Challenges and Prescriptive Measures in the Utilization of Information and Communications Technology (ICT)

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ABSTRACT

The effective utilization of Information and Communications Technology (ICT) has become a critical determinant of organizational efficiency, transparency, and service delivery in public institutions. This study examined the challenges encountered in ICT utilization and the corresponding prescriptive measures within the Department of Public Works and Highways (DPWH) Iloilo 1st District Engineering Office. Using a quantitative, cross-sectional survey design, data were gathered from 130 employees selected through purposive sampling. The study employed descriptive and inferential statistics, including frequency, percentage, mean, Mann–Whitney U test, and Kruskal–Wallis H test. Findings revealed that employees experienced high levels of ICT-related challenges, particularly in stakeholder management, communication flow, coordination, and risk management. Significant differences in challenges were found when respondents were grouped according to status of employment and division, while no significant differences were observed across age, educational attainment, or length of service. Prescriptive measures received near-unanimous support across all classifications, indicating strong organizational consensus toward ICT reform. Moreover, no significant relationship was found between the level of challenges and prescriptive measures, suggesting that employees support reform regardless of the severity of difficulties encountered. The study concludes that ICT barriers in the organization are structural rather than individual in nature and recommends the establishment of a comprehensive ICT governance framework, capacity-building programs, and a unified digital transformation strategy to enhance institutional effectiveness.

Keywords: ICT utilization, public sector digitalization, prescriptive measures, organizational challenges, DPWH, ICT governance

INTRODUCTION

The rapid evolution of Information and Communications Technology (ICT) has fundamentally reshaped how public institutions deliver services, manage resources, and engage stakeholders. In contemporary governance, ICT is no longer viewed as a supplementary administrative tool but as a core infrastructure that enables transparency, accountability, coordination, and efficiency in public service delivery (United Nations, 2022; OECD, 2021). Governments across the world are increasingly expected to harness digital technologies not only to streamline internal operations but also to enhance responsiveness, accessibility, and citizen trust through data-driven and technology-enabled systems (World Bank, 2020).

In the Philippine context, the Department of Public Works and Highways (DPWH) plays a crucial role in national development through the planning, implementation, and maintenance of infrastructure projects. Given the scale and complexity of its mandate, effective ICT utilization is essential for ensuring timely project execution, accurate documentation, efficient resource management, and coordinated communication among internal units and external stakeholders. National policies on e-governance and digital transformation emphasize the importance of ICT integration in government agencies to improve operational efficiency and public accountability (Department of Information and Communications Technology [DICT], 2022). However, despite sustained investments in digital tools and platforms, many public organizations continue to encounter challenges in embedding ICT into everyday workflows.

Previous studies have shown that ICT implementation in the public sector is often constrained not by technology itself but by organizational, procedural, and structural factors such as fragmented coordination, unclear policies,

resistance to change, and limited institutional support (Heeks, 2006; Cordella & Tempini, 2015). These challenges frequently result in underutilized systems, communication breakdowns, and inefficiencies that weaken the intended benefits of digital transformation. As such, ICT effectiveness depends not only on availability of hardware and software but also on governance structures, leadership commitment, and institutional readiness.

The DPWH Iloilo 1st District Engineering Office (1st DEO) reflects many of these realities. While ICT resources are present, their utilization is often shaped by organizational arrangements, workflow design, and inter-unit coordination rather than by employees' technical competence alone. Understanding these constraints requires a systematic examination of both the challenges encountered by personnel and the prescriptive measures they perceive as necessary to improve ICT utilization. Such an examination aligns with systemsoriented perspectives that view organizations as interconnected structures in which technological performance is influenced by human, procedural, and managerial subsystems (Bertalanffy, 1968).

This study therefore investigates the challenges in ICT utilization within the DPWH Iloilo 1st District Engineering Office and identifies corresponding prescriptive measures that may serve as a strategic framework for organizational improvement. By analyzing perceptions across age, employment status, educational attainment, length of service, and section, the study aims to generate empirical evidence that can inform policy direction, strengthen institutional capacity, and support sustainable digital transformation in public service delivery.

THEORETICAL FRAMEWORK

This study is anchored on General Systems Theory, as advanced by Ludwig von Bertalanffy (1968), which conceptualizes an organization as an integrated system composed of interrelated and interdependent components that continuously interact with one another and with their external environment. According to the theory, a system functions holistically rather than as a collection of isolated parts; any change in one component inevitably affects the performance and behavior of the whole system. In organizational settings, these components include people, structures, processes, technologies, and policies, all of which must function in coordination to achieve efficiency and stability.

Applied to the context of Information and Communications Technology (ICT) utilization, General Systems Theory provides a useful lens for understanding that technological challenges do not arise solely from individual limitations or technical deficiencies. Instead, such challenges emerge from the dynamic interactions among organizational subsystems, including governance structures, workflow arrangements, communication mechanisms, leadership practices, and institutional culture (Bertalanffy, 1968; Katz & Kahn, 1978). ICT systems therefore operate not as stand-alone tools but as embedded components within a broader organizational ecosystem that shapes how technologies are adopted, used, and sustained.

Within this framework, ICT utilization may be understood through three interconnected system components: inputs, transformation processes, and outputs. Inputs include resources such as ICT infrastructure, policies, training programs, human capital, and institutional support. Transformation processes involve the actual use, coordination, monitoring, and management of ICT in daily operations, including communication flows, data handling, decision-making, and inter-unit collaboration. Outputs consist of improved service delivery, transparency, accountability, efficiency, and responsiveness to stakeholders (Bertalanffy, 1968; Laudon & Laudon, 2022).

General Systems Theory also emphasizes the role of feedback mechanisms, which allow organizations to assess performance and adjust policies or practices accordingly. Feedback serves as a corrective loop that enables learning, adaptation, and continuous improvement (Skyttner, 2005). In this study, the identified prescriptive measures function as feedback-driven responses designed to address observed ICT challenges. These measures represent organizational efforts to restore balance, enhance coordination, and improve system performance through policy reform, capacity building, infrastructure development, and governance mechanisms.

By examining ICT challenges and prescriptive measures across demographic and organizational variables—such as age, employment status, educational attainment, length of service, and division—this study adopts a

systemic perspective that recognizes variation in roles and functional responsibilities within the organization. Such an approach aligns with the systems view that subsystems may experience differing pressures and constraints while remaining part of a unified organizational whole (Kast & Rosenzweig, 1972).

Through the lens of General Systems Theory, ICT-related challenges are therefore conceptualized as manifestations of systemic imbalance, while prescriptive measures are viewed as corrective mechanisms aimed at restoring equilibrium, coherence, and functional integration. This framework enables a holistic understanding of ICT utilization in the DPWH Iloilo 1st District Engineering Office and supports the development of evidence-based strategies for sustainable digital transformation in public service delivery.

Objectives of the Study

General Objective

To determine the challenges and prescriptive measures in the utilization of Information and Communications Technology (ICT) in the Department of Public Works and Highways (DPWH) Iloilo 1st District Engineering Office.

Specific Objectives

Specifically, this study seeks to:

1. Determine the profile of the respondents in terms of age, status of employment, educational attainment, length of service, and section.

2. Identify the challenges encountered in the utilization of ICT as assessed by the respondents when taken as a whole and when classified according to age, status of employment, educational attainment, length of service, and section.

3. Determine the prescriptive measures that may serve as a strategic framework for improving ICT utilization when respondents are grouped according to the same profile variables.

4. Determine whether there are significant differences in ICT challenges when respondents are classified according to age, status of employment, educational attainment, length of service, and section.

5. Determine whether there are significant differences in prescriptive measures when respondents are classified according to age, status of employment, educational attainment, length of service, and section.

6. Determine whether a significant relationship exists between ICT challenges and prescriptive measures.

METHODOLOGY

Research Design

The study employed a **quantitative research design** using a **cross-sectional survey approach**. This design enabled the systematic collection of numerical data describing the current conditions of ICT utilization at a single point in time. Quantitative methods were deemed appropriate for identifying patterns, comparing group differences, and testing relationships among variables related to ICT challenges and prescriptive measures.

Participants and Locale

The respondents of the study were **130 employees of the Department of Public Works and Highways (DPWH) Iloilo 1st District Engineering Office** for the year 2024. Purposive sampling was employed to select participants who were directly involved in or affected by ICT utilization in their daily work. Respondents came from various sections, including the Office of the District Engineer, Administrative, Finance, Construction, Maintenance, Planning and Design, and Quality Assurance.

Research Instruments

A structured survey questionnaire was used as the primary data-gathering instrument. It consisted of three parts:

- **Part I:** Profile of respondents (age, status of employment, educational attainment, length of service, and section).
- **Part II:** Fifteen (15) items measuring challenges in ICT utilization, answered in a dichotomous (Yes/No) format.
- **Part III:** Fifteen (15) items on prescriptive measures for improving ICT utilization, also answered using a dichotomous format.

The instrument was pilot-tested among 30 DPWH personnel from Bacolod City who were not part of the actual respondents to ensure clarity and reliability.

Data Gathering Procedure

Permission to conduct the study was secured from the appropriate authorities. After approval, questionnaires were distributed personally and through official coordination channels. Respondents were informed of the purpose of the study, assured of confidentiality, and allowed sufficient time to complete the instrument.

Completed questionnaires were retrieved, checked for completeness, and prepared for statistical analysis.

Data Analysis

The following statistical tools were used:

- **Frequency and Percentage** to describe respondent profiles and summarize responses.
- **Mean** to determine the overall level of challenges and prescriptive measures.
- **Mann–Whitney U Test** to determine differences between two independent groups.
- **Kruskal–Wallis H Test** to determine differences among more than two groups.

All statistical analyses were conducted using appropriate statistical software, with a 0.05 level of significance.

RESULTS AND DISCUSSION

Table 1. Profile of the Respondents

Profile Variable	Category	f	%
Age	Under 30	56	43.1
	30–50	46	35.4
	51 and above	28	21.5
Status of Employment	Permanent	78	60.0
	Contractual	52	40.0
Educational Attainment	Bachelor's Degree	116	89.2
	Master's Degree	14	10.8

Length of Service	Less than 5 years	52	40.0
	5–15 years	49	37.7
	More than 15 years	29	22.3
Section	Office of the District Engineer	15	11.5
	Administrative	15	11.5
	Finance	9	6.9
	Construction	25	19.2
	Maintenance	16	12.3
	Planning and Design	30	23.1
	Quality Assurance	20	15.4
Total		**130**	**100.0**

Table 1 presents the demographic profile of the respondents from the DPWH Iloilo 1st District Engineering Office. Most respondents belong to the younger and middle-age groups, indicating a relatively active workforce capable of adapting to technological demands. A majority are permanent employees, suggesting organizational stability and continuity in institutional operations. Most respondents hold bachelor's degrees, while a smaller proportion have completed graduate studies, reflecting moderate academic advancement within the agency. In terms of length of service, the distribution shows a balance between newer and more experienced employees, allowing for varied perspectives on ICT utilization. Representation across divisions ensures that the findings reflect both administrative and operational realities of the organization.

Table 2. Challenges in the Utilization of ICT (Overall Results)

Indicator	f	%	Rank
Challenges in addressing stakeholder concerns	125	98.4	1
Problems in securing stakeholder buy-in	124	97.6	2
Challenges in providing timely updates	123	96.9	3
Challenges in developing risk strategies	121	95.3	4
Problems in identifying risks	120	94.5	5
Issues in managing vendor contracts	121	95.3	4
Difficulties in cross-team communication	117	92.1	8
Struggles in project coordination	116	91.3	9
Problems in setting timelines	113	89.0	10
Difficulties in resource allocation	114	89.8	9
Issues in quality control	103	81.1	11
Difficulties in maintaining quality standards	100	78.7	12

Table 2 shows that respondents experienced a very high level of challenges in ICT utilization, particularly in areas related to stakeholder engagement, coordination, and communication. The highest-ranked challenges—addressing stakeholder concerns, securing buy-in, and providing timely updates—suggest that ICT-related issues are deeply embedded in coordination processes rather than purely technical limitations. High ratings for risk identification and vendor management further indicate that ICT systems are closely tied to project governance and accountability mechanisms. Overall, the findings imply that ICT challenges are systemic in nature and linked to organizational processes that require integrated planning, communication, and policy alignment.

Table 3. Challenges in ICT Utilization When Classified According to Age

Age Group	Level of Challenge	Interpretation
Under 30	Very High	Strong exposure to coordination and communication issues
30–50	Very High	High involvement in ICT-dependent functions
51 and above	High to Very High	Increased difficulty in resource and workflow management

Across all age groups, respondents reported high to very high levels of ICT-related challenges. This indicates that ICT issues are not confined to generational gaps or technological unfamiliarity. Younger employees, despite being digitally inclined, still experience challenges due to systemic constraints, while older employees encounter similar difficulties due to procedural complexity. The consistency across age groups supports the view that ICT barriers stem from institutional structures rather than individual capacity.

Table 4. Challenges in ICT Utilization When Classified According to Status of Employment

Status of Employment	Level of Challenge	Interpretation
Permanent	Very High	Greater exposure to coordination and accountability demands
Contractual	High to Very High	Limited access and restricted system involvement

The results indicate a significant difference in ICT challenges based on employment status. Permanent employees reported higher exposure to ICT-related challenges, likely due to their greater involvement in decision-making, coordination, and project supervision. Contractual employees, while still affected, may have limited system access or narrower task scopes. This finding underscores how organizational roles shape ICT experience and highlights the need for inclusive system access and standardized procedures.

Table 5. Challenges in ICT Utilization When Classified According to Educational Attainment

Educational Attainment	Level of Challenge	Interpretation
Bachelor's Degree	High to Very High	Broad exposure to operational ICT demands
Master's Degree	Very High	Greater engagement in planning and coordination roles

Regardless of educational attainment, respondents experienced substantial ICT-related challenges. Those with graduate degrees reported consistently high levels, likely reflecting their involvement in supervisory and planning functions. This suggests that advanced education does not insulate employees from systemic ICT constraints and reinforces the notion that challenges are organizational rather than individual.

Table 6. Challenges in ICT Utilization When Classified According to Length of Service

Length of Service	Level of Challenge	Interpretation
Less than 5 years	Very High	Adjustment to systems and procedures
5–15 years	High to Very High	Exposure to operational and coordination burdens
More than 15 years	Very High	Responsibility for oversight and compliance

All tenure groups reported high levels of ICT-related challenges, indicating that years of service do not significantly reduce difficulties in ICT utilization. Long-serving employees face challenges associated with oversight and accountability, while newer employees encounter difficulties adapting to institutional systems.

This pattern reinforces the need for organization-wide solutions rather than experience-based interventions.

Table 7. Challenges in ICT Utilization When Classified According to Section

Section	Overall Level of Challenge
Office of the District Engineer	Moderate to Very High
Administrative	Moderate to High
Finance	Moderate
Construction	Very High
Maintenance	Very High
Planning and Design	Very High
Quality Assurance	Very High

Operational divisions—particularly Construction, Planning and Design, and Quality Assurance—reported the highest levels of ICT-related challenges. These sections depend heavily on real-time data, coordination, and documentation, making them more vulnerable to system inefficiencies. Administrative and finance units reported comparatively moderate challenges, likely due to more standardized workflows. The findings highlight the uneven ICT burden across organizational units.

Table 8. Prescriptive Measures in ICT Utilization (Overall)

Prescriptive Measure Category	Level of Agreement	Interpretation
Governance and coordination mechanisms	99–100%	Very high
Capacity-building and training	99–100%	Very high
ICT infrastructure and software tools	99–100%	Very high
Communication platforms and feedback systems	99–100%	Very high
Risk management and monitoring systems	99–100%	Very high

Table 8 reveals near-unanimous agreement on all proposed prescriptive measures. Respondents strongly support governance reforms, capacity-building initiatives, improved ICT infrastructure, and stronger coordination mechanisms. This consensus reflects organizational readiness for digital transformation and indicates collective recognition of ICT as a strategic tool for improving efficiency and accountability.

Table 9. Prescriptive Measures Classified According to Age

Age Group	Level of Agreement	Interpretation
Under 30	Very High	Strong support for ICT reforms
30–50	Very High	Consistent endorsement
51 and above	Very High	Unified support despite age differences

All age groups demonstrated very high agreement on prescriptive measures, indicating that support for ICT reform transcends generational boundaries. This reinforces the finding that resistance to ICT initiatives is minimal and that organizational culture is generally receptive to change.

Table 10. Prescriptive Measures Classified According to Status of Employment

Status of Employment	Level of Agreement	Interpretation
Permanent	Very High	Strong institutional commitment
Contractual	Very High	High openness to reform

Both permanent and contractual employees showed strong consensus in supporting ICT-related reforms. This suggests shared recognition of existing limitations and a collective willingness to adopt improvements, regardless of employment security or role.

Table 11. Prescriptive Measures Classified According to Educational Attainment

Educational Attainment	Level of Agreement	Interpretation
Bachelor's Degree	Very High	Broad acceptance of ICT reforms
Master's Degree	Very High	Strong policy and systems orientation

The consistently high agreement across educational levels suggests that acceptance of ICT reform is not dependent on academic qualification. Instead, it reflects shared operational experiences and a common understanding of institutional needs.

Table 12. Prescriptive Measures Classified According to Length of Service

Length of Service	Level of Agreement	Interpretation
Less than 5 years	Very High	Strong openness to innovation
5–15 years	Very High	Balanced support for reform
More than 15 years	Very High	Endorsement grounded in experience

The findings indicate that support for ICT reforms is consistent regardless of tenure. Both new and longserving employees recognize the necessity of modernization, highlighting a favorable climate for implementing long-term digital initiatives.

Table 13. Prescriptive Measures Classified According to Section

Section	Level of Agreement	Interpretation
Office of the District Engineer	Very High	Strong endorsement of ICT reform initiatives across leadership functions
Administrative	Very High	High acceptance of digital systems for records, coordination, and communication
Finance	Very High	Strong support for ICT-based financial management and reporting mechanisms
Construction	Very High	High readiness for digital tools supporting project monitoring and coordination
Maintenance	Very High	Strong agreement on ICT use for scheduling, tracking, and reporting
Planning and Design	Very High	High recognition of the value of ICT in technical planning and documentation
Quality Assurance	Very High	Strong endorsement of ICT for monitoring, compliance, and quality control

All sections demonstrated very high agreement with prescriptive measures, underscoring organization-wide alignment toward ICT reform. This unanimity reflects readiness for coordinated implementation and supports the feasibility of a unified digital transformation framework.

Table 14. Differences in ICT Challenges According to Profile Variables

Variable	χ^2	p-value	Interpretation
Age	1.246	0.536	Not significant
Status of employment	9.711	0.002	**Significant**
Educational attainment	1.826	0.177	Not significant
Length of service	3.948	0.139	Not significant
Section	61.012	0.000	**Significant**

Significant differences in ICT challenges were observed when respondents were grouped by status of employment and by section. This indicates that organizational roles and structural placement shape the nature and intensity of ICT challenges. Other variables—age, education, and length of service—did not yield significant differences, reinforcing the conclusion that ICT issues are structural rather than demographic.

Variable	χ^2	p-value	Interpretation
Age	1.826	0.401	Not significant
Status of employment	0.667	0.414	Not significant
Educational attainment	0.121	0.728	Not significant

Length of service	1.653	0.438	Not significant
Section	3.333	0.766	Not significant

Table 15. Differences in Prescriptive Measures According to Profile Variables

No significant differences were found in prescriptive measures across any profile variables. This suggests a strong organizational consensus on the strategies needed to improve ICT utilization, regardless of demographic or professional classification.

Table 16. Relationship Between ICT Challenges and Prescriptive Measures

Variable	Mean	r	p-value	Interpretation
Challenges	17.72	0.140	0.113	Not significant
Prescriptive Measures	19.99			

The correlation analysis reveals no significant relationship between ICT challenges and prescriptive measures. This indicates that even employees who experience fewer challenges still strongly support reform initiatives. The finding highlights a collective institutional orientation toward modernization rather than a reactive stance based solely on perceived difficulties.

CONCLUSION

Based on the findings of this study, the following conclusions are drawn:

1. There is a high level of awareness among employees regarding the challenges in the utilization of ICT, particularly in stakeholder management, communication flow, and project coordination. This reflects a strong institutional consciousness of systemic issues rather than individual inadequacy.

2. Significant differences were found in ICT challenges when classified by status of employment and division, indicating that organizational roles and structural placement influence exposure to ICT-related difficulties.

3. Age, educational attainment, and years of service showed no significant difference in ICT-related challenges, suggesting that technological barriers are experienced uniformly across demographic groups.

4. All respondents expressed near-unanimous support for prescriptive measures, indicating a shared institutional readiness to adopt reforms and a positive disposition toward ICT integration.

5. No significant differences were found in prescriptive measures across age, status of employment, education, tenure, or division, reflecting a strong organizational consensus on the actions required to improve ICT utilization.

6. The relationship between ICT challenges and prescriptive measures was not statistically significant ($r = 0.140$, $p = 0.113$), implying that support for reform exists regardless of the level of difficulty experienced.

7. Operational divisions such as Construction, Planning and Design, and Quality Assurance experience higher ICT-related strain due to their dependence on real-time data, coordination, and monitoring functions.

8. Administrative, Finance, and Maintenance divisions reported moderate ICT challenges, reflecting partial digital integration and continued reliance on manual processes.

9. ICT barriers are institutional rather than personal, arising from systemic limitations such as unclear policies, fragmented coordination, and insufficient organizational support rather than from individual skill deficiencies.

10. The organization has reached a state of institutional readiness for technological transformation, as evidenced by consistent agreement across all classifications regarding ICT reforms and modernization initiatives.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed:

1. Develop and implement a comprehensive ICT governance framework that defines communication protocols, accountability structures, and data-sharing mechanisms to strengthen coordination and stakeholder engagement.

2. Adopt gender-responsive and division-specific ICT training programs to ensure equitable access to technological resources and capacity building across both technical and administrative units.

3. Institutionalize continuous ICT upskilling programs for all employees, regardless of age or rank, emphasizing practical applications, collaboration, and adaptive use of emerging technologies.

4. Establish an ICT Reform Implementation Committee tasked with translating recommended measures into concrete policies, timelines, and performance indicators.

5. Institutionalize an organization-wide digital transformation plan aligned with strategic goals and endorsed by top management.

6. Create participatory feedback mechanisms that allow employees to co-design solutions, ensuring reforms are grounded in operational realities rather than imposed hierarchically.

7. Prioritize operational divisions in the deployment of advanced ICT infrastructure, project management platforms, and digital dashboards to reduce manual workload and enhance coordination.

8. Implement process automation and digital record systems in support divisions to improve efficiency, minimize redundancy, and standardize documentation workflows.

9. Formulate comprehensive ICT policy guidelines covering cybersecurity, interoperability, data governance, and ethical use of digital systems to ensure sustainability and accountability.

10. Launch a comprehensive digital transformation program supported by executive leadership, integrating infrastructure upgrades, staff development, monitoring mechanisms, and regular ICT audits to sustain innovation and institutional accountability.

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