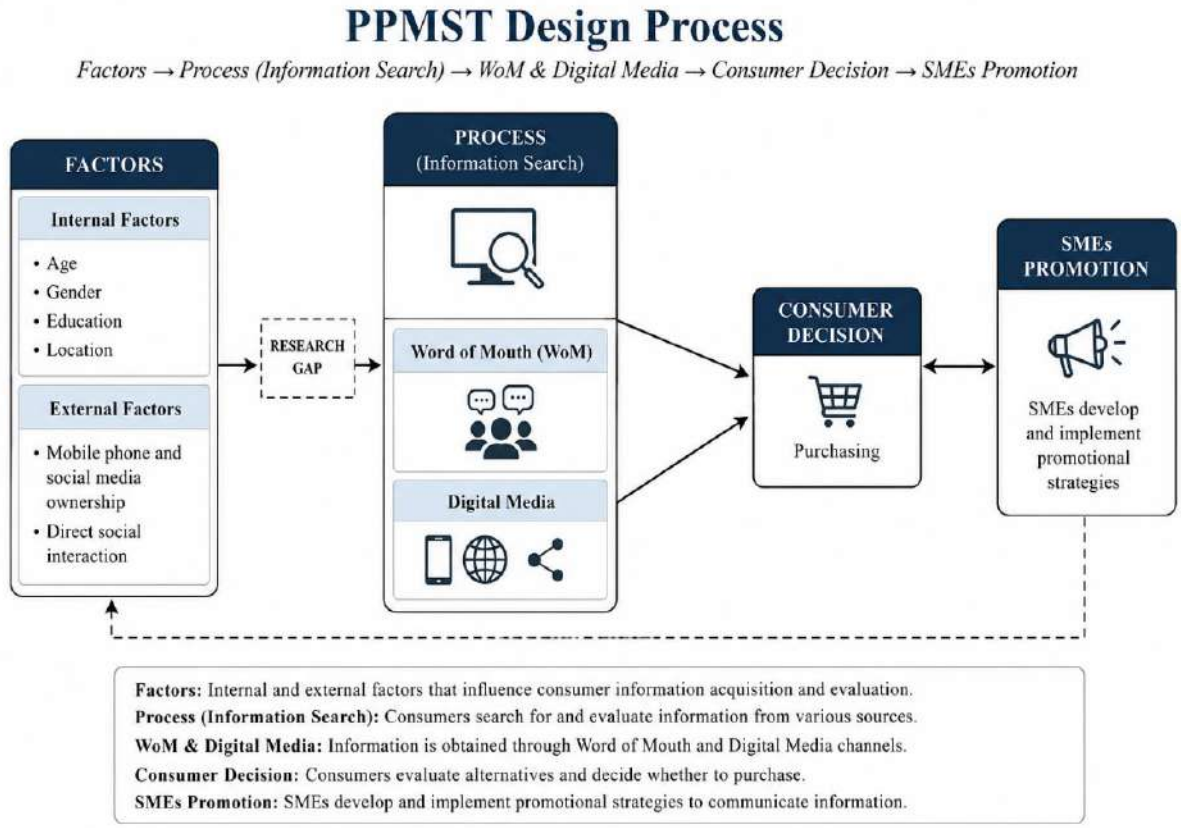


Figure 1. Conceptual Framework of the PPMST Design Process

This study showed that the design process of buyer-seller relationships focused on the role of trust in influencing how buyers and sellers interacted with one another. The pasa-buy concept, which allowed customers to consolidate their orders through a middleman to purchase products in bulk, had gained popularity across various industries because of its cost-effectiveness and convenience. This approach improved supply chain efficiency and enabled businesses to acquire goods at lower prices within the business-to-business (B2B) market. However, the efficiency of these transactions was often hindered by challenges such as order coordination difficulties, trust-related concerns, and inconsistent delivery schedules.

Many B2B pasa-buy organizers experienced difficulties in managing large orders, ensuring product quality, and maintaining effective communication with suppliers and buyers. These issues resulted in financial losses, customer dissatisfaction, and transaction delays. Furthermore, limited research had been conducted on best practices that could enhance operational efficiency, customer satisfaction, and supplier reliability within this business model.

The study aimed to explore the common problems encountered by B2B pasa-buy operators, identify the characteristics that influenced successful transactions, and propose solutions to improve process management and customer trust. Specifically, it sought to determine the characteristics of B2B models in terms of estimated time of arrival and product quality; identify the major reasons for using B2B models in relation to pricing strategy, supply chain management, market competition, and customer relationship management; evaluate best practices and strategies that improved operational efficiency and customer retention in B2B pasa-buy transactions; and develop a framework for enhancing the overall effectiveness of B2B pasa-buy business operations.

The study utilized information derived from consumer demographics, social factors, and technological factors that influenced purchasing behavior. Demographic factors included population

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size and density, location or distance, age, gender, education, occupation, nationality, and other relevant characteristics (Shodmonovich, 2024). Social factors were influenced by social interactions and responsible behavior, while technological factors were affected by innovations in products and technology. However, only selected variables were included in the study. Consequently, the study formulated hypotheses based on these identified factors.

III. METHODOLOGY

This study adopted a quantitative research design using a descriptive-correlational method. This design was appropriate because it allowed the researcher to describe the existing practices and behaviors in pasa-buy transactions and examine the relationships among demographic, social, and technological factors and the consumers' use of information sources in B2B transactions. The design also helped evaluate how factors such as trust, logistics, and marketing strategies affected operational efficiency and customer satisfaction.

The target population consisted of consumers and B2B pasa-buy operators in Cabanatuan City, particularly those who engaged in transactions through digital platforms such as Facebook, TikTok, and Instagram. According to the Department of Trade and Industry (DTI) in Cabanatuan City, there were 80 registered businesses. A survey questionnaire with open-ended questions was developed by the researcher and administered to 67 respondents selected through simple random sampling based on the sample size generated using the Raosoft online calculator. This method ensured that the participants had relevant experience and involvement in the B2B pasa-buy model.

To ensure the reliability of the research instrument, the internal consistency of the survey questionnaire was assessed using Cronbach's Alpha. The results indicated that most dimensions demonstrated good to excellent reliability, confirming that the instrument was appropriate for measuring the study variables. The "Purchase International/Local Items" dimension obtained a Cronbach's Alpha of 0.861, while "Estimated Time of Arrival" recorded 0.896, both interpreted as having good reliability. The dimension "The Following Factors Influence My Decision to Choose the Pasa-Buy for My Items" obtained a Cronbach's Alpha of 0.976, while "Perception and Usage" recorded 0.906, both interpreted as having excellent reliability. "Preferred Shipping Methods" yielded a reliability coefficient of 0.835, indicating good reliability, while "Preferred Using Payment Methods" obtained 0.750, interpreted as acceptable reliability. The "Usually Discover/Access Pasa-Buy Platforms" dimension recorded 0.805, which was also interpreted as having good reliability.

Furthermore, the dimensions related to customer satisfaction and technology demonstrated very high internal consistency. "Overall Satisfaction" obtained a Cronbach's Alpha of 0.945, while "Production Satisfaction," "Communication and Trust," and "Pricing and Fees" recorded coefficients of 0.983, 0.981, and 0.981, respectively, all interpreted as having excellent reliability. These findings indicated that the survey instrument consistently measured customer experiences, technological integration, communication practices, pricing concerns, and operational factors relevant to the B2B pasa-buy business model.

The reliability results further suggested that customer-related dimensions such as trust, service quality, and fair pricing were stable indicators within the pasa-buy context. In terms of technology-related dimensions, the high reliability scores indicated that platform integration, payment security, innovation, scalability, and sustainability were consistently valued by the respondents. Operational and partnership dimensions also demonstrated strong reliability, highlighting the importance of vendor partnerships and supply chain integration in maintaining effective business operations. Lastly, the results related to risk management and transaction security emphasized the critical role of secure digital transactions and regulatory compliance in fostering trust among consumers and business partners in B2B pasa-buy settings.

IV. RESULTS AND DISCUSSION

This section presented, analyzed, and interpreted the findings of the study on the factors influencing B2B pasa-buy transactions and their implications for improving operational efficiency, customer satisfaction, and business effectiveness.

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Table 1. Checkout/Order Confirmation Methods in Pasa-Buy Transactions

Checkout Method	Frequency	Percentage
E-commerce platforms (Shopee, Lazada, TikTok)	51	96.2%
Facebook/Instagram confirmation	16	30.2%
Pasabuy group order forms (Google Forms, etc.)	4	7.5%

The checkout and order confirmation processes utilized in pasa-buy transactions are shown in Table 1. The results showed that the most used technique was e-commerce platforms such as Shopee, Lazada, and TikTok with 51 respondents or 96.2% of respondents said they preferred this way. The next were Facebook and Instagram confirmations, that were used by 16 respondents or 30.2%. There were just 4 respondents or 7.5% that used pasa-buy group purchase forms such as Google Forms. Such results suggested that the respondents favored platforms that provide integrated transaction capabilities, such as product postings, payment processing, order status, and consumer protection mechanism. The dominance of the e-commerce platforms showed that convenience, efficiency and trust had a significant impact in encouraging participation in transactions for B2B pasa-buy.

These results were reinforced by Wang et al. (2025), who noted that e-commerce platforms increased transaction efficiency and consumer confidence through secure payment methods and simple purchasing procedures. Likewise, Budiana et al. (2025) discovered that digital platforms boosted consumer trust and engagement through the provision of trustworthy communication and transaction management capabilities. The results indicated that the adoption of existing e-commerce platforms with B2B pasa-buy business models may enhance the efficiency of operations, security of transactions and customer satisfaction.

Table 2. Access Channels for Pasa-Buy Platforms

Access Channel	Frequency	Percentage
TikTok	46	86.8%
Facebook	26	49.1%
General Messenger/Private Groups	22	41.5%
Instagram	10	18.9%

Table 2 showed the access channels used by respondents to participate in pasa-buy platforms. The findings revealed that the most used access channel was TikTok with 46 respondents or 86.8% followed by Facebook with 26 respondents or 49.1% and General Messenger/Private Groups with 22 respondents or 41.5%. Instagram was the least used among the platforms with only 10 responders or 18.9%. These results suggested that short-form video content and hyper-interactive social media platforms were crucial to enticing customers and enabling B2B pasa-buy transactions. This domination on TikTok demonstrated that consumers favored platforms that offered interesting product demonstrations, real-time evaluations, and direct engagement with sellers. The continuous use of Facebook and private chat groups further emphasized the importance of social contact, community participation and trust-building in online buying choices.

Findings were reinforced by Nasution et al. (2026) who underlined that social media platforms boosted customer engagement and purchasing behavior through interactive content and peer influence. Likewise, Sohaib (2021) discovered that social commerce platforms assist firms in enhancing customer relationships and increasing buy intentions through social interaction and user-generated content. These results show that a successful B2B pasa-buy business model should employ TikTok, Facebook, and messaging channels to enhance market reach, improve client interactions, and improve transaction efficiency.

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Table 3. Purchase International/local Items

Purchase International/local Items	Mean	Std. Dev.	Interpretation
Electronics (Gadgets, Computer Accessories, Office Equipment)	2.85	1.16	**Sometimes**
Womenswear & Underwear	2.78	1.34	**Sometimes**
Menswear & Underwear	2.33	1.25	**Rarely**
Beauty & Personal Care	3.44	1.34	**Often**
Food & Beverage Items	2.98	1.33	**Sometimes**
Home Supplies & Tools	3.06	1.21	**Often**
Baby & Maternity	2.28	1.47	**Rarely**
Automotive Parts & Accessories	2.37	1.39	**Rarely**
Fashion Accessories	3.17	1.27	**Sometimes**
Shoes	3.22	0.96	**Sometimes**
Sport & Hobbies (Books, Sports & outdoor, Pet Care, etc.)	2.81	1.19	**Sometimes**
Luggage & Bags	2.89	1.27	**Sometimes**
Overall Mean	**2.85**		

Table 3 showed the frequency of buying international and local items through the B2B pasa-buy model. The results indicated mean overall of 2.85 which means "Sometimes" which means moderate level of involvement in purchasing different product categories through pasa-buy transactions. Among these, Beauty & Personal Care had the highest mean (M = 3.44, SD = 1.34), which is translated as "Often". Next is Shoes (M = 3.22, SD = 0.96), and Fashion Accessories (M = 3.17, SD = 1.27). Conversely, the least commonly purchased products, understood as "Rarely," were Baby and Maternity (M = 2.28, SD = 1.47), Menswear and Underwear (M = 2.33, SD = 1.25), and Automotive Parts and Accessories (M = 2.37, SD = 1.39). Results showed that the main products purchased through pasa-buy were personal, fashion and lifestyle products that were either difficult to obtain locally or were offered at a lower price from international providers.

Shimul et al. (2021) confirmed the results by stating that customer purchase decision is greatly affected by perceived value, product assortment and accessibility especially for personal care and fashion products. Similarly, Chen et al. (2023) found that internet and cross-border purchasing channels were frequently used for consumer items with high demand and frequent usage, as consumers desired better product range and competitive prices. The results suggest that a B2B pasa-buy business model should focus on lifestyle and personal care products with high demand and increase product offers based on consumer preferences to improve market competitiveness and customer satisfaction.

Table 4. Estimated Time of Arrival

Estimated Time of Arrival	Mean	Std. Dev.	Interpretation
A delayed ETA affects my satisfaction.	3.39	1.18	**Often**
I lose my potential orders when ETA is too long.	3.22	1.13	**Sometimes**
I plan my orders around estimated delivery schedules.	3.52	1.12	**Often**
Faster delivery time (ETA) encourage repeat transaction with customers.	3.78	1.20	**Often**
Clear communication of ETA builds trust with my buyers.	3.81	1.20	**Often**
I choose suppliers based on their ability to meet reliable delivery timelines.	3.78	1.18	**Often**
Overall Mean	**3.58**		

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Table 4 showed the perception of the respondents on the importance of Estimated Time of Arrival (ETA) in B2B pasa-buy transactions. The results showed a mean of 3.58 which overall is read as "Often". I.e. ETA was a substantial consideration in purchasing and operational decisions. The highest mean (M = 3.81, SD = 1.20) was achieved by the statement "Clear communication of ETA builds trust with my buyers", followed by "Faster delivery time (ETA) encourages repeat transactions with customers" and "I choose suppliers based on their ability to meet reliable delivery timelines" (both M = 3.78). These studies revealed that the key determinants in building consumer trust and encouraging repeat business were delivery reliability and clear communication. The statement "I lose my potential orders when ETA is too long" had the lowest mean (M = 3.22, SD = 1.13) but it was read as "Sometimes" that long delivery times could have a negative impact on purchase decisions.

The findings are consistent with Durlik et al. (2024) who stressed that delivery dependability and lead-time management are critical components of supply chain performance and customer satisfaction. Similarly, Suryani et al. (2024) pointed out that prompt delivery and efficient communication are essential for consumer trust, loyalty and repurchase intentions. These findings pointed to the importance of a good B2B pasa-buy business model built on precise ETA management, supplier reliability, and proactive communication tactics to improve customer happiness, build buyer-seller relationships, and boost overall operating efficiency.

Table 5. Perception and Usage

Perception and Usage	Mean	Std. Dev.	Interpretation
I frequently use pasa-buy services to purchase items.	2.93	0.92	**Sometimes**
I find pasa-buy services convenient for my shopping needs.	3.28	1.11	**Sometimes**
I trust pasa-buy buyers to purchase the correct items.	3.43	1.08	**Often**
Pasa-buy services save me time and effort.	3.41	1.16	**Often**
I prefer pasa-buy over traditional shopping or online apps.	3.13	0.86	**Sometimes**
I place bulk orders for my pasa-buy business.	2.72	1.11	**Rarely**
Overall Mean	**3.15**		

Table 5 displayed the perception and utilization of the respondents on B2B pasa-buy services. The results showed an overall mean of 3.15 translated as "Sometimes" which means that the respondents have a moderate level of acceptance and consumption of pasa-buy services. Among the indicators, the item "I trust pasa-buy buyers to purchase the correct items" had the highest mean (M = 3.43, SD = 1.08), followed by "Pasa-buy services save me time and effort" (M = 3.41, SD = 1.16), both interpreted as "Often." The results indicated that trust and convenience were the main variables influencing pasa-buy services utilization. On the other hand, the lowest mean (M = 2.72, SD = 1.11) was "I place bulk orders for my pasa-buy business" with the interpretation of "Rarely". This means that mainly respondents used pasa-buy services for individual or occasional purchases rather than bulk purchases. The data also revealed that while respondents appreciated the advantages of pasa-buy services, their use of such services was selective and contingent upon their particular purchasing requirements.

The findings were similar with Al-Maroof et al. (2022) who indicated that Perceived convenience, trust and value are the main factors influencing consumer adoption of alternative shopping channels. In the same vein, Manzoor et al. (2020) identified trust as a key ingredient in the consumers' readiness to perform online and intermediary-based transactions, especially when purchasers are dependent on others to make purchases on their behalf. These results revealed that a B2B pasa-buy business model needed to increase trust-building mechanisms, transaction transparency, and service convenience to drive more usage and client loyalty.

Table 6. Production Satisfaction

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Production Satisfaction	Mean	Std. Dev.	Interpretation
I was satisfied with my items through pasa-buy.	2.41	1.01	**Rarely**
I bought my items via pasa-buy are usually fresh and of good quality.	2.43	1.03	**Rarely**
I am satisfied with the variety of items I can request through pasa-buy.	2.41	1.01	**Rarely**
Overall Mean	**2.41**		

Table 6 demonstrated the level of satisfaction of the respondents on the production of products purchased by the pasa-buy method. The results yielded an overall mean of 2.41, which can be translated as "Rarely" indicating a typically low degree of satisfaction with the products bought via pasa-buy transactions. The indicator "I bought my items via pasa-buy are usually fresh and of good quality" had the highest mean among the indicators (M = 2.43, SD = 1.03) and the mean for "I was satisfied with my items through pasa-buy" and "I am satisfied with the variety of items I can request through pasa-buy" was both 2.41 (SD = 1.01). While variances among the markers were small, all were read as "Rarely" indicating respondents had worries about product quality, freshness, consistency, and product diversity. These results indicated that the current pasa-buy system had issues in achieving consumer expectations and ensuring satisfactory product quality.

According to Afinia (2024) consumer happiness is greatly influenced by the amount to which product performance matches or surpasses customer expectations, which validated the results. Similarly, Rahman et al. (2023) found that perceived service quality and product reliability are significant predictors of customer satisfaction and repeat patronage. The poor satisfaction ratings indicated that B2B pasa-buy operators should improve supplier selection, quality control systems, and product verification processes to ensure that clients regularly obtain high-quality products. Improving these factors will lead to higher customer satisfaction, more trust in the pasa-buy system, and long-term sustainability of the proposed B2B pasa-buy business model.

Table 6. Preferred Payment Methods

Preferred Payment Methods	Mean	Std. Dev.	Interpretation
Cash	3.48	1.24	**Often**
Gcash/Paymaya (e-wallet)	3.41	1.21	**Often**
Bank Transfer	2.91	1.40	**Rarely**
Cash on Delivery	3.96	1.23	**Often**
Overall Mean	**3.44**		

Table 6 shows the preferred payment method of respondents for B2B pasa-buy transactions. The results showed an overall mean of 3.44 which may be read as "Often". This result implies that the respondents often use the indicated payment methods while they are doing pasa-buy transactions. Cash on Delivery (COD) was the most popular payment method with a mean of 3.96 (SD = 1.23), followed by Cash (M = 3.48, SD = 1.24) and GCash/PayMaya (e-wallet) (M = 3.41, SD = 1.21), which were all evaluated as "Often". Bank transfer received the lowest mean (M = 2.91, SD = 1.40) that was read as "Infrequently." Findings revealed that respondents favored payment options that provided ease, flexibility, and perceived security. Customers showed a strong preference for COD as they liked to verify things before payment hence minimizing perceived transaction risks. Similarly, the increasing adoption of digital payment technology in e-commerce was evidenced by the widespread use of e-wallets.

These findings were reinforced by Rizvi et al. (2025) who discovered that consumers are inclined to embrace payment options that are convenient, accessible and reduce transaction uncertainty. Likewise, Aidarus and Abu (2025) found that confidence, ease of use and perceived security had a substantial impact on the adoption of mobile and electronic payment systems. These results suggested

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that a successful B2B pasa-buy business model should include several payment choices especially COD and e-wallet services to meet the needs of customers, increase transaction convenience and improve the overall customer satisfaction.

Table 7. Pricing and Fees

Pricing and Fees	Mean	Interpretation
I consider the pricing of pasa-buy items to be fair and jreasonable.	2.48	Rarely
I am willing to pay a service fee for the convenience of pasa-buy.	2.46	Rarely
I understand how fees and item costs are calculated in pasa-buy transactions.	2.54	Rarely
Overall Mean	**2.49**	

Table 7 indicated the respondents' views on price and fees in B2B pasa-buy transactions. The results indicated an overall mean of 2.49, which was read as "Rarely". This implies that respondents had a low agreement to the assertions relating to price justice, service charge acceptance and fee transparency. The indicator "I understand how fees and item costs are calculated in pasa-buy transactions" got the highest mean (M = 2.54) while "I am willing to pay a service fee for the convenience of pasa-buy" recorded the lowest mean (M = 2.46). The variances across the indicators were small, but all were read as "Rarely," meaning respondents found pricing structures and service costs to be ambiguous or not sufficiently justified. The results show that the deployment of the pasa-buy services still faced important problems, such as transparency and value perception.

These findings were reinforced by Prum et al. (2024) who stressed that perceived pricing justice has a major impact on consumer satisfaction, trust and purchase decisions. Similarly, Furrer et al. (2021) shown that consumers are more willing to pay fees and extra charges when pricing systems are transparent and seen fair. Tan and Le (2023), the low ratings indicated that customers may have had no confidence in the pricing structure of pasa-buy transactions which could negatively impact their propensity to engage in repeat purchases. Hence, the proposed B2B pasa-buy business model should include open pricing rules, full breakdown of costs and explicit communication of service prices to increase customer confidence, perceived value and long-term customer loyalty.

Table 8. Preferred Shipping Methods

Preferred Shipping Methods	Mean	Std. Dev.	Interpretation
Local courier services (e.g., Lalamove, LBC, JNT)	3.52	1.21	**Often**
Same-day delivery	3.22	1.15	**Sometimes**
Standard shipping (2–5 days)	3.74	1.14	**Often**
Pick-up by customer (meet-up or hub)	2.94	1.18	**Sometimes**
Pasabuy rider delivery	3.19	1.22	**Often**
Overall Mean	**3.32**		

Table 8 presented the preferred shipping options of the respondents in B2B pasa-buy transactions. The results yielded an aggregate mean of 3.32, which is read as "Often", indicating that delivery methods played an important factor in the respondents' purchasing decisions. The option of Standard Shipping (2–5 days) had the highest mean (M = 3.74, SD = 1.14) followed by Local Courier Services such as Lalamove, LBC and J&T (M = 3.52, SD = 1.21) which were both read as "Often." These results indicate that respondents valued reliable and cost-effective delivery services more than alternative fast shipping. On the contrary, Pick-up by Customer (meet-up or hub) had the lowest mean (M = 2.94, SD = 1.18) which was classified as "Sometimes," indicative of a lower preference for customer-managed delivery arrangements. The results showed that convenience, accessibility, and delivery dependability were

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significant factors in selecting shipping modes in the pasa-buy system.

The findings were reinforced by Halbusi et al. (2022) who stressed that effective logistics and reliable delivery services are important predictors of customer happiness and supply chain performance. Likewise, Indriastuti et al. (2022) discovered that delivery reliability, responsiveness, and service convenience strongly affect customers' evaluations of service quality and their inclination to continue commercial transactions. Thompson et al. (2021), the choice for conventional shipping and well-known courier services by the respondents showed that they valued predictable delivery times and trusted logistics providers. Therefore, the recommended B2B pasa-buy business model should work with reliable courier firms and give flexible shipping alternatives to ensure delivery efficiency, boost customer happiness and optimize operational performance.

Table 9. Pasa-Buy Sources

Pasa-Buy Sources	f	%	Rank
Korea	30.00	55.60	2
Dubai	8.00	14.80	6
USA	27.00	50.00	3
Canada	13.00	24.10	5
Japan	35.00	64.80	1
Thailand/Bangkok	25.00	46.30	4

The nations that were the main sources of products in the pasa-buy transactions were reported in Table 9. The results indicated that Japan had the highest number of respondents (35 respondents, 64.80%), followed by Korea (30 respondents, 55.60%) and the United States (27 respondents, 50.00%). Thailand/Bangkok was in fourth place with 46.30%, followed by Canada (24.10%) and Dubai (14.80%). These data suggested that the respondents were mostly obtaining products from nations with robust consumer goods sectors, product quality and unique merchandise choices. The significant preference for Japan and Korea indicated considerable demand for products such as beauty items, fashion products, electronics, collectibles, and specialized goods that may not be readily available in the local market. The diversity of sourcing sites also reflected the increased importance of international trade and crossborder e-commerce in enabling B2B pasa-buy activities.

The results were backed by the work of Madhavan et al. (2025) who argued that cross-border e-commerce helps consumers and enterprises to access a greater choice of items, competitive pricing and distinctive commodities from foreign markets. Similarly, He et al. (2020) underlined that globalization and international sourcing strategies help firms to accommodate different consumer demands while increasing market prospects. Chen et al. (2023), the preference for Japan, Korea and the United States indicated that a successful B2B pasa-buy business model should develop trustworthy supplier networks in these countries and build international logistical alliances. Schroeder et al. (2020), such techniques could boost product availability, improve customer happiness and increase the competitiveness of the suggested B2B pasa-buy business model.

Table 10. Access Pasabuy Platforms

Access Pasabuy Platforms	Mean	Std. Dev.	Interpretation
Facebook	3.63	1.19	**Often**
Instagram	3.04	1.22	**Sometimes**
Tiktok	3.63	1.42	**Sometimes**
General Messenger	2.93	1.15	**Sometimes**
Private Chat	2.93	1.17	**Sometimes**

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Word of Mouth	3.04	1.17	**Sometimes**
Friend Referral	3.48	1.24	**Often**
Youtube	2.89	1.20	**Sometimes**
Viber	2.17	1.01	**Sometimes**
Overall Mean	**3.08**		

Table 10 indicated the platforms and channels via which respondents utilized pasa-buy services. The results revealed an aggregate mean of 3.08 interpreted as "Sometimes". This indicated modest level of consumption of various access channels. Facebook was the platform with the highest mean (M = 3.63, SD = 1.19), followed by TikTok (M = 3.63, SD = 1.42) and Friend Referral (M = 3.48, SD = 1.24), all rated as "Often". These results indicated that social media platforms and personal recommendations were significant in bringing customers into contact with pasa-buy services. On the other hand, Viber was the least used channel for pasa-buy transactions, with the lowest mean (M = 2.17, SD = 1.01). The success of Facebook and TikTok revealed the efficiency of interactive and content-based platforms in reaching potential customers, while the high ranking of friend referrals showed the importance of trust and social influence in purchase decisions.

Leong et al. (2021), corroborated the findings by emphasizing that social media platforms provide consumers with involvement, information exchange, and buying decision-making through interactive communication. In a similar vein, Ng et al. (2024) discovered user-generated content and peer influence on social commerce platforms enhance customer relationships and improve buy inclinations. Novianty et al. (2025), the findings indicated that the proposed B2B passa-buy business model should target Facebook and TikTok as the key marketing and communication channels, while also advocating for referral-based initiatives to boost trust, customer reach, and business expansion

Table 11. Checkout Methods

Checkout Methods	Mean	Std. Dev.	Interpretation
E-commerce platforms (Shopee, Lazada,Tiktok etc.)	3.80	1.35	**Often**
Facebook/Instagram confirmation	3.00	1.29	**Sometimes**
Pasabuy group order forms (Google Forms, etc.)	2.44	1.26	**Rarely**
Overall Mean	**3.08**		

Table 11 showed the preferred checkout methods of the respondents for the proposed B2B Pasa-Buy business model. The results indicated that e-commerce platforms including Shopee, Lazada and TikTok Shop recorded the highest mean score of 3.80 (SD=1.35) and were interpreted as Often, suggesting that respondents regularly utilized established e-commerce platforms to conduct transactions. Meanwhile, Facebook/Instagram confirmation yielded a mean of 3.00 (SD = 1.29) interpreted as Sometimes, indicating moderate dependence on social media-based transaction confirmation. On the other hand, the Pasa-buy group order forms (Google Forms, etc.) had the lowest mean of 2.44 (SD = 1.26) and were read as Rarely, meaning it is not common to be familiar and use form-based checkout systems. The grand mean of 3.08 showed that respondents used the identified checkout methods sometimes.

The data pointed to a consumer preference for checkout systems that are familiar, convenient and connected with existing online purchasing platforms. This finding was in line with Wulandari and Utami (2026) who identified convenience and accessibility as some of the main characteristics that influenced the consumer adoption of e-commerce platforms. Similarly, Muharam et al. (2021) found that user experience and simplified checkout procedures played a substantial role in online buying choices and customer happiness. Therefore, Hiltunen (2017) the B2B Pasa-Buy model can be improved by including e-

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commerce checkout capabilities to promote customer acceptance and transaction efficiency.

Table 12. Pasabuy Platforms through Channels

Pasabuy Platforms through Channels	Mean	Std. Dev.	Interpretation
Facebook	3.50	1.23	**Often**
Instagram	2.94	1.30	**Sometimes**
Tiktok	3.52	1.38	**Often**
General Messenger	3.07	1.27	**Sometimes**
Private Chat	3.17	1.23	**Sometimes**
Viber	2.20	1.13	**Rarely**
Overall Mean	**3.07**		

Table 12 showed the preferred platforms and channels used by the respondents in participating in pasa-buy transactions. The results indicated that TikTok had the highest mean score of 3.52 (SD = 1.38) and Facebook had a close mean score of 3.50 (SD = 1.23), Both were evaluated as Often. The results also confirmed that respondents often utilized social media platforms with high communication and interaction characteristics for buying purposes. Private Chat (M = 3.17, SD = 1.23), General Messenger (M = 3.07, SD = 1.27), and Instagram (M = 2.94, SD = 1.30) were assessed as Sometimes, signifying moderate use for transaction coordination and questions. In contrast, Viber obtained the least mean score of 2.20 (SD = 1.13) translated as Rarely which suggested the respondents' little desire. The aggregate mean of 3.07 means that the respondents sometimes use the indicated channels for pasa-buy transactions.

Wu et al. (2024), these findings suggested that social media platforms combining conversation, content sharing and promotional features were more interesting to customers than conventional messaging apps. The findings were consistent with the research by Alves et al. (2024) who observed that social media sites have a key role in shaping customer engagement and purchase intention via attractive content and social connectedness. Similarly, Handoyo (2024) highlighted that social media platforms like Facebook and Instagram increased consumer trust, involvement, and purchase intentions via social influence mechanisms. Thus, the suggested B2B Pasa-Buy business model can profit from the prioritization of Facebook and TikTok as main customer interaction and transaction channels for maximum reach and user participation.

Table 13. Communication and Trust

Communication and Trust	Mean	Std. Dev.	Interpretation
I communicate with the pasa-buy buyer in a clear and effective manner.	2.33	1.07	**Rarely**
I feel confident that the pasa-buy buyer will follow special instructions (e.g., brand preference, quantity).	2.28	1.01	**Rarely**
I trust the pasa-buy buyer to be honest and reliable.	2.35	1.06	**Rarely**
Overall Mean	**2.32**		

Table 13 presented the perception of the respondents towards communication and trust in pasa-buy transactions. Findings found that all parameters were rated as Rarely with an overall mean of 2.32 indicating relatively low levels of communication efficacy and trust between buyers and pasa-buy service providers. The indication with the highest mean of 2.35 (SD = 1.06) was believing the pasa-buy buyer to be honest

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and reliable followed by communicating in a straightforward and effective manner with a mean of 2.33 (SD = 1.07). The lowest mean of 2.28 (SD = 1.01) was confidence that the pasa-buy buyer will follow special instructions. Such findings suggested that the respondents were uncertain about the dependability, correctness and consistency of pasa-buy transactions which could have hampered their desire to participate in such transactions.

The results were consistent with Manzoor et al. (2020) who discovered that trust was crucial in consumers' propensity to indulge in online and intermediary-based transactions. Similarly, Mikalef et al. (2020) found that good communication and perceived trustworthiness had significant effects on transaction intents and helped minimize uncertainty in electronic commerce settings. The findings revealed that the suggested B2B Pasa-Buy business model should have clear communication channels, real-time order monitoring, verification procedures, and feedback systems to build customer confidence and improve transaction dependability.

Table 14. Overall Satisfaction

Overall Satisfaction	Mean	Std. Dev.	Interpretation
I am satisfied with my overall pasa-buy experience.	3.72	1.10	**Sometimes**
I would recommend pasa-buy services to friends or family.	3.67	1.14	**Sometimes**
I am likely to continue using pasa-buy in the future.	3.56	1.23	**Often**
Overall Mean	**3.65**		

Table 14 showed the overall satisfaction of the respondents on their experience at pasa-buy. The results indicated an overall mean of 3.65 which reflected a relatively positive degree of satisfaction among the respondents. The indicator for satisfaction with the entire pasa-buy experience had the highest mean of 3.72 (SD = 1.10) and was interpreted as Sometimes, which meant that respondents were typically satisfied with the service they received. The recommendation of pasa-buy services to friends or family likewise got a mean of 3.67 (SD = 1.14). This is also read as Sometimes which shows a positive view of the service. Future use of pasa-buy obtained a mean of 3.56 (SD = 1.23) which was evaluated as Often, showing a strong intention to continue using it in spite of certain constraints observed.

Biswas et al. (2024), these results indicated that the respondents were aware of the convenience and benefits of pasa-buy services that had a favorable impact on their satisfaction and repatronage. The results were consistent with the work of Irawati et al. (2025) which revealed that customer satisfaction greatly affected loyalty and repurchase intentions in online service environments. Likewise, Chughtai et al. (2023) found that positive service experience increased customers' desire to promote services and continue using them for the long run. Service quality, convenience and customer experience are key priorities based on the B2B Pasa-Buy business model to improve client retention and favorable word of mouth recommendations.

Table 15. Pasabuy Platforms through Channels

Factors Influence Decision to Choose Pasabuy	Mean	Std. Dev.	Interpretation
Product quality	3.91	1.34	**Often**
Competitive pricing	3.76	1.28	**Often**
Shipping speed	3.76	1.29	**Often**
Supplier reviews	3.83	1.36	**Often**
Return/refund policy	3.44	1.37	**Often**
Communication and responsiveness of supplier	3.59	1.18	**Often**
Customization or branding options (if applicable)	3.91	1.29	**Often**
Trust in the owner	3.87	1.23	**Often**
Overall Mean	**3.76**		

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Table 15 highlighted the drivers of respondents' decisions in choosing pasa-buy services. The results showed an overall mean of 3.76, interpreted as Often. This implies that the criteria highlighted were significant in the purchasing decisions of the respondents. Among the variables, the product quality and customization or branding choices were rated the highest with a mean score of 3.91. This suggests that the respondents greatly valued obtaining excellent products and the possibility to personalize orders. Trust in the owner (M = 3.87), supplier reviews (M = 3.83), competitive pricing (M = 3.76) and shipping speed (M = 3.76) were all interpreted as Often. Return/refund policy had the lowest mean score of 3.44, but was still an essential consideration. The data showed that product value, credibility, and service reliability were the respondents' priority in choosing a pasa-buy provider.

The results are congruent with the findings of Elsie et al. (2025) who indicated that product quality, trust and customer reviews greatly impacted online buying behavior and supplier selection. Similarly, Sibagariang et al. (2025) identified competitive price, service responsiveness, and trustworthiness as the main factors of consumer satisfaction and buy intention in digital commerce platforms. Ho and Chow (2023), the results showed that the B2B Pasa-Buy business model to be developed should focus on quality products, trustworthy supplier relationships, honest customer reviews, and tailored products and services to attract and keep consumers and generate long-term trust and loyalty.

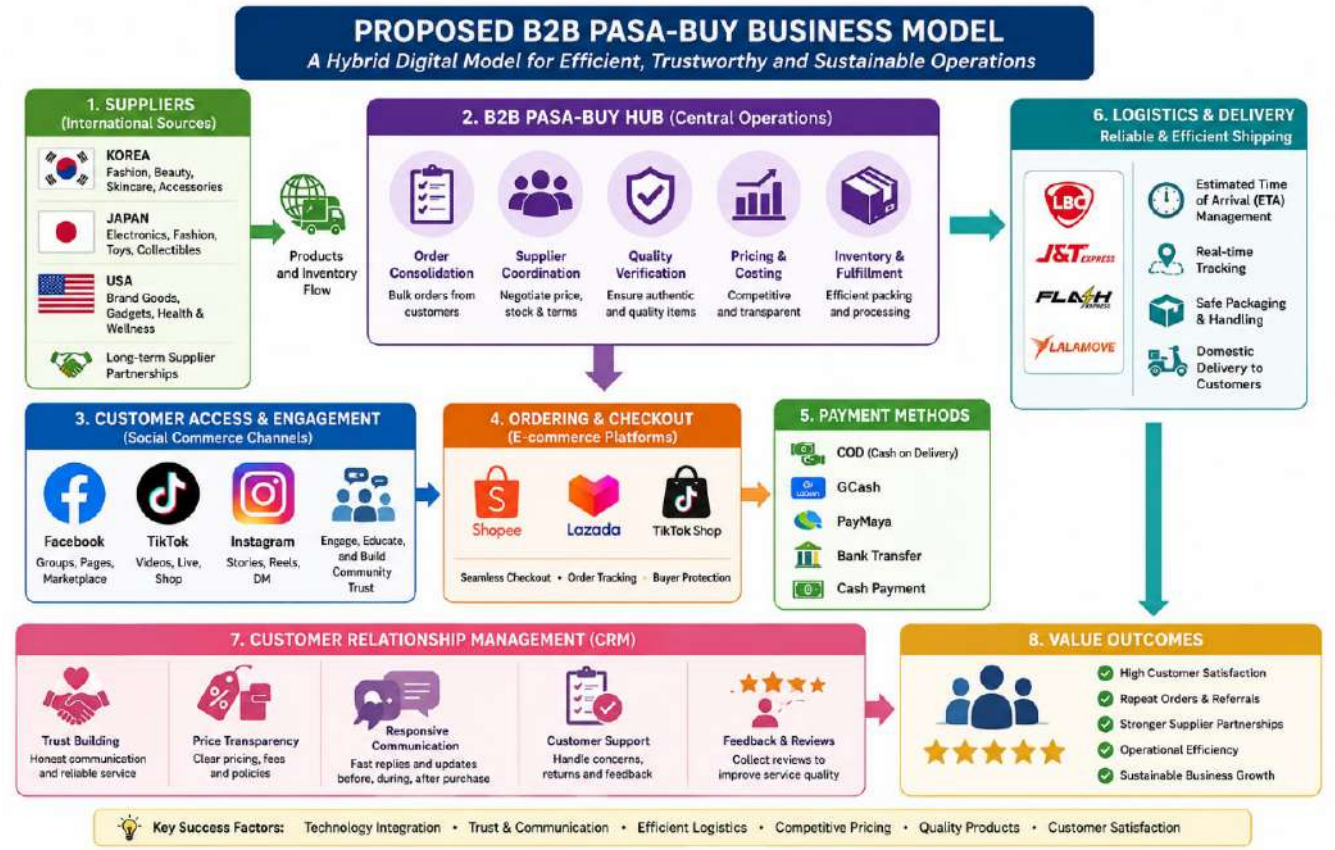


Fig.2. The Proposed Hybrid Digital B2B Pasa-Buy Business Model for Sustainable Social Commerce Operations

The proposed B2B Pasa-Buy Business Model begins with establishing partnerships with reliable international suppliers, particularly from Japan, Korea, and the United States, which emerged as the primary product sources in the study. The B2B Pasa-Buy Hub serves as the central coordinating unit responsible for consolidating orders, verifying product quality, managing supplier relationships, and ensuring operational efficiency.

Marketing and customer acquisition are conducted primarily through Facebook and TikTok, which were identified as the most effective channels for customer engagement and platform access. Customer orders are

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processed through trusted e-commerce platforms such as Shopee, Lazada, and TikTok Shop, which provide secure and convenient checkout systems. Payment options include Cash on Delivery (COD), GCash, PayMaya, and cash payments to accommodate customer preferences.

The logistics component relies on reputable courier services and effective ETA management to ensure timely delivery. Supporting the entire process is a Customer Relationship Management (CRM) system that emphasizes trust-building, transparent pricing, real-time communication, and customer feedback mechanisms. These elements collectively enhance customer satisfaction, encourage repeat transactions, strengthen supplier-buyer relationships, and ensure the long-term sustainability of the B2B Pasa-Buy business model.

V. CONCLUSION AND RECOMMENDATION

The study revealed that the proposed B2B Pasa-Buy business model is a realistic and sustainable method to strengthen social commerce operations in Cabanatuan City. The results found that technology integration, social media involvement, reliable logistics, and customer trust greatly affected the effectiveness of pasa-buy transactions. E-commerce sites such as Shopee, Lazada and TikTok Shop emerged as the preferred checkout methods, while TikTok and Facebook became the main platforms for customer engagement and market access. Consumer purchasing decisions were influenced most by: product quality, customization options, trust in the seller, supplier reviews, competitive pricing and shipping efficiency. The results also showed that customers placed a premium on ease, accessibility and open lines of communication, particularly in terms of predicted delivery timelines and transaction updates. But product satisfaction, pricing transparency and communication dependability were still issues that could affect customer loyalty and repeat transactions. The research showed that the integration of e-commerce platforms, social media marketing, reliable supplier networks, secure payment systems, and efficient logistics management in a hybrid digital business model can enhance operational performance, customer satisfaction, and long-term business sustainability in the B2B pasa-buy industry.

Based on the findings, entrepreneurs and business operators can apply the suggested Hybrid Digital B2B Pasa-Buy Business Model to enhance operational efficiency, customer trust, and business sustainability. The strategy should incorporate e-commerce platforms, social media channels, customer relationship management systems and trusted logistics partnerships to facilitate transactions and improve service delivery. Transparent pricing structures and service prices can boost confidence and customer transparency. Also, build stronger ties with local and international suppliers to assure product quality, availability and consistency. In addition, the operators need to set up real-time order tracking, prompt customer service, and feedback systems to enhance communication and client satisfaction. Customer preferences must be met by offering several payment alternatives, such as cash-on-delivery and e-wallet services. Authors would like to motivate future studies to validate and pilot test the business model provided in various places and industries to see the effectiveness, scalability, and long-term effects on social commerce and digital entrepreneurship.

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Management Control Systems and Organizational Performance in Public and Private Higher Education Institutions: A Multiple Case Study

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Abstract *— Philippine public and private higher education institutions (HEIs) operate under the same regulator but different governance and financing regimes, yet little is known about how their management control systems (MCS) differ and how those systems relate to performance. Guided by Management Control Theory and Performance Management Theory, this qualitative multiple case study examined MCS implementation and organizational performance in a public state college (Case A) and a private Catholic college (Case B) in the same Philippine province. Twelve purposively selected key informants, six per case, representing top administration, finance, and academic or unit leadership, were interviewed with a semi-structured guide. Data were analyzed through reflexive thematic analysis within each case and cross-case synthesis against four research propositions. Case A operated a formal, compliance-driven system of layered plans, government-regulated budgeting and audit, and documented performance commitments, but multiple control points and handoffs slowed processes. Case B operated a mission-guided, consultative, and revenue-sensitive system in which short communication lines enabled quick decisions, but informal handling, uneven documentation, and weak tracking of corrective actions limited consistency. Both cases tied budget requests to plans, fed monitoring results back into planning, and named an integrated planning, budgeting, and performance information system as the most needed improvement. The propositions on planning formality and financial revenue-sensitivity were supported, the proposition on monitoring was partly supported, and the relationship between MCS and performance was supported as perceived by informants. An integrated MCS framework of five linked elements, adaptable to public and private contexts, is proposed.*

Keywords ***— management control systems, organizational performance, higher education institutions, multiple case study, public and private HEIs, Philippines***

I. INTRODUCTION

Higher education institutions face rising demands to show that they use resources efficiently, attain their goals, and serve students and other stakeholders well. Management control systems (MCS), the formal and informal mechanisms through which managers align the behavior of organizational members with strategy (Merchant & Van der Stede, 2017), are the means by which institutions translate plans into budgets, actions, and measured results. Reviews of management accounting and control in universities show that HEIs adopt control tools mainly in response to external pressure and often implement them incompletely (Vale et al., 2022), and that human resource problems, organizational constraints, and weak technological integration are the most frequently reported challenges to MCS in higher education (Lambovska & Angelova-Stanimirova, 2025).

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The Philippine higher education system is mixed: public state universities and colleges (SUCs) and private HEIs serve the same national goals under the oversight of the Commission on Higher Education (CHED), but they are financed and governed differently. SUCs depend mainly on government appropriations and work within national budgeting, procurement, and Commission on Audit (COA) rules that limit their financial autonomy (Flores, 2025). Private HEIs depend mainly on tuition and have faced enrollment pressure since the Universal Access to Quality Tertiary Education Act took effect, with public HEIs recovering enrollment faster than private HEIs in its first year (Orbeta et al., 2019). Financial sustainability has therefore become a strategic imperative for both sectors (Bayudan-Dacuycuy et al., 2024).

Philippine studies of management control in HEIs have examined each sector separately. A case study of a state university found that procurement, budgeting, and payroll were highly structured and compliant but that adapting to a complex regulatory environment was time-consuming and costly (Nillos & Libo-on, 2024). A survey of private HEIs in Nueva Ecija found internal control systems generally effective but weakened by gaps in monitoring, risk mitigation, and personnel engagement (Alarcon et al., 2026). Other studies have assessed the management capacity of a state college (Anjirani, 2024), proposed a strategic performance measurement system for a state university (Armas et al., 2025), and reviewed the corporatization of SUCs under Republic Act No. 8292 (Carbonell, 2025). No identified study has compared how a public and a private HEI in the same locality design and use management control and how each relates its controls to performance.

This study therefore examined management control systems and organizational performance in a public state college (Case A) and a private college (Case B) in the same Philippine province. Specifically, it described the key informants' profile; examined how each case implemented its MCS in terms of strategic planning, financial management, and performance monitoring and evaluation; examined how organizational performance was manifested in terms of efficiency, goal attainment, service delivery, and institutional effectiveness; identified the similarities and differences between the cases; and proposed an MCS framework applicable to both public and private HEIs.

II. LITERATURE REVIEW

Management Control Systems in Higher Education

Management control has evolved from Anthony's (1965) view of planning and control as a process for ensuring that resources are obtained and used effectively toward a broader view of MCS as a package of planning, cybernetic, reward, administrative, and cultural controls that operate together (Malmi & Brown, 2008). Simons (1995) distinguished the diagnostic use of controls, which monitors outcomes against preset targets, from their interactive use, which engages managers in dialogue about strategic uncertainties. Organizations often use both, and the balance shifts with their stage of development and strategic needs (Lewis et al., 2024; Su et al., 2017). In the public sector, MCS tend to be used to steer the implementation of existing strategy rather than to shape new strategy, and feedback mainly supports single-loop learning (Fitz Verploegh et al., 2025).

In universities, strategic planning and performance management have usually been studied separately, although they are interdependent: planning tools can support performance management, and performance information can reshape strategy (Biondi & Russo, 2022). Performance reporting in public universities is shaped by external isomorphic pressures as well as by organizational and individual factors (Tiron-Tudor et al., 2022), which is consistent with evidence that HEIs adopt control tools in response to external demands (Vale et al., 2022). In the Philippines, government agencies and SUCs operate the Strategic Performance Management System, with office and individual performance commitments (OPCR and IPCR) linked to the performance-based bonus. ₹A process evaluation found that SPMS compliance requirements made most SUCs ineligible for the bonus in 2017 and that information was cascaded mainly through memoranda and orientations (Albert et al., 2021).

Public and Private HEI Contexts in the Philippines

SUCs are governed by boards under Republic Act No. 8292, which granted them expanded fiscal and administrative authority while keeping them within public accountability rules. Corporatization

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has increased revenue generation and reduced dependence on subsidies in some SUCs, but it has also raised concerns about profitability, operational efficiency, and the balance between economic and educational goals; strong governance, financial management, and strategic planning are the conditions for its success (Carbonell, 2025). SUCs remain constrained by limited financial autonomy, bureaucratic processes, and uneven budget allocation (Flores, 2025). Private HEIs, by contrast, are governed by their own boards and are exposed to enrollment and tuition revenue, and many sectarian institutions draw on their religious mission as a source of direction and identity. Internal control in private HEIs is shaped strongly by organizational culture and institutional capacity (Alarcon et al., 2026). These differences suggest that the two sectors may rely on different mixes of administrative, financial, and cultural controls (Malmi & Brown, 2008).

Theoretical Framework and Research Propositions

The study was anchored on Management Control Theory (Anthony & Govindarajan, 2007; Merchant & Van der Stede, 2017) and Performance Management Theory (Armstrong, 2022). Management Control Theory supplied the structural lens, identifying strategic planning, financial management, and performance monitoring as the components of MCS. Performance Management Theory supplied the evaluative lens, explaining how goals, indicators, and feedback translate those systems into efficiency, goal attainment, service delivery, and institutional effectiveness. Following Yin's (2018) logic, four propositions guided the inquiry: (P1) public and private HEIs differ in the formality and centralization of strategic planning; (P2) the private HEI shows greater flexibility and revenue sensitivity in financial management, whereas the public HEI is bound by public fund regulations and audit; (P3) monitoring in the public HEI is more formally documented, whereas monitoring in the private HEI is tied to enrollment, reputation, and stakeholder considerations; and (P4) in both cases, MCS implementation is related to organizational performance.

III. Methodology

Research Design

A qualitative multiple (collective) case study design was used (Yin, 2018). Each institution was treated as a complete case and analyzed on its own terms before the two cases were compared, which allowed analytic rather than statistical generalization.

Cases and Key Informants

The two cases were located in the same province in Central Luzon, Philippines, so that governance structure rather than regional context distinguished them. Case A is a public state college operating under national budgeting, procurement, and COA audit rules. Case B is a private Catholic college governed by its own board. Key informants were selected purposively from three parallel categories in each case: top-level administrators responsible for strategic planning, finance or accounting heads responsible for financial management, and academic or unit heads responsible for performance monitoring. Informants were included if they held primary responsibility for one of these areas, had served in it for at least one year, and gave informed consent; those serving in an officer-in-charge capacity, under investigation, on extended leave, or with a close personal or supervisory relationship with the researcher were excluded. Six informants per case (12 in total), two from each category, were interviewed. This number followed Yin's (2018) replication logic and the principle of information power, under which a focused, theory-guided study with knowledgeable informants requires a comparatively small sample (Malterud et al., 2016), and is consistent with evidence that saturation in homogeneous samples is often reached within a similar number of interviews (Guest et al., 2006).

Instruments

A five-part semi-structured interview guide, developed from the conceptual framework following Kallio et al. (2016), covered the informant profile, strategic planning, financial management, performance monitoring and the four performance indicators, and closing reflective questions on what was distinctive about each institution's management control. A document review checklist listed institutional plans, budget and financial reports, performance and accreditation reports, and organizational charts for triangulation.

The interview guide and checklist were validated by 5 experts in the field of business administrations, management, and prolific

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researchers to ensure coherence and alignment of the instrument with the objective of the study.

Data Collection

After approval from the Graduate School and permission from both institutions, informants received an information sheet and gave written informed consent. Interviews were conducted individually, in person or by secure video conference, and lasted about 45 minutes to one hour. Interviews were audio-recorded with consent, transcribed verbatim, and returned to informants for member checking. Institutional documents were requested from both cases.

Data Analysis

Informant profiles were summarized in a profile matrix. For each case, transcripts and documents were coded and themed through reflexive thematic analysis (Braun & Clarke, 2006) against the three MCS components and four performance indicators, and the number of informants whose coded excerpts carried each theme was recorded. Case A was analyzed completely before Case B. The two within-case analyses were then compared through cross-case synthesis (Yin, 2018), in which each dimension was classified as a similarity, difference, or mixed pattern and interpreted against the four propositions. The convergent and divergent findings informed the proposed MCS framework.

Trustworthiness and Ethical Considerations

Credibility was supported by triangulating interviews with institutional documents and by member checking; transferability by thick description of both cases; dependability by an audit trail of data collection, coding decisions, and analysis; and confirmability by reflexive memoing and debriefing with the adviser and the study's rater (Lincoln & Guba, 1985). Participation was voluntary, informants could withdraw before the analysis was finalized, and institutions and informants were assigned codes. Data were stored in a password-protected repository accessible only to the researcher.

IV. RESULTS AND DISCUSSION

Profile of the Key Informants

Each case contributed six informants: two top-level administrators, two finance or accounting heads, and two academic or unit heads (Table 1). Case B informants had served longer in their current positions (4 to 8 years, $M \approx 6.0$) than Case A informants (1 year 1 month to 7 years, $M \approx 4.3$). Several informants held more than one area of responsibility, particularly in Case A, where four informants each reported financial management and performance monitoring duties.

Table 1: Profile of the Key Informants by Case

Case	*n*	Informant categories	Length of service in position	Areas of responsibility (*n*)
Case A (public state college)	6	2 top-level administrators; 2 finance or accounting heads; 2 academic or unit heads	1 year 1 month to 7 years ($M \approx 4.3$)	Strategic planning (2); financial management (4); performance monitoring (4)
Case B (private college)	6	2 top-level administrators; 2 finance or accounting heads; 2 academic or unit heads	4 to 8 years ($M \approx 6.0$)	Strategic planning (2); financial management (2); performance monitoring (4)

Note. Counts of areas of responsibility exceed six because several informants hold more than one area.

Implementation of the Management Control System

Table 2 summarizes the within-case findings on the three MCS components. In Case A, strategic planning was a formal, layered, top-management-led cycle coordinated by a planning and development unit and bound to the government budget calendar. All six informants cited institutional plans, performance commitments (OPCR and IPCR), the Program Expenditure Classification (PREXC), and CHED and accreditation requirements as their guides, and four described decisions implemented through prioritization and phasing under limited fiscal space. As the Vice President for Academic Affairs put it, “For me, monitoring is useful only when it leads to a decision” (A2). In Case B, planning was a mission-guided, consultative cycle led by the President, Executive Vice President, and College Affairs Officer with board approval. All six

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informants cited plans, budgets, and CHED and quality assurance requirements as guides; three (B1, B2, B5) gave planning examples that began with an external regulatory or recognition requirement, and three (B2, B4, B6) said informal handling needed to be formalized.

Table 2: Within-Case Findings on Management Control System Implementation

Component	Case A: Public state college	Case B: Private college
Strategic planning	Formal, layered planning led by top management and coordinated by a planning unit; plans, OPCR/IPCR commitments, PREXC, and CHED and accreditation requirements guide direction (6 of 6). Decisions are implemented through prioritization and phasing (4 of 6). Constraints: fiscal space, release timing, delayed data, multi-campus coordination.	Mission-guided, consultative planning with board approval through direct contact in a compact structure; plans, budgets, and CHED, PEAC, and quality assurance requirements guide direction (6 of 6). Examples often start from an external requirement (3 of 6), and informal handling needs formalizing (3 of 6). Constraints: enrollment variability, rising costs, documentation load.
Financial management	Rule-bound, multi-office budgeting through CHED and DBM, with segregation of duties, procurement rules, and COA audit (4 of 6). Requests must name the target they support (6 of 6), and spending is checked against delivered output (4 of 6). Strain: appropriations and release timing, managed by prioritization and phasing.	Budgeting starts from expected enrollment and revenue and is monitored against collections; approval limits, separation of duties, and documentation in all six accounts. Sustainability and recurring cost are explicit tests (3 of 6). Strain: revenue sensitivity (2 of 6), managed by conservative projections and phased spending.
Performance monitoring and evaluation	Formal, documented, multi-source system: OPCR/IPCR, PREXC, internal audits, accreditation, and physical and financial accomplishment reports (6 of 6). Evidence is validated and read beyond the numbers (3 of 6). Results feed the next planning and budgeting cycle (6 of 6).	Report-based monitoring complemented by close contact (6 of 6); CHED and quality assurance findings are a main trigger for action (3 of 6). Results return to planning and budgeting (4 of 6), but tracking of corrective actions is weaker and the formal side is still being strengthened.

Note. Figures in parentheses are the number of informants, out of six per case, whose coded excerpts carried the finding. OPCR/IPCR = Office/Individual Performance Commitment and Review; PREXC = Program Expenditure Classification; PEAC = Private Education Assistance Committee.

Financial management in Case A was rule-bound and multi-office: unit proposals were consolidated, processed through CHED and the Department of Budget and Management, and controlled through segregation of duties, procurement rules, and COA review. All six informants said that budget requests had to name the target or project they supported, and four checked spending against delivered output; as the Budget Officer explained, "Meeting a spending target is not, by itself, goal attainment" (A3). In Case B, budgeting began from expected enrollment and revenue and was monitored against collections, and all six informants described approval, separation-of-duty, and documentation controls. Sustainability and recurring cost were explicit tests: "Strategic alignment therefore includes both relevance and sustainability" (B3). Performance monitoring in Case A was formal and documented in all six accounts, and its results fed the next planning and budgeting cycle. Case B relied on reports complemented by close contact, and regulatory and quality assurance findings were a main trigger for action, but tracking whether corrective actions were completed was weaker.

The two cases thus show the contrast between administrative and cultural controls described by

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Malmi and Brown (2008). Case A's control package was dominated by administrative and cybernetic controls imposed by the national budget, procurement, and audit framework, which agrees with the highly structured and compliant procurement and budgeting processes found in a Philippine state university (Nillos & Libo-on, 2024) and with the SUC financing constraints of limited autonomy and bureaucratic processes described by Flores (2025). Its use of monitoring mainly to steer the implementation of existing plans and to correct deviations in the next cycle mirrors the diagnostic, single-loop use of MCS in public organizations (Fitz Verploegh et al., 2025; Simons, 1995). The documented use of OPCR and IPCR commitments is consistent with the SPMS framework, whose compliance demands have weighed heavily on SUCs (Albert et al., 2021).

Case B relied more on cultural controls, with its Catholic mission as the common reference for decisions, and on direct, interactive communication among a small leadership group. This agrees with the strong influence of organizational culture and institutional capacity on internal control in private HEIs in Nueva Ecija, where controls were generally effective but weaker in monitoring and follow-through (Alarcon et al., 2026). The revenue-sensitive budgeting reported by Case B informants reflects the tuition dependence and enrollment pressure on private HEIs (Bayudan-Dacuycuy et al., 2024; Orbeta et al., 2019). In both cases, external requirements were important triggers of control: CHED, accreditation, and audit in Case A and CHED and quality assurance reviews in Case B. This supports the finding that HEIs adopt control tools largely in response to external pressure (Vale et al., 2022; Tiron-Tudor et al., 2022). The link between planning, budgeting, and monitoring in both cases is consistent with Biondi and Russo's (2022) argument that strategic planning and performance management in universities are interdependent, and with the participatory, resource-aligned planning recommended for public and nonprofit organizations (Bryson & George, 2024).

Manifestation of Organizational Performance

Table 3 summarizes the within-case findings on the four performance indicators. Efficiency in Case A had improved through standardized procedures, quality management controls, and digital communication, but five of six informants said that multiple approval points and handoffs still lengthened processes, and three distinguished necessary control from avoidable delay: “In a large institution, especially one with many offices and approval points, sometimes the process can take longer than we would like” (A2). In Case B, five of six informants credited short communication lines with speed, but unstandardized procedures, documents returned for correction, and peak-period staffing caused delay. Both cases asked for request tracking and predictable workflows. Goal attainment in Case A was judged by broad, externally framed indicators such as access, licensure, accreditation, research, and resource stewardship (6 of 6), and most informants said meeting a number or spending target was not enough (5 of 6). Case B paired academic and service indicators with enrollment and financial sustainability, which three informants treated as a condition of goal attainment: “Not every important outcome is financial, but financial sustainability enables the institution to continue delivering those outcomes” (B2).

Both cases gathered service feedback through several channels and treated recurring concerns as signals of a process problem: “Repeated concerns are particularly important because they may indicate a process issue rather than an isolated case” (A5). Case B relied more on direct access to administrators and acknowledged that responses needed to be consistent and documented. Both cases assessed their institutions favorably and named consistency or integration as the remaining gap, but the evidence differed. Case A pointed to external results and the strain of growth, whereas all six Case B informants described effectiveness as continuity of mission and adaptability under pressure: “We need to make sure good service does not depend solely on a particular employee's personal initiative but is supported by clear standards and processes” (B6).

These findings show that efficiency in each case was shaped by its control system, but in opposite ways. In Case A, the number of control points lengthened processes; in Case B, the lack of formalized procedures did. This pattern corresponds to the leading MCS challenges identified in higher education, namely human resource limits, organizational constraints, and weak technological integration (Lambovska & Angelova-Stanimirova, 2025), and to the gaps in monitoring and personnel

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engagement found in Philippine private HEIs (Alarcon et al., 2026). Case A's broad, externally framed indicators correspond to the multi-perspective performance measurement proposed for a Philippine state university, which covers financial stewardship, stakeholder engagement, internal processes, and learning (Armas et al., 2025). Case B's emphasis on financial sustainability as an enabler of mission is consistent with the view of financial sustainability as both an educational asset and a strategic imperative for Philippine HEIs (Bayudan-Dacuycuy et al., 2024). The integration of financial and non-financial measures sought in both cases also agrees with evidence that cost accounting, budgetary control, and balanced measurement support organizational performance (Hammouch et al., 2024).

Table 3 Within-Case Findings on Organizational Performance

Indicator	Case A: Public state college	Case B: Private college
Efficiency	Improved by standardization, quality controls, and digital communication, but multiple control points and handoffs lengthen processes (5 of 6); necessary control is distinguished from avoidable delay (3 of 6).	Short communication lines speed decisions (5 of 6), but unstandardized procedures, document rework, and peak-period staffing cause delay. Needs: standardized workflows and shared tracking.
Goal attainment	Broad, externally framed indicators: access, completion, licensure, accreditation, research and extension, resource stewardship (6 of 6); quality and delivered output valued over numbers or spending (5 of 6).	Academic indicators (enrollment, retention, completion, faculty qualifications) paired with compliance milestones and financial sustainability, which is read as a condition of goal attainment (3 of 6).
Service delivery	Feedback through surveys, complaints, the Citizen's Charter, and consultations (5 of 6), turned into corrective action and follow-up (4 of 6); repeated concerns treated as process signals (3 of 6).	Feedback through direct access, evaluations, and consultations (3 of 6), turned into corrective action (3 of 6); responses need to be consistent and documented.
Institutional effectiveness	Effective and improving, with external evidence (licensure and employability above targets, accreditation, ISO recertification) cited by one informant; growth must be matched by capacity and funding (4 of 6); consistency and integration remain gaps (3 of 6).	Effective in sustaining mission, programs, and student support under financial and regulatory pressure (6 of 6), without citing external results; systematization, documentation, and institution-wide performance information remain gaps.

Note. Figures in parentheses are the number of informants, out of six per case, whose coded excerpts carried the finding.

Similarities and Differences Between the Cases

Table 4 presents the main cross-case themes. The strongest convergence was the recommendation, made by all six Case A informants and five Case B informants, to establish an integrated planning, budgeting, and performance information system or dashboard. Both cases also tied budget requests to plans, closed the loop from monitoring to planning, managed resource gaps by prioritization and phasing, and framed management control as support for mission and culture, not only compliance: "A mature performance system should distinguish between a problem that needs correction and a person who needs blame" (A6). The differences followed governance. Only Case A named public accountability and legal controls as its distinctive feature, while only Case B named mission identity, revenue exposure, and a compact, personal structure that "can make coordination fast, but it also requires us to formalize systems so that institutional knowledge is not concentrated in a few people" (B2).

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Table 4 Main Cross-Case Themes

Cross-case theme	Case A	Case B	Pattern
Plans, commitments, and external requirements guide direction	6 of 6	6 of 6	Similarity; Case A uses more formal instruments
Budget requests linked to plans, targets, and priorities	6 of 6	6 of 6	Similarity; Case B adds a sustainability test
Rule-based controls and documentation secure accountability	4 of 6	6 of 6	Similarity in practice; rule source differs (government vs. institutional)
Monitoring results feed the next planning and budgeting cycle	6 of 6	4 of 6	Similarity; Case B loop less systematically tracked
Multiple control points and handoffs slow processes	5 of 6	1 of 6	Difference
Short communication lines speed work but informality limits standardization	–	5 of 6	Case B only
Revenue sensitivity and sustainability shape financial decisions	–	3 of 6	Case B only
External review findings drive action	–	3 of 6	Case B only
Public accountability and legal controls shape management	6 of 6	–	Case A only
Integrated planning, budgeting, and performance information system recommended	6 of 6	5 of 6	Strongest convergence
Control as support for mission, culture, and judgment	6 of 6	3 of 6	Similarity

Note. Counts are the number of informants, out of six per case, whose coded excerpts carried the theme; – = theme not evident in that case.

Table 5 relates the findings to the propositions. Proposition 1 was supported for formality, since Case A worked through more numerous and more formal planning instruments, although centralization was not examined directly. Proposition 2 was supported: Case A anchored financial control in government rules and audit, while Case B informants described revenue sensitivity and faster internal decisions, although the evidence of flexibility came from two informants. Proposition 3 was partly supported, because Case A's monitoring was more formally documented and Case B's indicators were tied to enrollment and financial sustainability, but no informant mentioned reputation. Proposition 4 was supported as informants perceived it, since both cases carried monitoring results into the next plan, budget, or procedure and linked efficiency to the design of their controls; the study did not measure performance outcomes independently.

The cross-case pattern suggests that the two sectors face mirror-image control problems. The public college has strong formal controls whose number and sequencing slow its responsiveness, while the private college has responsiveness and cultural cohesion but insufficiently formalized procedures and follow-through. This is consistent with Malmi and Brown's (2008) view that controls work as a package, so that strength in one type cannot fully substitute for weakness in another, and with Simons's (1995) argument that diagnostic and interactive controls must be balanced. It also agrees with Carbonell's (2025) conclusion that governance, financial management, and strategic planning must be strengthened together if SUCs are to balance accountability with performance. The shared call for

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an integrated information system addresses the technological integration gap that recurs in the higher education MCS literature (Lambovska & Angelova-Stanimirova, 2025). These interpretations rest on informants' accounts from two institutions and should be read as analytic rather than statistical generalizations.

Table 5 Findings in Relation to the Research Propositions

Proposition	Evidence from the two cases	Finding
P1. Public and private HEIs differ in the formality and centralization of strategic planning.	Case A uses a layered set of formal instruments and a coordinating planning unit; Case B consults directly, and three informants say informal handling needs formalizing. Both cascade goals through meetings and memoranda.	Supported for formality; centralization not examined
P2. The private HEI is more flexible and revenue-sensitive in financial management; the public HEI is bound by public fund rules and audit.	Case A anchors control in government rules and COA audit and names public accountability as distinctive (6 of 6). Case B describes revenue sensitivity and faster internal decisions (B2, B3).	Supported; flexibility evidenced by two informants
P3. Public HEI monitoring is more formally documented; private HEI monitoring is tied to enrollment, reputation, and stakeholders.	Case A reports a formal, documented system in all six accounts. Case B ties indicators to enrollment, retention, financial sustainability, and regulator feedback; no informant mentions reputation.	Partly supported
P4. MCS implementation is related to organizational performance in both cases.	Both carry monitoring results into the next plan, budget, or procedure (6 of 6; 4 of 6). Efficiency is linked to the control system in both, and service feedback becomes corrective action.	Supported as perceived by informants

Proposed Management Control System Framework

Figure 1 presents the proposed framework. It is anchored on the institution's mission, vision, and core values and recognizes the distinct public and private contexts identified in the study. Its core is a cycle of five linked elements: (a) planning and goal setting through a leadership-directed, consultative, and evidence-based process; (b) resource allocation and financial control that links budget requests to plans and applies prioritization, phasing, and sustainability analysis; (c) implementation and operations through standardized processes, defined responsibilities, and shared tracking tools; (d) monitoring and performance evaluation with multidimensional indicators that value quality and delivered outputs over numbers or spending; and (e) feedback and corrective action in which recurring concerns are treated as process signals and actions are documented and carried into the next cycle. An integrated planning, budgeting, performance, and document-tracking information system supports all five elements. The framework is intended to strengthen efficiency, goal attainment, service delivery, and institutional effectiveness, with public HEIs emphasizing the reduction of avoidable delay within accountability rules and private HEIs emphasizing formalization and follow-through.

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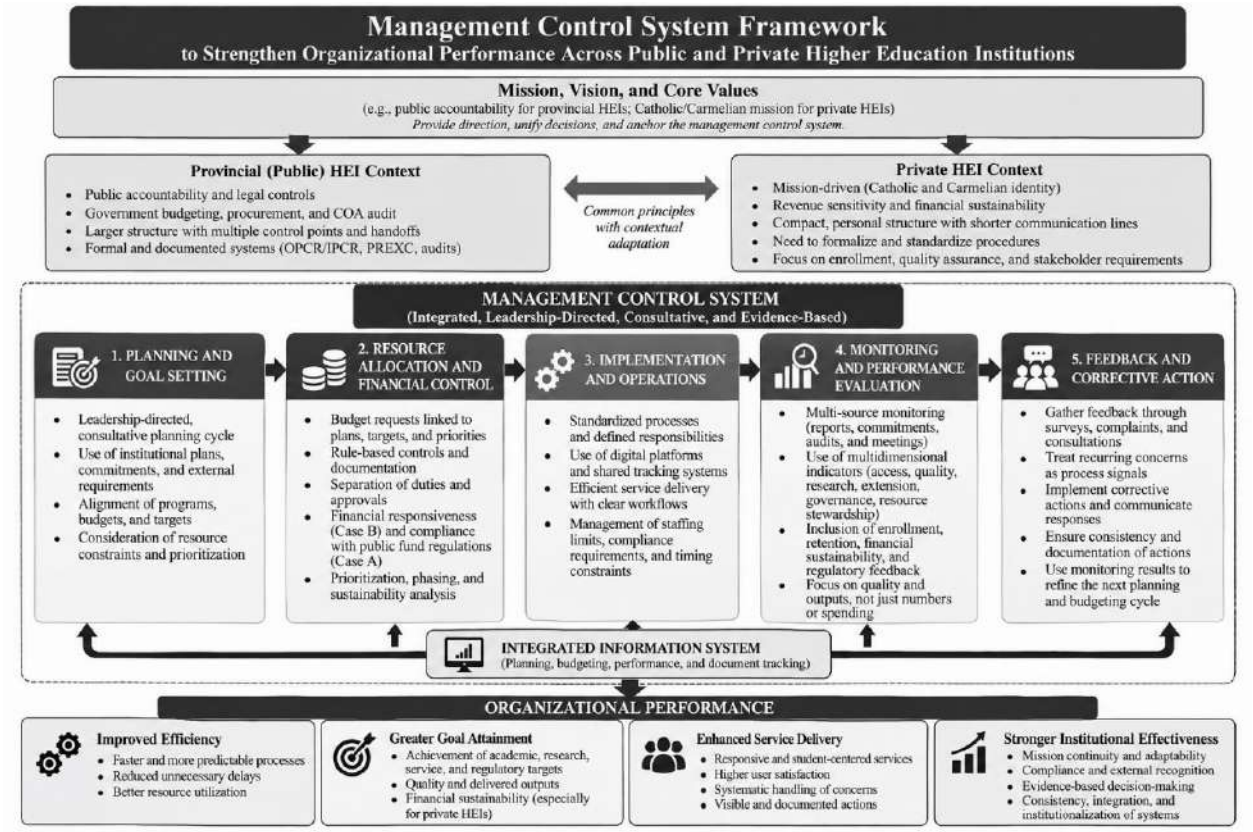


Fig.1: Proposed Management Control System Framework for Public and Private Higher Education Institutions

Note. Developed from the within-case and cross-case findings of the study.

Limitations

The study examined two institutions in one province, and its findings rest mainly on the accounts of six informants per case, so they support analytic rather than statistical generalization. Organizational performance was examined as informants described it, not through independently measured outcomes, and the relationship between MCS and performance was therefore not established causally. The informants were senior personnel, and the views of faculty, staff, and students were not included.

V. CONCLUSIONS AND RECOMMENDATIONS

The public state college implemented a formal, compliance-driven management control system of layered plans, government-regulated budgeting and audit, and documented performance monitoring, which secured accountability and traceability but lengthened processes through multiple control points and handoffs. The private college implemented a mission-guided, consultative, and revenue-sensitive system in which short communication lines supported quick decisions, but informal handling, uneven documentation, and weak tracking of corrective actions limited consistency. Both institutions integrated planning, financial management, and performance monitoring, tied budgets to plans, and fed monitoring results back into planning, and both identified an integrated information system as the most needed improvement. The relationships between management control and performance were perceived by informants rather than causally established. An integrated, five-element MCS framework adaptable to public and private contexts was proposed.

HEI administrators and governing boards may align planning, budgeting, and monitoring around shared institutional objectives and indicators while respecting the governance requirements of each sector. Planning, budget, and finance officers may develop an integrated planning, budgeting, and performance information system with request tracking to reduce fragmented records and repeated follow-up. In public HEIs, administrative and

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procurement units may review approval sequences to separate legally required controls from avoidable delay. In private HEIs, administrators may formalize routine workflows, document responses to stakeholder concerns, and track the completion of corrective actions so that good practice does not depend on particular individuals. Quality assurance offices and academic heads in both sectors may treat recurring concerns as process signals and verify that corrective actions produce measurable improvement. CHED may consider these sectoral differences in its capacity-building support for HEI governance. Institutions may pilot-test the proposed framework, and future researchers may validate it across more public and private HEIs, include faculty, staff, and student perspectives, and combine informant accounts with quantitative performance indicators.

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DECLARATION OF CONFLICT OF INTERESTS

The authors declare no conflict of interest. [Note to authors: the first author heads the planning and development unit of one of the participating institutions; consider disclosing this role here and describing how its influence was managed.

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Night-Time Rainfall and Free-Flow Speed on Two-Way Highway with No Light: Implications for Travel Time

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Abstract *— Travel time is an intrinsic measure used in assessing roadway performances and it is affected by environmental factors such as weather changes. The study investigates the implication of nighttime rainfall on travel time of a two-way highway without light. In Akure, for a period of eight weeks, rainfall and traffic data were obtained across four different sites. The data obtained were filtered, sorted into dry and night-time conditions. Observed traffic volumes were converted to flows using modified passenger car equivalent values. Subsequently, regression methodologies were employed to establish functional relationships between flow and traffic density. For all the models obtained, the coefficient of determinant R^2 varies between 0.79 and 0.98 for all the weather conditions across the four sites. The R^2 values were greater than 0.5, which confirmed that the models were satisfactory for prediction. The results obtained show significant decrease in free-flow speed with corresponding increase in travel time for rainy nighttime. Travel time increased as rainfall intensity increases. The average travel time for dry nighttime was 0.73 min, which increased to 0.78 min (6.8%) for light rain, 0.81 min (11.0%) and 0.96 min (31.5%) for heavy rain. Heavy rainfall intensity has a more significant effect on travel time increase as compared to other rainfall intensities. The paper concludes that the influence of rainfall as a weather factor is evident on roadways without light, hence the combination of rainfall and darkness impacts travel time greatly. Irrespective of rainfall intensity, travel time increases under nighttime condition of a two-way highway.*

Keywords *—* ***Nighttime, rainfall, traffic flow, travel time, two-way highway***

I. INTRODUCTION

Highways are regarded as an important element of transportation and as a means of communication. It serves as a vital connection between other types of transportation mode hence it is expected that traffic flow on such highway should be safe, efficient and be with little or no delay as the case maybe. However, it had been discovered that traffic movement on highways is often time incapacitated due to many influencing factors such as traffic, roadway, weather conditions amongst others. These factors affect traffic behaviour in terms of both its microscopic and macroscopic properties.

Weather events are a global phenomenon in which their occurrence varies from place to place over time. Its impacts either constructively or otherwise. This weather event occurs in various forms such as fog, wind, darkness and rainfall with varying intensities of either being mild or harsh. Rain as a weather condition may occur in terms of its intensity such as light rainfall, moderate rainfall, heavy and at times very heavy. Rainfall occurrence during driving

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on the roadway calls for attention and study as it affects the performance of the road and its services. Makinde and Ben-Edigbe (2020) reported reduction in travel speed on a two-way road because of weather (rainfall) condition.

Darkness is another weather condition that occurs due to the absence of naturally occurring light. It is a natural phenomenon that cannot controlled by man however it could be mitigated using artificial lighting. Gallen et. al. (2015) reported that larger proportion of road accidents occur during nighttime due to altered visibility. The Highway Capacity Manual recognized darkness as a contributing factor capable of affecting traffic parameters with consequent reduction in roadway capacity though the quantification in terms of the effect remains limited. It is therefore correct to say the combination of rainfall and darkness will significantly affect traffic on roadways in terms of safety and operations. Anarkooli and Hosseilou (2016) reported that roadways without road lighting are prone to accident occurrence while drivers travel at lower speeds on such roads.

Many research works have reported different influences of weather, especially rainfall on traffic flow parameters in terms of travel, speed, headway, service quality, capacity and many more. Ibijola 2018 studied the impact of rainfall on quality of service at multilane roundabouts and reported a significant adverse effect on functional quality service at roundabout. Oyaro and Ben-Edigbe (2020) considered the impact of rainfall on capacity loss at signalised intersection and reported speed reduction at signalised intersections while Makinde 2020 assessed the influence of rainfall on service quality of road without light and reported significant deterioration of service quality.

As travel time is an intrinsic measure used in assessing roadway performance, little is known about it relative to weather influence, hence this leaves a research gap. This research is therefore aimed at studying the effect of both nighttime and rainfall combined with travel time of a two-lane highway.

The rest of this paper is presented as thus – section two is the literature review while section three gives the methodology of the research. Section four is for results and discussions while conclusion and recommendations are presented in section five.

II. THEORY

A two-way highway is complex in nature due to the bidirectional nature of traffic flow. The complexity gives rise to the possibility of head-on collisions amongst drivers. This raises the question of safety risks which become more complicated when considering weather conditions such as rainfall and darkness on such roadways.

Rainfall is a spatiotemporal naturally occurring weather condition capable of affecting traffic flow on the roadways. One common effect of rainfall on traffic flow is poor visibility. Driving on roads while the rain is falling impairs the vision of drivers, however the extent of the impact is subjected to the intensity of the rainfall. The consequent effects of rainfall during driving often lead to various impacts such as speed reduction and headway increase amongst others. These impacts affect the behaviour of traffic in terms of its parameters on roadways. Mathew and Pulugurtha (2022) reported that rainfall and poor visibility disrupt the performance of road operation in different ways. Tobin et al. 2019 reported that 8.6% of vehicle-related fatalities occurred during rainfall occurrences on roadways.

Speed, headways, flow and density are the major traffic flow parameters in designing highways, but travel time is considered paramount for use in assessing the service performance of a roadway. Past studies were centred on the influence of rainfall on the major traffic flow parameters with little report on travel time. The few literatures on travel time were focused on freeways. Zhang and Chen (2019) reported that the impact from weather events is more prominent on the reliability of travel time.

Travel time according to HCM 2020 is defined as the average time a vehicle traverse through a segment of a roadway. It is useful in measuring and assessing the performances of a roadway in terms of its delivery either qualitatively or quantitively. Travel time is useful to both the highway designers, traffic planners and the road users as everyone desires to accomplish a journey within the shortest possible time with little or no delay. Thus, the time taken to traverse a road length is a function of road, traffic and weather conditions. Travel time used in conjunction with delay and capacity is useful in measuring the effectiveness of roadways (Mashros et al. 2012). The general travel time equation is given as

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$$t = \frac{d}{u} \quad 1$$

where t = travel time, d = distance travelled and u = speed of travelling

According to the US Bureau of Public Roads (US-BPR), travel time over a length of a roadway could be determined using equation 2

$$T = t_f[1 + \rho(x)^{\beta}] \quad 2$$

where T = travel time for the length of the roadway

t_f = travel time at free flow speed

ρ = ratio of free-flow speed to the speed at capacity

β = abrupt drop of curve from the free flow speed

x = degree of saturation (v/Q)

v = demand flow $(q = uk)$

Q = roadway capacity taken as 80% of actual capacity

In determining ρ and β, the 1965 BPR version suggested $p = 0.14$ and $\beta = 4$ in solving travel time however more studies by Dowling and Skarbadonis (1993) on the BPR curve faulted the underestimation of the values of ρ and β. They suggested higher values of $p = 0.2$ and $\beta = 10$, therefore equation 2 can be re-written as

$$T = t_f[1 + 0.2(x)^{10}] \quad 3$$

Recall that $x = v/Q$, therefore equation 3 becomes

$$T = t_f\left[1 + 0.2\left(\frac{v}{Q}\right)^{10}\right] \quad 4$$

For this paper, the condition considered is the free flow situation where drivers choose their individual speed because of no vehicles on the road. The capacity Q in equation 4 is defined as the maximum hourly flow rate at which vehicles or persons are expected to pass a certain point or a uniform section of a roadway for a certain period under prevailing roadway and traffic conditions (HCM 2020) is obtainable using the fundamental flow diagram. Estimating the capacity is possible using different methods such as headway, selected maxima, product limit, fundamental diagram. The choice of capacity estimation method depends on the available data, hence, for this paper, the availability of enough empirical data encouraged the adoption of the fundamental diagram method. The fundamental flow diagram features the relationship that co-exists amongst the three basic traffic parameters. The relationships are bi-variable in nature and exist as flow-density, speed-density and speed-flow diagrams as shown in figure 1.

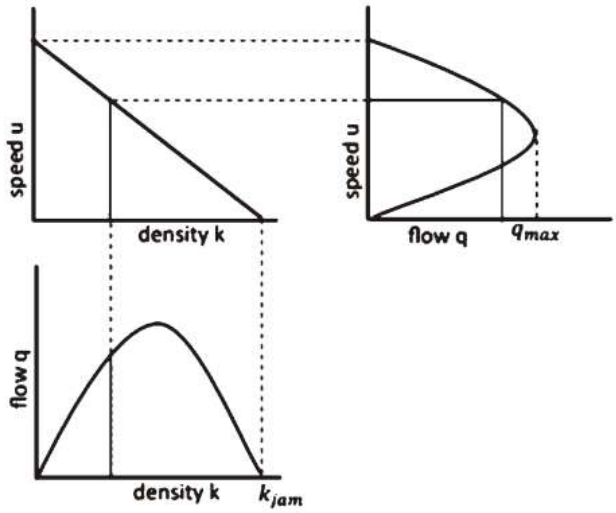


Fig.1: Fundamental flow diagram showing the bi-variable relationship of flow, density and speed

In analysing the relationships, the speed-density is a linear function (Greenshield, 1934) as given in equation 5

$$u = u_f - \varphi k \quad 5$$

where u = mean speed, u_f = free-flow speed, φ = coefficient = $\frac{u_f}{k_j}$, k = density

equation 5 is further written as

$$u = u_f - \frac{u_f}{k_j}k$$

The flow-density is represented using quadratic equation (equation 6) while the speed-density is a linear function (Greenshield, 1934) as given in equation 6 however the speed-flow cannot prescribe any model equation because the graph is not a function. Wang and Luo (2016) studied the impact of rainfall on freeway traffic flow using the speed-density distribution. They reported decrease in flow rate and free flow speed as rainfall intensity increases. The flow-density relationship had been used by various studies to analyse traffic stream relationships. Ipindola and Falana (2019) and Makinde (2020) reported the suitability of the flow-density relationship to study traffic streams on a two-lane highway. The flow-density relationship is given as

$$q = -ak^2 + bk - c \quad 6$$

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where q = flow, k = density

Based on the usefulness of the flow-density relationship, it is possible to determine density (both jam and critical), their corresponding speed values and roadway capacity, therefore equation 6 is further expressed to give equation 7

$$Q = -\frac{v_f}{k_j}\left(\frac{v_f}{2\left(\frac{v_f}{k_j}\right)}\right)^2 + (v_f)\frac{v_f}{2\left(\frac{v_f}{k_j}\right)} - c \qquad 7$$

Equation 7 is inserted into equation 4 to give equation 8

$$T = t_f\left[1 + 0.2\left(\frac{v}{Q}\right)^{10}\right] \Rightarrow T = t_f\left[1 + 0.2\left(\frac{v}{-\frac{v_f}{k_j}\left(\frac{v_f}{2\left(\frac{v_f}{k_j}\right)}\right)^2 + (v_f)\frac{v_f}{2\left(\frac{v_f}{k_j}\right)} - c}\right)^{10}\right] \qquad 8$$

According to Makinde and Ben-Edigbe (2019), equation 8 can be used to estimate travel time. They further stated that the equation is suitable for both rainy and dry conditions during daylight and night-time periods.

III. METHODOLOGY

The method employed for this research study was collection of empirical data which were obtained from four selected roadways sites in Akure, Nigeria. The selected sites were ensured to be sites with good road pavement, devoid of all forms of distractions and unusual illumination. The lighting used at night during data collection solely relied on car headlamps as this helped to ensure that the darkness condition was maintained to achieve the research objectives. Traffic data was collected continuously using automatic traffic counter (ATC) machine which was placed across the selected roadways. The ATC had two pneumatic tubes placed across the roadway and laid 1m apart. For the rainfall data, the use of rain gauge was employed, the precipitation data from it retrieved and converted into rainfall intensity according to using World Metrological Organization (WMO) standard.

Traffic data were separated into both daylight (from 5am to 6pm) and nighttime (6pm to 5am). The nighttime period of 6pm to 5am was used in sorting the rainfall data into its respective intensity based on the WMO standard. The WMO rainfall intensity i standard is light rain (i < 2.5mm/hr), moderate rain (2.5 ≤ i < 10 mm/hr), heavy rain (10 ≤ i < 50 mm/hr) and very heavy rain (i > 50mm/hr). The very heavy rain for this study was disregarded because of possible drag force and aquaplaning. Traffic and rainfall data between the hours of 12 am to 5 am were not considered due to inconsistency in traffic flow.

IV. RESULTS AND DISCUSSION

The method used in analysing data was simple and clear enough for proper understanding. Both rainfall and traffic data obtained were separated into daylight and darkness periods using the time frame allotted to each. Traffic data under the nighttime period were separated into data with and without rainfall. The rainfall during the nighttime period was separated into light rain, moderate rain and heavy rain intensities and synchronised with traffic data with rainfall that corresponds with each rainfall intensity.

The synchronised traffic data for each rainfall intensity was further divided into passenger cars, light vehicles and heavy vehicles to allow for proper configuration of the vehicles involved in obtaining the traffic volume. The traffic volume was converted into traffic flow using the appropriate passenger car equivalent which was modified to reflect the prevailing condition under which the data was obtained. Subsequently, regression methodologies were employed to establish functional relationships between free-flow speed and traffic density.

Using equation $q = uk$, density was obtained for typical speed and its corresponding flow as shown in table 1 below. Density was obtained for all conditions of dry and varying rainfall intensity conditions at nighttime.

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Table 1: Dry nighttime condition for site 1

Period	PC	MV	HV	vol	MV	HV	Q	q	u	k
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
					*3*1.15*	*4*1.34*	*2+6+7*	*8 *12*		*9/10*
1	72	7	4	83	8.05	5.36	85.41	1025	73	14
2	74	4	5	83	4.6	6.7	85.3	1024	65	16
3	67	7	3	77	8.05	4.02	79.07	950	63	15
4	60	10	5	75	11.5	6.7	78.2	938	66	14
5	84	5	7	96	5.75	9.38	99.13	1190	65	18
6	68	5	5	78	5.75	6.7	80.45	965	73	13
7	52	3	3	58	3.45	4.02	59.47	713	65	11
8	53	2	2	57	2.3	2.68	57.98	700	68	10
9	61	9	6	76	10.35	8.04	79.39	952	69	14
10	75	8	4	87	9.2	5.36	89.56	1075	64	17
11	69	6	4	79	6.9	5.36	81.26	975	65	15
12	55	2	1	58	2.3	1.34	58.64	703	74	10

Note: 1, 2, 3...11 = column numbers, column 2 – 5 = volume by 5mins, column 6 - 8 = flow (pce/5mins), q = total flow (pce/h.), u = speed (km/h), k = density (pce/km), PC = passenger car, MV = medium vehicle, HV = heavy vehicle

Density and flow for each weather condition were related graphically (fig 2) to obtain the quadratic model given in equation 9. The statistical testing of the model confirmed that the coefficient of determinant $R^2 = 0.93$ was more than 0.5 with a t-test greater than 2.2. The results of the statistical test showed that the variables are significant, hence the models are satisfactory for event prediction.

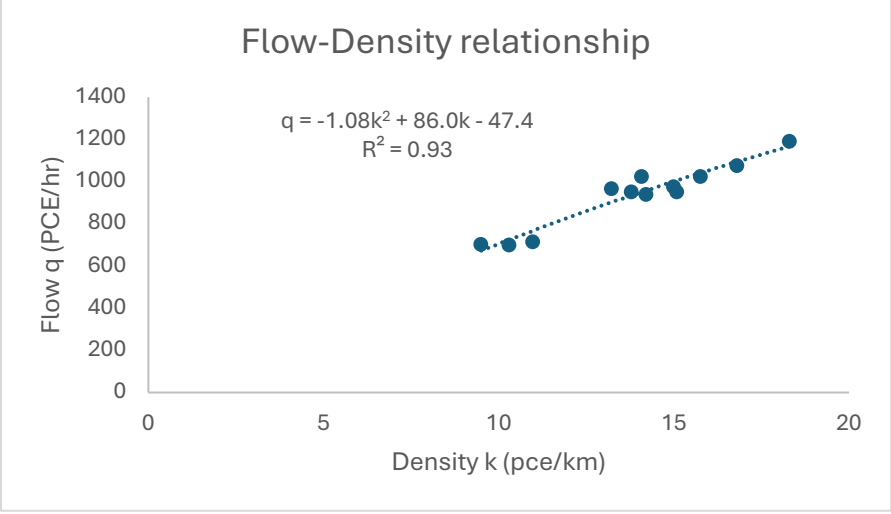


Fig 2: Graphical representation of flow-density relationship

Consider the model equation of the dry night condition as given in equation 9,

$$q = -1.08k^2 + 86.0k - 47.4 \quad (9)$$

The equation was differentiated to determine the critical density, and its corresponding capacity is shown below.

$$\frac{dq}{dk} = -2 * 1.08k + 86.0 = 0$$

$$-2.16k + 86.0 = 0$$

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$$k_c = \frac{86.0}{2.16} = 39.8pce/km$$

Insert the value of k_c obtained into equation 9 to obtain maximum capacity

$$q = -1.08k^2 + 86.0k - 47.4$$

$$q = -1.08 * (39.8)^2 + 86.0 * 39.8 - 47.4$$

$$q = 1664.63pce/h$$

Furthermore, the maximum speed was calculated using equation $q = uk \Leftrightarrow u = \frac{q}{k}$

$$u = \frac{q}{k} = \frac{1664.63}{39.8}$$

$$u = 41.8km/h$$

Recalling equation 8, the travel time is thus obtained as

$$T = t_f\left[1 + 0.2\left(\frac{v}{Q}\right)^{10}\right] \Rightarrow T$$

$$= t_f\left[1 + 0.2\left(\frac{v}{-\frac{v_f}{k_j}\left(\frac{v_f}{2\left(\frac{v_f}{k_j}\right)}\right)^2 + (v_f)\frac{v_f}{2\left(\frac{v_f}{k_j}\right)} - c}\right)^{10}\right]$$

The free flow speeds and travel times for all weather conditions of the selected sites are summarised and presented in tables 2 - 5

Table 2: Free flow speeds and travel times for site 1

Weather condition	Flow-density relationship equation	R^2	Free flow u_f	Travel time T (min)
Dry NT	$-1.08k^2 + 86.0k - 47.4$	0.93	86.0	0.75
Light rain NT	$-1.01k^2 + 81.7k - 43.9$	0.92	81.7	0.79
Moderate rain NT	$-0.96k^2 + 79.4k - 18.2$	0.94	79.4	0.81
Heavy rain NT	$-0.92k^2 + 69.4k - 16.4$	0.86	69.4	0.93

Table 3: Free flow speeds and travel times for site 2

Weather condition	Flow-density relationship equation	R^2	Free flow u_f	Travel time T (min)
Dry NT	$-1.07k^2 + 88.9k - 63.9$	0.92	88.9	0.72
Light rain NT	$-1.03k^2 + 78.9k - 40.1$	0.84	78.9	0.81
Moderate rain NT	$-1.02k^2 + 72.8k - 8.0$	0.79	72.8	0.88
Heavy rain NT	$-1.08k^2 + 70.2k - 18.5$	0.85	70.2	0.92

Table 4: Free flow speeds and travel times for site 3

Weather condition	Flow-density relationship equation	R^2	Free flow u_f	Travel time T (min)
Dry NT	$-0.99k^2 + 93.5k - 89.0$	0.86	93.5	0.67
Light rain NT	$-1.14k^2 + 80.2k - 0.24$	0.98	80.2	0.80
Moderate rain NT	$-1.05k^2 + 75.5k - 2.42$	0.87	75.5	0.85
Heavy rain NT	$-1.11k^2 + 71.4k - 2.93$	0.98	71.4	0.90

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Table 5: Free flow speeds and travel times for site 4

Weather condition	Flow-density relationship equation	R^2	Free flow u_f	Travel time T (min)
Dry NT	$-1.11k^2 + 87.9k - 13.7$	0.88	87.9	0.73
Light rain NT	$-0.91k^2 + 82.1k - 86.3$	0.90	82.1	0.78
Moderate rain NT	$-1.03k^2 + 78.9k - 21.9$	0.87	78.9	0.81
Heavy rain NT	$-1.09k^2 + 67.3k - 15.6$	0.89	67.3	0.96

From the tables for the four sites considered, the R^2 values for the flow-density relationship equations were above 0.5 which implies that the variables are significant.

At site 1, the free-flow speeds and travel times varied for the identified weather conditions. The free-flow speed decreases as the condition changes from dry nighttime to rainy nighttime while travel time increases as the weather changes from dry nighttime to rainy nighttime. Free flow speed of 86 km/h with a corresponding travel of 0.75 minutes was obtained for the dry nighttime condition. For the rainy nighttime condition, the travel time is 0.79 minutes for light nighttime rainfall, 0.81 minutes for moderate nighttime rainfall and 0.93 minutes for heavy nighttime rainfall. The difference in travel time is 0.04 minutes (5.3%) for light rain intensity, 0.06 minutes for moderate rain intensity while heavy rain intensity is 0.18 minutes (24%)

In similar manner, sites 2, 3 and 4 also experienced decrease in free-flow speed with corresponding increase in travel time as the conditions change from dry nighttime to rainy nighttime. The decrease in free-flow speed and increase in travel time do not follow any trend in terms of the differences, however a significant increase in travel time under heavy rainfall intensity was observed across the four sites as presented in table 6.

Table 6: Summary of change in travel time across the four sites

Site	Weather condition	Free flow speed	Travel time	Change in travel time	Percentage change in travel time
1	D - NT	86.0	0.75		
	LR - NT	81.7	0.79	0.04	5.3
	MR - NT	79.4	0.81	0.06	8.0
	HR - NT	69.4	0.93	0.18	24.0
2	D - NT	88.9	0.72		
	LR - NT	78.9	0.81	0.09	12.5
	MR - NT	72.8	0.88	0.16	22.2
	HR - NT	70.2	0.92	0.20	27.8
3	D - NT	93.5	0.67		
	LR - NT	80.2	0.80	0.13	19.4
	MR - NT	75.5	0.85	0.18	26.9
	HR - NT	71.4	0.90	0.23	34.3
4	D - NT	87.9	0.73		
	LR - NT	82.1	0.78	0.05	6.9
	MR - NT	78.9	0.81	0.08	11.0
	HR - NT	67.3	0.96	0.23	31.5

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Considering the changes in travel time across the four sites, the average increase in travel time for light-rain nighttime condition is 0.08 min (11%), moderate rain nighttime accounts for 0.12 min (16.7%) while the heavy rain nighttime is 0.21 min (29.2%). Heavy rainfall intensity is of more significant impact on travel time as compared to both light rain and moderate rain intensities.

V. CONCLUSION

Driving on roadways without light at night experiences many challenges while the addition of rainfall with the absence of light aggravates the problems. This paper addresses the impact of nighttime rainfall on travel time of a two-way highway without light. The result of the study shows significant impact of nighttime rainfall on travel speed.

Travel time increases as rainfall intensity increases, in which the increase is more pronounced with heavy rainfall intensity. Based on the evidence obtained between the nighttime rainfall and roadway without light, it is evident to conclude that rainfall encourages drivers to drive with less speed under a no-light condition on roadways. The reduction in speed leads to increase in the time spent on roadways under the condition of no-light on roadways.

It is therefore correct to say that travel time increases on a two-lane highway under nighttime rain irrespective of its intensity is correct. The cumulative effect of both rainfall and darkness on travel time is significant enough in the consideration of safety of road users by highway designers. In ensuring proper and efficient usage of road to enhance performance, road lightings are recommended to be made available to aid visibility under rainfall conditions at nighttime.

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