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Implementation, Effectiveness, and Operational Challenges of an Integrated Command and Control Center: A Multi-Dimensional Analysis in Urban Policing

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ABSTRACT

This research analyzed the deployment, performance level, and issues of an Integrated Command and Control Center (IC3) in urban policing using a convergent parallel mixed-methods design. Quantitative information was gathered from 337 police officers in four operational groups using a validated survey tool covering nine implementation and effectiveness domains. The qualitative data came from interviews and field observations to give a deeper insight into the operational issues. The findings show that implementation of IC3 on average is effective (M = 3.08), with top marks for information and intelligence management and coordination mechanisms. Yet, communication infrastructure was rated the lowest at the same time, indicating that there are still issues in real-time field communication contract. Results of a one-way ANOVA revealed statistically significant differences between the operational groups in eight out of nine domains, which indicates that the experience with the system and access to it are not uniform. Qualitative results supported these findings and identified communication lapses, unequal access to technology, irregular training, and ineffective integration of feedback loops as the main operational problems. The combined interpretations indicated that even though the IC3 is well-functioning at a structural level, the disparities at the infrastructural, organizational, and user levels have led to uneven

operational performance of the system. The paper argues that technological integration is not enough to produce optimal system performance and points to system design that is inclusive, continuous training, and feedback mechanisms that are adaptive as the keys to success. The results add to the developing knowledge on technology-led policing and offer well-founded suggestions for upgrading the sustainability and efficiency of command and control systems in urban areas of developing countries.

Keywords: Integrated Command and Control Center; Urban Policing; Operational Effectiveness; Technology Integration; Law Enforcement Systems

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INTRODUCTION

Rapid urbanization, rising population densities, and the increasing complexity of the nature of public safety incidents are some of the primary factors that have prompted the law enforcement agencies to take help of technology and integrate it with their working systems so as to make their operational procedures more efficient and their response times better. Nowadays, cities' police forces have been moving away from simply reacting to crimes after they happen, through their patrolling and arrests, to gathering and analyzing intelligence, making use of technology, and enable faster and better decisions, as well as coordination, among the officers. Integrated Command and Control Centers (ICCCs) have grown to be the main infrastructures in not only radically changing the way police work, but also providing the very communication, surveillance, and data analysis equipment that the police need at a single, central platform, thus enabling better awareness of the situation and coordination of activities (Sims, 2023; Almadani et al., 2023). In fact, with the help of such systems, the police in very urbanized settings are able to respond to the needs of their communities more suitably, not only to emergencies and crimes, but also to large scale events. Ultimately, this is leading to a better and safer environment for all citizens.

Worldwide, the use of ICCCs and peer platforms like Real-Time Intelligence Centers (RTICs) has yielded notable gains in policing efficiency and service delivery among other benefits. In the U.S. and Europe, such systems are feeding on multi-agency data streams to aid emergency response and policing forecasting measures (Sims, 2023). On a related note, the development of smart cities in India and other countries has led the way in making ICCCs indispensable elements of urban management, thereby improving traffic control, disaster mitigation as well as law enforcement (Uchoi et al., 2023; Bhardwaj et al., 2023). Further, the integration of AI, big data analytics and cybersecurity measures have provided these systems with capabilities of carrying out predictive scenarios, automatic monitoring and real-time identification of threats (Zia et al., 2024). Yet, alongside their immense promise, research points out that

issues such as data integration, cyberattacks, and governance obstacles still hamper these systems from being fully effective (Jasim et al., 2025; Goztepe, 2015).

When we talk about the Philippines, it is apparent that although the implementation of the command and control system involves the merger with other national measures to transform the policing structure and ensure security for all, the PNP has been increasingly incorporating technology-oriented approaches. Among these, the creation of Integrated Command and Control Centers, which enable criminal activity reaction and police management, can be mentioned (Caliwan, 2023; Chua, 2025). As an example, we can take the Quezon City Police District (QCPD) Integrated Command and Control Center (IC3), which acts as a focal point for monitoring, communications, and event management. Thanks to the development of such programs as the QCitizen Helpline and the Three-Minute Response Time approach, IC3 has greatly facilitated crime prevention and police reaction times (Pineda, 2023; Jose, 2023). Thus, besides reflecting national objectives of the Philippine Development Plan (2023, 2028), they show the significance of information and communication technologies in building institutional resilience.

Despite the above developments, it should be noted from the existing literature that the adoption and utilization of ICCCs remain highly uneven, particularly in the cities of developing countries. While previous research tends to emphasize technology aspects and the advantages of command centers, it hardly ever takes a comprehensive perspective on the various ways in which ICCCs can be used at the organizational and operational levels. For example, such aspects as command structure, communication system, decision-making process, coordination, and feedback are usually discussed in isolation rather than as parts of a sophisticated socio-technical system (Johansson & Lundberg 2024; Ellis et al., 2024). Moreover, serious challenges like inadequate infrastructure, insufficient training, non-interoperability, resource shortages, etc., continue to affect system efficiency (Atilano-Tang, 2023; Miranda, 2020). It seems fair to say that such problems suggest that there is a need for adopting a holistic framework that combines the considerations of both implementation and operation efficiency.

There is also a lack of research that takes into account the difference in perception and experiences of various types of police officers. The use of a command and control system by a frontline officer will be entirely different from a mobile police officer, hence affecting his/her perception of the usefulness of the command center. Research has shown that variations in access to information and technology affect the success of an operation (Banatao et al., 2024). However, such variables are largely ignored in most studies, leaving room for a skewed assessment of the performance of the command center. Also, not much has been done in the effort of identifying operational challenges hindering the development of ICCCs.

This study aims to fill these gaps by conducting an extensive and multi-dimensional analysis of the installation, functioning, and operational problems of an Integrated Command and Control Center within the urban law enforcement context. Specifically, the study will focus on the implementation stage and operational efficiency of IC3 in key domains including command hierarchy, communication infrastructure, decision-making procedure, information and intelligence management, situational awareness tools, coordination methods, training and simulations, technology-based systems, and monitoring and feedback. Additionally, the study will analyze the diversity of views held by various segments of the police force, and identify critical operational barriers to effective system performance. By bringing all these elements together, this paper not only seeks to contribute to the growing body of literature on the application of technological innovations in policing but also provide valuable and well-justified recommendations to improve the efficiency and sustainability of IC3 systems within the urban law enforcement context.

MATERIALS AND METHODS

Study Design

In this research, the authors employed convergent parallel mixed methods by using two distinct methodologies to get a comprehensive perspective on the implementation, effectiveness, and issues encountered during the operationalization of the IC3 in the context of an urban law enforcement setting. Specifically, the quantitative method adopted a cross-sectional descriptive-evaluative and comparative design to investigate the level of implementation and effectiveness in various locations, while the qualitative method served to provide additional information about the operational challenges encountered and the technical issues related to the IC3.

Command and control systems represent complex socio-technical systems, which include the integration of organizational components, human elements, and technological infrastructure (Lundberg et al., 2024). In this regard, the use of the mixed-method framework in evaluating such systems is appropriate, and the use of methodology triangulation may increase its credibility.

Study Setting

The research has been undertaken at the Quezon City Police District (QCPD) in the Philippines, one of the most urbanized police districts in the country. QCPD operates the Integrated Command and Control Center (IC3), which functions as the central control room responsible for coordinating surveillance, communication, and operations of the police force.

The IC3 comprises a number of technological sub-systems including CCTV cameras, GPS devices, body cameras, among others, which are utilized in real-time decision making.

Population, Sample Size, and Sampling Technique

The target population was the members of police forces currently serving on the frontline of the various strata of QCPD, whose operations involve, directly or indirectly, the use of the IC3 database. The sample size consisted of 337 participants. In order to ensure proportional representation from each of the strata, a stratified random sampling method was applied as follows:

Respondent	Population	Sampling
Beat Patroller	1420	85
Mobile Patroller	271	85
Tactical Motorcycle Rider (TMR)	240	85
Operatives	193	85
Total	**2124**	**337**

Instrument and Measurement

Data were collected using a structured, self-administered questionnaire developed from established frameworks on command and control systems and ICT-enabled policing. The instrument operationalized two primary constructs:

1) *Level of Implementation*
2) *Operational Effectiveness*

Each construct was measured across nine dimensions:

- Command Structure
- Communication System
- Decision-Making Mechanism
- Information and Intelligence Management
- Situation Awareness Tools
- Coordination Mechanism
- Training and Simulation
- Technological System
- Monitoring and Feedback

Responses were recorded using a four-point Likert-type scale (1 = Low, 4 = High), intentionally designed to eliminate central tendency bias and enhance discriminatory power in responses.

Instrument Validation and Reliability

The instrument underwent a thorough content validation review by a group of criminology, public safety administration, and research methodology experts to validate that the constructs were relevant and representative. A pilot test was also done before the main use of the scale, and the values of internal consistency reliability were calculated by Cronbach alpha whose results were higher than the threshold level ($\alpha \geq 0.70$) which is satisfactory reliability in all areas.

Data Collection Procedure

Before the researchers started data collection, they acquire formal approval from the right institutional authorities. We told the study respondents about the purpose of the study and obtained their informed consent to ensure their participation was voluntary. The questionnaires were handed out personally to a sample of respondents from different departments as mentioned. We also collected qualitative data through informal interviews and field observations focusing on system functionality, operational bottlenecks, and user experiences to complement the quantitative data. These steps helped us to have a thorough understanding of the contextual challenges that influence IC3 implementation.

Data Analysis

Numerical data have been encoded and analyzed through statistical software whereas qualitative data have been analyzed by thematic analysis, which includes coding, categorization, and synthesis of recurring patterns related to operational challenges. The combination of qualitative insights with quantitative findings was made possible through this process.

Ethical Considerations

The study adhered to established ethical standards for research involving human participants. Participation was voluntary, and respondents were assured of anonymity and confidentiality. No personally identifiable information was collected. Data were securely stored and used exclusively for academic and research purposes.

RESULTS AND DISCUSSION

Table 1. Level of Implementation of IC3 Across Key Operational Variables

Variable	Composite Mean	Verbal Interpretation
Command Structure	3.07	Agree
Communication System	3.05	Agree
Decision-Making Mechanism	3.11	Agree
Information and Intelligence Management	3.14	Agree
Situation Awareness Tools	3.29	Agree
Coordination Mechanism	3.19	Agree
Training and Simulation	3.20	Agree
Technological System	3.13	Agree
Monitoring and Feedback	3.14	Agree
Overall Composite Mean	**3.08**	**Effective**

Legend: 3.26–4.00 = Strongly Agree; 2.26–3.25 = Agree

The overall extent of implementation of the Integrated Command and Control Center (IC3) in nine operational domains is presented in Table 1. It shows the results indicating the total composite mean at a level of 3.08, which when interpreted, is "*Effective*". This means that the IC3 is operating satisfactorily at the operational level for all the dimensions that have been measured. Information and Intelligence Management attained the highest score among the variables (M = 3.14), thereby, confirming that this is the domain which is the strongest in performing the functions of collecting, processing, and dissemination of intelligence. On the other hand, the Communication System (M = 3.05) was the domain that got the lowest mean even though it was still within the "Effective" range which means that the performance in real-time communication reliability and coordination is weaker comparatively. The more or less equal mean scores of the variables indicate that the implementation of IC3 is quite deeply integrated from a systemic point of view but is far from optimized at this stage. This is supported by the fact that no domain has attained the classification "*Highly Effective*".

Even though the results show that IC3 is, in general, effective, they refute the idea of command centers being fully optimized as Azucena (2024) suggested. As researcher, she asserted that integrated command systems achieve a high level of operational efficiency when communication systems and inter-agency workflows are in complete synchronization. On the other hand, the lower communication system rating in this research indicates that integration

does not necessarily result in flawless execution, especially at the field level where there are infrastructural and signal limitations. The findings partly in addition disagree with the perfect model of smart command centers featured in global literature, which highlight real-time interoperability and a consistent user experience across units. The differences found in the various areas show that the IC3, although being well-structured, is still facing difficulties when it comes to the operational aspect, specifically in communication and training. This further supports the idea that technological systems on their own are not enough if the field-level adoption and capacity-building are not consistent.

Table 2. One-Way ANOVA Results on Differences in IC3 Implementation Across Operational Groups

Variable	F-value	p-value	Interpretation
Command Structure	1.7523	0.1967	Not Significant
Communication System	101.8087	0.0000	Significant
Decision-Making Mechanism	59.0725	0.0000	Significant
Information & Intelligence Management	38.3240	0.0000	Significant
Situation Awareness Tools	15.4607	0.0001	Significant
Coordination Mechanism	61.4865	0.0000	Significant
Training and Simulation	8.7607	0.0011	Significant
Technological System	4.3162	0.0207	Significant
Monitoring and Feedback	16.5974	0.0000	Significant

Significance level: $p < 0.05$

The findings of the One-Way ANOVA analysis on the differences in the perception of different groups towards IC3 implementation, namely Mobile Patrollers, Beat Patrollers, Tactical Motorcycle Riders (TMRU), and Operatives are recorded in Table 2. It has been found that there are significant differences ($p < 0.05$) in eight out of the nine variables measured, thus suggesting that different roles have significantly different views on the effectiveness of IC3. Command Structure ($p = 0.1967$) was the only variable for which there appeared to be no significant difference, implying that all the groups had a common and consistent perception of the hierarchical organization.

Large variations in areas like communication, decision-making, and technology systems indicate that the level of operation, availability of resources, and job roles could shape the

experience of users. For example, mobile security guards usually give higher ratings but the staff who actually do the operations give the lowest scores. This shows that there may be differences in the accessibility of the system and the support of operations. Besides, this difference reveals that the advantages of the system are not fairly shared among the organizational levels and functions. These results dispute the original idea from integrated systems theory that centralized command structures can ensure that even of all users have the same operational experiences. Systems theory assumes that different subsystems, when they are well coordinated, work together seamlessly. However, the big differences in perception that were found indicate that just structural integration doesn't guarantee that different parts will have the same experience at the operational level.

The results are also contrary to the concept proposed in Joshi et al. (2026), where decision systems that use data contribute to ensuring that there is consistency between various units within police operations. Since the variability in perception is quite evident in this case, then the use of decision support systems does not appear to be equalized among different users. As such, the model of technology adoption in this scenario appears to be more in line with the Diffusion of Innovations Theory, where the adoption depends on different user categories.

Table 3. Selected Domain Analysis for Technological System and Monitoring & Feedback

Variable	Composite Mean	Interpretation
Technological System	3.13	Agree
Monitoring and Feedback	3.14	Agree

Table 3 highlights two important areas that enable the operations which includes the Technological System and Monitoring and Feedback. These areas resulted in overall scores in the "*Agree*" range. The Technological System (M = 3.13) shows that although infrastructure is working, it is still not maximally utilized in different units, especially the operatives who have reported less access and usage.

On the other hand, Monitoring and Feedback (M = 3.14) reveal that systems for control and assessment exist, but they may not be uniformly experienced at all levels of operation.

However, as can be seen in the reality, these findings contradict the theory advocated by Nayak & Choudhury (2024), stating that the performance monitoring and the frontline engagement process can be enhanced with the help of AI feedback mechanisms. According to IC3 research results, even in case monitoring strategies are present, frontline employees do not consider the process beneficial as a platform for real change. Also, although there are

feedback mechanisms within the framework of the global command center models which are able to close the loop, the poorer results obtained from the operatives suggest that IC3 operates more like an open loop system, at least partially, since feedback is gathered, yet not always used appropriately to facilitate the process of improving the operations.

Figure 1. Thematic Framework of IC3 Implementation Based on Respondents' Narratives

Theme 1. Several people noted that IC3 has enhanced efficiency through centralized command, notably in response time and surveillance. Results of the study indicate very high rank in terms of coordination and intelligence management, all of which are closely related to the above observation on IC3.

Theme 2. Mention was made of how the use of centralized dashboards and real-time monitoring systems greatly assist in boosting situational awareness, especially when it comes to mobility. Yet narratives indicate a communication problem arising from time to time, mostly due to issues of signal strength in the field and incompatibility between devices, directly pointing to the low rank of communication.

Theme 3. Additionally, the main operatives stated that there is an uneven distribution of the tools used for technology, which then serves to prove the statistically significant differences among them.

Theme 4. In some people interviewed, their dissatisfaction was shown by stating that the training offered is inadequate and that the period for drill exercises, also included in training, is insufficient to develop confidence in the usage of the system.

Theme 5. The individuals involved in the discussion have highlighted the fact that although the monitoring systems are available, the feedback process is not always set up so well as to ensure proper response.

Although it is a common perception that centralization enhances the effectiveness of the command system (such as the smart policing model), it can be argued that centralization does not solve all problems and inefficiencies in police work. The existence of barriers in communication goes against the general assumption in digital policing research that technology is the key to overcoming all issues related to communication. It is also important to note that there is an uneven distribution of technological devices, going against the democratic adoption of technology in innovation research. In contrast, the results seem to support the idea that technology creates "*technology asymmetry*" in public sector organizations. The expectation for the training process is also proven wrong because of the varying preparedness of the participants.

Table 4. Quantitative Results and Supporting Qualitative Themes

Quantitative Finding	Supporting Qualitative Theme	Integrated Insight
High rating in Intelligence Management	Centralized Command Efficiency	*Strong backend coordination system*
Low rating in Communication System	Communication Gaps	*Infrastructure and signal issues persist*
Significant group differences	Unequal Access to Technology	*Role-based disparity in system usage*
Moderate Training Scores	Training Limitations	*Inconsistent training exposure*
Monitoring rated "Agree"	Feedback Issues	*Weak feedback loop integration*

The table below illustrates the integration of both qualitative and quantitative outcomes regarding the role of stories in explaining the statistical findings.

According to Table 4, there is a correlation between the high scores in the aspect of intelligence management and the centralized command topic. Thus, the primary advantage of IC3 is its back-end coordination and data gathering ability. Contrariwise, low ratings concerning communication are associated with the qualitative evidence of inefficient communication on the field, indicating that certain technical limitations have an effect on the

performance of IC3 users. As it can be seen from the table above, significant group differences observed statistically can be explained not only by purely numerical differences, but also by structural disparities concerning the availability of certain technologies and training resources. Therefore, implementation of IC3 is efficient, but operationally inconsistent.

In fact, the outcome of the combined method does not support the common belief in the field of systems integration theory that coordination between components will ensure the efficiency of the entire system. The outcome clearly shows that despite the strength of the structure in the system, local mismatches can easily ruin the efficiency of the entire system. Moreover, although studies on the application of combined methods in policing generally exhibit consistency between the quantitative and qualitative findings, in this case, the authors establish a rather intricate relationship between them. The qualitative data reveal the latent discrepancies that the quantitative averages conceal, indicating that relying solely on quantitative indicators might lead one to erroneously believe that the efficiency of the system is greater than it actually is.

CONCLUSION

From the analysis of the research outcomes, it can be stated that the IC3 proves itself to be rather efficient in terms of its level of implementation and operational efficiency in the major policing aspects, especially as far as the use of intelligence management and coordination is concerned. At the same time, it should be said that the system's efficiency cannot be characterized as equal across different groups of users due to considerable differences in their perceptions and access to technological resources. Constant problems with communication, training and A&R, on the one hand, show that IC3 is a sound structure yet inefficient operation-wise. It became clear from the outcomes analyzed that, despite being an integrated structure, the system does not provide for impeccable performance because a number of other factors have an important impact on the results.

RECOMMENDATIONS

The first thing law enforcement agencies can do to improve the IC3 system operationally is to upgrade the communication infrastructure, especially in field operations where there are still reliability issues in the system, making that the key focus. Secondly, since the frontline personnel seem the most affected by the limited access to the system, it makes sense to put emphasis on the training of this group, and indeed, the entire staff in a consistent manner, in order to bring everyone at the same level of skills and self-assurance. Having said that, the other way of dealing with the problem/issue is through the formulation of the relevant policies that would facilitate the fair allocation of the technological resources and the system

access across the units so as to diminish the existing gaps in the usage. Furthermore, to make sure that the monitoring outputs lead to actionable improvements, the deployment of a closed-loop, technology-enabled feedback system is indispensable. Lastly, the subsequent system enhancements should rely on a user-centered and adaptive design methodology, taking into account not only the quantitative performance indicators but also the qualitative user feedback, with a view to fostering the sustainable and inclusive evolution of command and control systems.

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