Enhancing Incident Reporting Through the SULC Framework for Digital Transformation: A Case Study of Traffy Fondue Adoption in Chanthaburi Province

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Abstract

Incident reporting is one of the significant challenges in urban management, particularly in terms of delayed responses, limited transparency, and low citizen engagement. Thus, digital transformation enables the solution of the urgent need for public service delivery. Traffy Fondue, an urban problem management platform developed by the National Science and Technology Development Agency (NSTDA), serves as a digital tool to strengthen communication between citizens and local authorities. This study aims to enhance the operational efficiency and sustainability of Traffy Fondue by implementing the Software Usage Lifecycle (SULC) framework. The research objectives are: 1) to design and implement a Software Usage Lifecycle (SULC) framework for Traffy Fondue to improve problem resolution efficiency, 2) to evaluate the effectiveness of Traffy Fondue in managing community issues through the proposed framework, and 3) to identify key challenges and propose improvements in the citizen reporting process and problem resolution speed. This study utilized a mixed-methods research design, a quantitative and qualitative approach. The sample size of 352 respondents was from Thephanimit Subdistrict, Chanthaburi Province. The respondents were selected using stratified random sampling. The analysis results showed a statistically significant increase in knowledge

after the training (mean scores improved from 7.90 to 14.30, $p < 0.000$) and very high satisfaction across key dimensions of accessibility, responsiveness, and usability (mean > 4.50). Also, findings reveal that using the SULC framework through the Traffy Fondue platform can result in significant integration and enhance operational efficiency, citizen understanding, and system satisfaction. Digital transformation not only enhances service processes for incident reporting and management but also utilizes adaptive digital frameworks. This study even provides a practical and sustainable model for promoting citizen-centered governance and advancing data-driven urban management in Thailand.

Keywords: Digital Transformation, Incident Reporting, Software Usage Lifecycle, Traffy Fondue, Adoption Effectiveness

Introduction

Digital technology has become a driving force in city social and around urban development. The concept of a smart city gains significant traction in recent years, reflecting a growing global recognition of the need to leverage technology to improve the efficiency of incident reporting in urban for management and enhance the quality of life for citizens (Khan & Zia, 2021; Okonta & Vukovic, 2024). A smart city is a concept of integrated advanced technologies, such as mobile connected applications, Artificial Intelligence (AI), Machine Learning (ML), the Internet of Things (IoT), cloud computing, and Geographic Information Systems (GIS), into its infrastructure and services. The services enable urban management and address challenges for better decision-making, resource optimization, and increased responsiveness and sustainability (Caragliu et al., 2011; Abu-Rayash & Dincer, 2023). Incident reporting of urban management today faces rapidly evolving challenges, ranging from infrastructure maintenance and environmental concerns to transportation and public safety.

Digital transformation can be innovative solutions to address incident reporting challenges in city and urban management and adapt effectively supporting real-time data collection, intelligent analysis, and citizen participation (Batty, 2013; Okonta & Vukovic, 2024). Traffy Fondue is an application for an urban problem management platform, developed by the National Science and Technology Development Agency (NSTDA), is one of the digital platforms that can exemplify how digital platforms can transform smart city management by enhancing communication between citizens and local authorities (Consoli et al., 2015). A single

platform of the smart city concept successfully embodies the use of digital systems to collect public reports, coordinating with relevant agencies to resolve issues as suggested in Peng et al. (2022). The Subdistrict Administrative Organization (SAO) doubly plays a vital role in managing citizen complaints. Traditional management methods of answering phone calls or manual filing forms often resulted in days of processing, so the responses were delayed, and limitations on transparency in the administrative performance of services. The limitations of administrative services can be successfully and effectively handled by utilizing digital tools to enhance responsiveness, accountability, and welcome citizen participation.

Therefore, this study applies the Software Usage Lifecycle (SULC) framework to measure Traffy Fondue in sustainable performance improvement after deployment. The objectives of this research are as follows:

1. Software Usage Lifecycle (SULC) framework for Traffy Fondue uses technical design and implementation to improve efficiency for resolutions.

2. The proposed framework can evaluate the effectiveness of Traffy Fondue in managing community issues.

3. To identify key challenges and propose improvements in the citizen reporting process and problem resolution speed.

This research contributes to the practical usage of the Traffy Fondue application as a digital tool for smart city initiatives by creating a structured and adaptable system. Local governments can better understand and respond more efficiently to urban issues by fostering greater civic engagement and transparency via a service report platform. The success of this initiative will provide a guideline for other cities to leverage and practically use digital technology, initiating more responsive and proactive citizen-centric urban environments. Furthermore, the outcomes will offer practical insights for improving digital governance and public service delivery in urban contexts.

Literature Review and Conceptual Framework

Urban Problem Management and Digital Technologies

Urban problem management of incidents is creatively built upon platforms of ecosystems using advanced digital technologies, enabling cities to operate intelligently and responsively. The integration of multiple technological layers, ranging from data acquisition and transmission to analysis of citizen interactions, ensures that challenges of urban incident management are identified and addressed in a timely and efficient manner. Recent technology, like the Internet of Things (IoT), plays an innovative role in connecting and effectively managing smart cities of things, especially using devices, sensors, cameras, and monitoring units to collect real-time data of the environment and infrastructure (Netinant et al., 2024). The real-time data collection of events such as equipment failure, flooding, or waste overflow was recorded on the real-time monitoring system, which provides and notifies local authorities with continuous situational awareness and reports, allowing them to detect incidents and handle them before they become larger problems. Complementing IoT systems, data analytics platforms process and interpret massive volumes of information gathered from devices and sensors. Not only can big data analysis, but also machine learning algorithms, be utilized on these platforms to generate actionable insights, enhance evidence-based decision-making, and inform policy formulation. In Andrade et al. (2023), the study was concerned with the support for a positive reduction in carbon emissions and improving sustainability for administrative services of transportation management, optimized traffic flow, monitored public transport usage, and managed energy consumption on urban mobility platforms. To make citizen engagement platforms, the system services can bridge the gap between the government and the public services platforms of online portals and mobile applications, facilitating various senses of collective ownership and transparency in urban governance, enabling citizens to report issues, share feedback, and participate in decision-making as suggested in (Zhao et al., 2023). Together, these digital systems form the technological backbone of modern smart cities, facilitating more proactive, participatory, and sustainable approaches to urban problem management.

Limitations of Traditional Urban Management Approaches

The Subdistrict Administrative Organization plays a vital role in overseeing and developing local communities within its jurisdiction. One of the core responsibilities is handling citizen complaints to maintain order and enhance community satisfaction. However, the current complaint management system, which involves several key steps such as receiving complaints, coordinating with relevant agencies, investigating and monitoring the resolution progress, and informing the complainant of the outcome, is less than satisfactory. Typical administrative responding methods for dealing with problems in cities often involve long wait times and inconsistent responses, such as calling the right agency directly and submitting complaints to government officials. Problems often happen on the weekends or public holidays and aren't fixed until business hours again, which can make people angry. Moreover, there exists no transparent and user-friendly mechanism for citizens to monitor the progress of their grievances, leading to sluggish and disorganized responses to urban issues. Many issues exemplify significant challenges in government responsiveness, transparency, and citizen engagement in incident reporting and urban management, which in turn have a substantial impact on citizen satisfaction.

Traffy Fondue Platform

Traffy Fondue is an application of the urban problem management platform, used as a channel for reporting and managing urban incident issues, utilizing an automated LINE Chatbot as a supporting fundamental platform. In 2020, the system was initially developed by the National Science and Technology Development Agency of Thailand (National Electronics and Computer Technology Center, 2020) to provide a direct and accessible channel for citizens to report any incident issues, including city infrastructure problems such as broken streetlights, potholes, waste management failures, and environmental concerns like air pollution or flooding risks. The system not only digitally transforms incidents reported in urban management, but also enables citizens to willingly participate and directly connect with the closest relevant authorities by using a digital platform, facilitating real-time issue reporting and tracking, documenting, and ensuring problems are swiftly directed to the appropriate agencies and efficiently managed for resolution. Digital platforms enhance the speed and efficiency of urban problem-solving, increasing transparency and accountability in

public service management. Citizens can track the progress of their reports, thereby gaining greater confidence in the responsiveness and effectiveness of their local government. Many existing studies have examined the application of Traffy Fondue in the context of smart city management, highlighting its potential to enhance urban problem-solving efficiency and citizen engagement. Researchers have focused on various aspects of the platform, including its implementation, effectiveness, and opportunities for improvement.

Table 1 Key Research Findings on Traffy Fondue Adoption and Implementation

Researcher (s)	Key Findings	Recommendations
Prempree (2020)	Surveyed problems and satisfaction levels with the efficiency of problem-solving and complaint-handling services at Nakhon Pathom Rajabhat University.	Develop and improve the application design based on the analysis of reported issues to better align with the organization's needs.
Boonyayothin (2023)	Studied the process, problems, and challenges of using the Traffy Fondue platform in Bangkok.	Organize training sessions for all relevant personnel and staff on how to use the Traffy Fondue platform effectively.
Thongrattanadol et al. (2023)	Investigated the factors influencing the acceptance of the Traffy Fondue platform and how it impacts the behavior of officers managing urban issues in East Bangkok.	Improve the efficiency and completeness of the incident reporting of urban management system, establish clear responsibility among agencies, and consider the attitudes of the responsible officers.
Leekrajang and Jensantikul (2024)	Analyzed the definition, importance, advantages, and disadvantages of the Traffy Fondue platform.	Address delays in problem resolution caused by multi-agency coordination and promote the use of the platform among local administrative organizations nationwide.

This study integrates the literature review into the Introduction section, as supported by Table 1, to maintain conciseness while providing sufficient theoretical background for the application of the SULC framework. Although existing research has explored the operational challenges and benefits of Traffy Fondue, significant gaps remain in understanding how to sustain and optimize the platform post-deployment, particularly in terms of citizen engagement and system responsiveness.

Research Gaps

Although previous studies confirm the benefits of Traffy Fondue in enhancing urban communication and responsiveness, most have focused on short-term implementation outcomes. Few have examined how to maintain or optimize platform performance after deployment, especially regarding user engagement, operational efficiency, and adaptive learning. This gap underlines the requirement for a framework that supports continuous monitoring, feedback collection, and iterative system enhancement.

Conceptual Framework: The Software Usage Lifecycle (SULC)

The traditional SDLC usually concentrates on requirements, design, development, and delivery of high-quality software (Sommerville, 2011). However, for platforms such as Traffy Fondue, post-deployment performance and sustained usability are correspondingly critical. To address software development concerns, the Software Usage Lifecycle (SULC) extends the SDLC by incorporating processes of user usage analysis, user feedback, maintenance, and ongoing improvement (Boehm, 1988).

The SULC framework is divided into six phases: planning, requirements analysis, operational design, deployment, user acceptance testing, and evaluation and improvement. The design of the framework ensures that software systems are adaptive and responsive to user functional needs, promising flexible adaptation to changing operational contexts of the system. Applying the SULC framework to the Traffy Fondue system enables continuous improvement in problem-resolution efficiency and effectiveness, citizen engagement, and system sustainability, as illustrated in Figure 1. A software development model encompasses not only the development phase but also the application, maintenance, and continuous improvement of the platform, based on practical, real-world usage and theoretical technology acceptance. The innovative SULC model essentially emphasizes gathering user feedback,

monitoring performance, and assuredly implementing additional functional needs with enhancements to the Traffy Fondue system efficiently and user-friendly over time. The proposed new approach ensures effective urban problem management on Traffy Fondue, including sustainability, adaptability, and flexibility to accept further changes in user needs as well as government agency requirements. By extending the concept of SDLC into SULC, the platform can be regularly updated and optimized to address emerging urban challenges more effectively (Boehm, 1988).

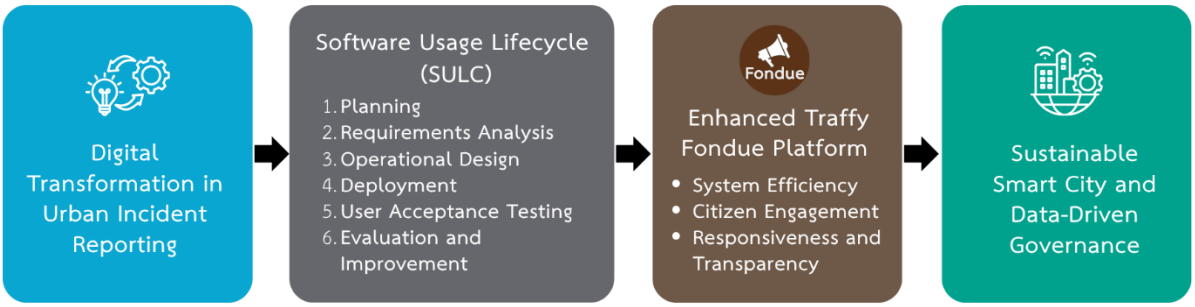

Figure 1 Conceptual framework in this study

Research Methodology

This study follows a structured research methodology to ensure the accuracy and reliability of the findings. The research methodology consists of four key components: research design, population and sampling, research instruments, data collection, and data analysis, which are described.

Research Design

This study employed a well-selected mixed-methods research design, in which quantitative and qualitative data were collected simultaneously, analyzed independently, and then integrated during the analysis and interpretation stages. The research design allows cross-validation of findings and provides a more comprehensive understanding of the research problem. The quantitative aspect involves collecting structured data through surveys and tests to measure user satisfaction and platform effectiveness. The qualitative aspect involves gathering user experiences and suggestions through open-ended responses to inform platform improvements. This approach ensures a comprehensive understanding of numerical trends and contextual factors influencing platform adoption and satisfaction.

Population and Sampling

The population for this study consists of residents of Thephanimit Subdistrict, Pong Nam Ron District, Chanthaburi Province, which includes eight villages with a total of 1,818 households and a population of 5,575 people. The population size is of 2,853 males and 2,751 females. However, the study explicitly targets individuals aged 18 years and older, eligible to vote, totaling approximately 3,000 people. This target population reflects the group likely to engage with local governance and urban problem-reporting platforms. The study applied Yamane's (1973) formula for sample size calculation to determine an appropriate sample size. The calculated sample size is approximately 341 respondents, rounded to 350 to account for potential non-responses. Thus, the sample size of 352 respondents was adequate, and a stratified random sampling method was used to ensure balanced representation across all eight villages. Stratification was based on population size, gender, and village location to minimize sampling bias and enhance the sample's representativeness.

Research Instruments

In the quantitative design, the data collection tool used in this study is a structured questionnaire created by researchers. The questionnaire is designed as a mixed format, combining a checklist with a rating scale based on the principles and methods of creating instruments following the Likert scale. The questionnaire consists of four sections: 1) Demographic Information – Includes gender, age, occupation, and education level. 2) Platform Usage and Frequency – Measures how often and for what purpose participants use the Traffy Fondue platform. Satisfaction with Platform Performance – Measures satisfaction levels across five key dimensions (Accessibility – Ease of accessing and using the platform, Notification and Tracking – Effectiveness of status updates and notifications, Responsiveness and Problem Resolution – Speed and efficiency of handling reported issues, Confidence and Security – Trust in data security and problem resolution process, and Overall Satisfaction – General perception of platform effectiveness), and 4) Open-Ended Questions – To collect qualitative insights on user experience and suggestions for improvement. The questionnaire was validated through expert review, achieving an IOC value of 0.92 (indicating high content validity). Reliability testing using Cronbach’s Alpha yielded a value of 0.89, indicating good internal consistency without overfitting. Exploratory factor analysis (EFA) was conducted to confirm the underlying structure

of the satisfaction scale, which resulted in three distinct dimensions: system performance, user experience, and problem resolution.

To ensure the quality and credibility of qualitative instruments, the interview guidelines were validated by three experts in smart city management and digital governance, achieving an Index of Item-Objective Congruence (IOC) of 0.91, indicating high content validity. Data reliability was enhanced through triangulation of sources (citizens, officials, and platform data) and member checking during the analysis phase. Thematic analysis was conducted following the coding–categorization–interpretation procedure to identify patterns and themes.

Pre-Test and Post-Test

A pre-test and post-test were conducted to measure the platform's effectiveness and the impact of user training. The tests consisted of 20 multiple-choice questions with four answer options, focusing on knowledge of the Traffy Fondue platform's functionality, understanding of the complaint resolution process, and user expectations of platform performance. The tests were reviewed by three experts in smart city technology and governance, achieving an IOC score of 0.96 (indicating high content validity). The expected learning improvement target was set at 15%. The intervention will be considered effective if the average post-test score increases by 15% or more.

Data Collection

The researchers selected the sample using a stratified random sampling method from the population of eight villages in the Thephanimit subdistrict. To minimize selection bias, data collection included both online and offline channels. Paper-based surveys were administered during village meetings and home visits.

All participants provided informed consent before participating, and their responses were anonymized to protect privacy. Before completing the questionnaire, respondents were informed about the study's purpose and their right to withdraw at any time without consequence. The study does not require research ethical approval because it meets the criteria for exemption under non-human subject research. The study poses no greater risk to participants than they would encounter daily. The questionnaire does not collect personally identifiable information such as names, addresses, or contact details. Data is collected anonymously through paper-based surveys with informed consent learned about the study's

purpose, their right to withdraw, and how the data will be used. Participation is entirely voluntary, and participants are not pressured to respond. Figure 2 shows training activities on the use of the Traffy Fondue platform with residents. In addition, the qualitative component involved 15 key informants, including community leaders, local administrative officers, and frequent users of the Traffy Fondue platform. Informants were selected through purposive sampling based on their direct experience with urban problem reporting and resolution. The selection criteria included: (1) at least one year of involvement in community management or public service, and (2) active use or supervision of the Traffy Fondue platform.

Figure 2 Training activities of Traffy Fondue platform

Data Analysis

The data collected from the questionnaire, pre-test, and post-test were analyzed using descriptive and inferential statistical methods to evaluate the effectiveness of the Traffy Fondue platform and user satisfaction. Descriptive statistics used frequency and percentage to summarize the demographic profile and platform usage patterns. Mean and standard deviation were used to measure satisfaction levels across five key dimensions: accessibility, notification and tracking, responsiveness and problem resolution, confidence and security, and overall satisfaction. Each sub-item was rated on a five-point Likert scale, and the corresponding

ranges for mean scores were applied. The mean score is between 4.50 – 5.00, with high satisfaction. The mean score is between 3.50 – 4.49, with very high satisfaction. The mean score is between 2.50 – 3.49, with moderate satisfaction. The mean score is between 1.50 – 2.49, with low satisfaction. The mean score is between 1.00 – 1.49, with very low satisfaction.

To assess the questionnaire's internal consistency, Cronbach's Alpha was calculated, yielding a value of 0.89, indicating high reliability. Exploratory Factor Analysis (EFA) confirmed three dimensions: system performance, user experience, and problem resolution. Confirmatory Factor Analysis (CFA) validated the model fit (CFI = 0.93, RMSEA = 0.05), confirming the accuracy of the questionnaire structure.

The effectiveness of the platform and training sessions was evaluated using a paired-sample t-test to compare pre-test and post-test scores. A target improvement rate of 15% was set to measure knowledge enhancement. The training would be effective if the average post-test score increased by 15% or more. Correlation analysis examined the relationship between platform usage and satisfaction levels, while regression analysis identified key predictors of satisfaction and problem resolution efficiency. Thematic analysis of open-ended responses identified common patterns related to platform usability and improvement areas. By combining descriptive, inferential, and qualitative methods, the study comprehensively evaluated Traffy Fondue's strengths and weaknesses, offering insights to enhance platform performance and user satisfaction.

Research Findings

Analysis Results Comparing Knowledge and Understanding of the Traffy Fondue Platform Before and After the Training

The researcher attended the village meetings for September 2024 and October 2024, proposing an agenda item on implementing the Traffy Fondue platform in Thepnimit Subdistrict to address public grievances. As part of this initiative, an introduction and training program on how to use the Traffy Fondue platform was conducted for 352 target participants. Table 2 shows a comparison of their knowledge and understanding of the platform before and after participating in these activities.

Table 2 Results of the analysis of target participants' knowledge and understanding of the Traffy Fondue platform after the training and knowledge-sharing activity

Tests	N	$\bar{x}$	S.D.	*t*	*P*
Pre-test	352	7.90	2.080	35.3	0.000*
Post-test	352	14.30	2.790		

*$p<0.000$

Table 2 presents a detailed comparison of participants' knowledge and understanding of the Traffy Fondue platform before and after the training, guidance, and knowledge-sharing activities. The data include the total number of participants (N), mean scores ($\bar{x}$), standard deviation (*S.D.*), *t*-value, and *p*-value for both the pre-test and post-test. A total of 352 participants completed both assessments.

The findings indicate that the mean pre-test score was 7.900 (*S.D.* = 2.080), reflecting participants' baseline level of knowledge regarding the platform. Following the training, introduction, and knowledge-sharing activities, the mean post-test score increased to 14.30 (*S.D.* = 2.790). This increase, supported by a *t*-value of 35.3 and a p-value of 0.000, signifies a statistically significant improvement (at the 0.05 level) in participants' comprehension utilizing the Traffy Fondue platform to address community issues.

Descriptive Summary of Key Findings

Overall, the majority of respondents are male (250 individuals, or 71.02%). Focusing on the age groups, the largest cohort falls between 31 and 40 years old (100 individuals, or 28.40%). In terms of occupation, most respondents are farmers (230 individuals, or 65.34%). Regarding educational background, over half (190 individuals, or 53.97%) have completed primary education.

When examining the usage frequency of the Traffy Fondue platform, most respondents (310 individuals, or 88.07%) use it once a week. Concerning the type of issues reported through the platform, the majority (215 individuals, or 61.08%) report infrastructure problems such as water or power outages, followed by public health concerns (112 individuals, or 31.81%) and environmental issues (25 individuals, or 7.11%).

Table 3 Satisfaction with the Use of the Traffy Fondue Platform

Item	$\bar{x}$	*S.D.*	Interpretation	*CR*	*AVE*
Accessibility and Ease of Use	4.82	0.380	Very High	0.859	0.859
Convenience in accessing and using the Traffy Fondue platform	4.68	0.520	Very High		
Clarity and ease of use	4.88	0.320	Very High		
Aesthetics and appropriate design of the platform interface	4.91	0.200	Very High		
Notifications and Follow-up	4.60	0.500	Very High	0.814	0.814
Speed of notifications and follow-up on reported issues	4.64	0.480	Very High		
Completeness of the notification information received	4.62	0.490	Very High		
Reliability of the information received	4.56	0.530	Very High		
Response and Problem Resolution	4.52	0.600	Very High	0.779	0.779
Speed of receiving and acknowledging complaints	4.67	0.470	Very High		
Speed of official response and problem resolution	4.38	0.720	Very High		
Officials' competence in solving issues	4.53	0.580	Very High		
Overall Satisfaction	4.80	0.410	Very High	0.849	0.849
Friendliness and clarity of the language used	4.87	0.340	Very High		
Overall satisfaction with using the Traffy Fondue platform	4.84	0.370	Very High		
Value of using the platform relative to the convenience provided	4.80	0.400	Very High		
Appropriateness of features and functionalities	4.68	0.470	Very High		

As shown in Table 3, respondents expressed a very high level of satisfaction with the use of the Traffy Fondue platform across all measured dimensions. The highest mean scores were observed in Aesthetics and appropriate design of the platform interface ($\overline{x}$ = 4.91, S.D. = 0.200) and Clarity and ease of use ($\overline{x}$ = 4.88, S.D. = 0.320), reflecting the platform's user-friendly interface and intuitive design. Similarly, respondents reported strong satisfaction with Notifications and Follow-up ($\overline{x}$ = 4.60, S.D. = 0.500) and Response and Problem Resolution ($\overline{x}$ = 4.52, S.D. = 0.600), indicating that users perceive the platform as reliable and responsive in handling reported issues. The overall satisfaction dimension also received a very high average score ($\overline{x}$ = 4.80, S.D. = 0.410), highlighting the perceived effectiveness and value of the Traffy Fondue system in facilitating communication between citizens and authorities.

The analysis of the table using the Fornell-Larcker Criterion confirms strong internal consistency and discriminant validity among the constructs. The Composite Reliability (*CR*) values for all primary constructs exceed 0.70 (ranging from 0.779 to 0.859), indicating high internal consistency. The Average Variance Extracted (*AVE*) values are also well above the acceptable threshold of 0.50 (ranging from 0.779 to 0.859), reflecting strong convergent validity. The square root of the *AVE* values for each construct (from 0.883 to 0.927) exceeds potential correlations between constructs, demonstrating that the constructs are distinct and measuring different dimensions effectively. This technique supports the overall validity and reliability of the measurement model.

Conclusion

The implementation of the Traffy Fondue platform represents a main development in urban management by addressing the inefficiencies inherent in traditional problem-reporting methods. The platform's automated system enables citizens to submit complaints at any time, enhancing responsiveness and ensuring service continuity beyond standard office hours.

Firstly, this study effectively designed and implemented the SULC framework for Traffy Fondue, extending the traditional SDLC to include post-deployment analysis, user feedback integration, and continuous system improvement. This approach allowed the platform to evolve dynamically in response to operational realities and user needs.

Secondly, the research findings demonstrated measurable improvements in user outcomes following the implementation of the framework. There was a statistically significant

increase in participants' knowledge and satisfaction levels (mean increase from 7.90 to 14.30, $p < 0.000$), confirming the effectiveness of Traffy Fondue in improving problem resolution efficiency and fostering citizen engagement. These outcomes are attributed to the platform's intuitive interface, real-time issue tracking, and direct communication channels with responsible agencies, all of which contributed to enhanced transparency and trust in local governance. The data qualitative results from participants further supports the quantitative findings. Many respondents reported feeling more confident in reporting local issues after using the platform. One participant noted, *'Now I can track my complaint and see how it is being solved; it makes me feel that the local office really listens.'* Another mentioned, *'Before Traffy Fondue, we had to wait for days to know if our report reached anyone. Now we receive updates immediately.'* These narratives illustrate not only improved satisfaction but also a deeper sense of civic engagement fostered through the digital platform. Overall, both the quantitative and qualitative findings demonstrate that the application of the SULC framework to the Traffy Fondue platform enhances urban problem management through measurable knowledge gains, high satisfaction, and observable improvements in citizen participation. However, sustaining engagement will require ongoing support, user training, and transparency in inter-agency coordination.

Finally, this study identified key operational challenges, such as varying digital literacy among citizens, occasional delays in agency coordination, and the need for sustained user training and system monitoring. Addressing these issues will be essential for maintaining long-term citizen participation and maximizing platform performance.

In summary, the integration of the SULC framework into Traffy Fondue has proven effective in digital transformation within urban incident reporting. The achievement of this initiative highlights the value of adaptive, data-driven, and citizen-centered approaches to urban management, demonstrating how smart technologies can contribute to more responsive, transparent, and sustainable governance in the future.

Discussions

Traffy Fondue was utilized to address delays in the village problem-reporting process, which had previously been inefficient. New digital platforms are continuously being developed to enhance service efficiency and improve problem-solving processes in the digital era. Government agencies seeking to organize activities and implement digital transformation

initiatives may benefit from adopting a structured process. These findings are consistent with Thongrattanadol et al. (2023), emphasized the importance of system usability and staff attitudes in driving successful adoption of Traffy Fondue. The SULC framework strengthened these outcomes by establishing a structured feedback loop that supports continuous learning and adaptive improvement. Furthermore, the integration of real-time data and user feedback contributes to digital transformation aligned with Caragliu et al. (2011), who identified responsiveness and transparency as key smart city dimensions. The authors have developed and proposed the SULC as a systematic framework for developing, deploying, and improving software systems based on real-world feedback and user interaction, as shown in Figure 3.

The SULC is an extended framework that focuses on the post-deployment phases of software use, ensuring that the system remains effective and adaptable based on real-world feedback and user interaction. The research process follows the SULC model, which consists of six key stages as follows:

Planning Phase: This first crucial phase sets the foundation for the entire software development process, beginning with defining the scope of the implementation plan, time, identifying the target users, defining the software's objectives, and outlining the benefits and expected outcomes. The planning phase is instrumental in ensuring the software design and user needs, along with functional goals.

Requirements Analysis Phase: This second phase is dedicated to understanding user needs and system limitations, which are crucial in guiding the creation of detailed system requirements and specifications, conducted mainly through target end users. Classifying user requirements, user skills, and experiences aligns with technology usage and characteristics of software compatibility. All data sample studies will be collected and analyzed to define the appropriate software's functionalities and non-functional requirements met by user tasks.

Operational Design Phase: The operational design phase is the user testing of the system functionality on their current working tasks. It involves creating the framework for the system's daily operational uses, including designing the system specification, software components, user interfaces, developing training materials, and setting up public communication strategies. Testing instruments such as pre-test and post-test questionnaires are also designed to measure the system effectiveness of user working tasks and satisfaction during the system design phase. The questionnaire constructs and items are designed and

validated by the system developer and designer with user approval to ensure user needs are at the forefront of the design process.

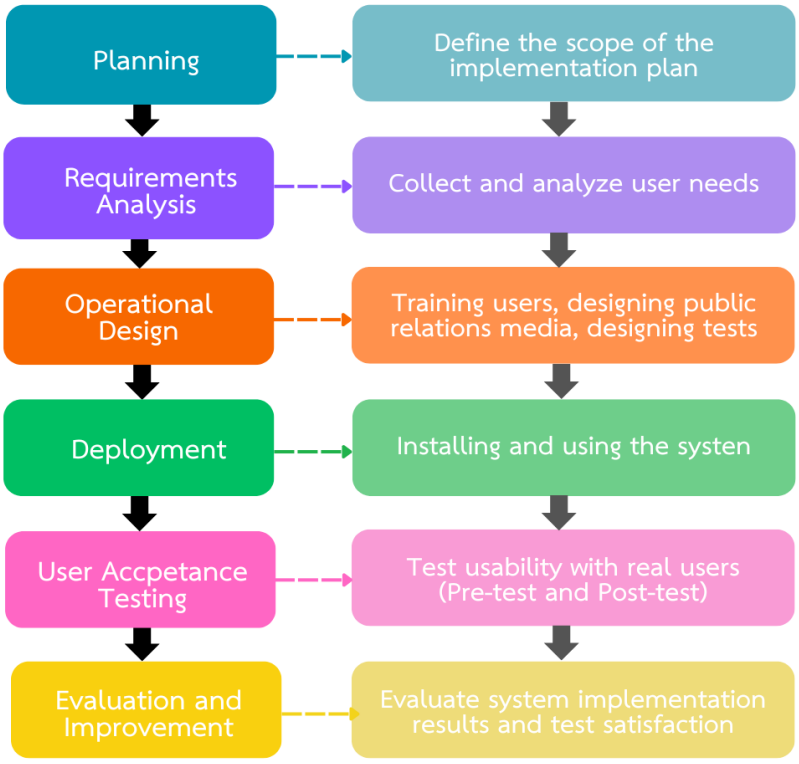

Figure 3 Software Usage Life Cycle Framework

Deployment Phase: This final phase is the essential step before the system is permanently used in daily work. After the proposed system is fully developed and tested internally, it can be deployed. This phase includes making instructions for trainers and users, installing and configuring the software, providing user access, and ensuring the system operates smoothly and connects to the internet continuously. Initial user feedback is collected during this stage when the software is installed on the users' mobile platforms.

User Acceptance Testing Phase: In this phase, the system's usability, acceptance, and performance are tested with practical system operational working. A pre-test is conducted before users interact with the system platform, followed by a post-test after the training and a period of familiar system usage. The sampling group of users is notified of the importance of the consent form prior to data collection of the users' feedback on using the practical system, and whether it meets the users' requirements. The results measure user understanding, satisfaction, and overall system performance improvements.

Evaluation and Improvement Phase: This necessary phase is not only the end involving, but the beginning of the design and development of a continuous improvement system journey. It focuses on analyzing user innovative requirements for improving practical systems, adding the system's functionalities, and improving system performance. Feedback on user data includes user acceptance testing, satisfaction surveys, and operational performance metrics, used to identify areas for improvement and system use in the long-term satisfaction.

Therefore, the SULC model provides a comprehensive approach to ensuring that software solutions are effectively designed, tested, and continuously improved to meet evolving user needs and operational demands. By implementing this framework, government agencies can enhance user engagement, improve operational efficiency, and ensure digital transformation initiatives align closely with user expectations and requirements.

As presented in Table 3, the figure explains the principles of the SULC framework, particularly on iterative improvement and user-centered design. The high satisfaction ratings across accessibility, responsiveness, and overall usability indicate that the Traffy Fondue has transitioned from a digital platform of a functional reporting tool into an integrated citizen engagement system. This demonstrates that citizens can actively participate in urban governance.

Qualitative feedback supports being more connected to local authorities and being more confident because citizens' issues can be reported through the digital platform and addressed and solved promptly. The positive experiences reported by users reflect how post-deployment feedback is provided through the final process of the SULC framework. The framework successfully engages the improvement of service delivery and user trust. The results explain rationale along with previous research that emphasizes the importance of transparency and responsiveness in smart city (Zhao et al., 2023; Okonta & Vukovic, 2024).

Recommendations

Traffy Fondue is a digital platform that enables citizens to report issues, track citizens' reported issues, receive regular updates, and provide feedback for city solutions. The platform's main feature enables city workers to respond faster and makes the reporting process more transparent. The Traffy Fondue helps the government responsible and builds public trust. Traffy Fondue encourages people to get more involved in helping manage city issues by giving them a bigger role in solving problems. This study also presents the SULC

framework. The proposed framework is a guideline design of six phases to help people effectively utilize digital technologies and information systems. The phases help promotes better digital government and smart city projects by designing more effective platforms and increasing the number of people who utilize them. Future research should examine how the SULC framework operates over time with various groups and in different settings, while investigating how people utilize technology and accept to use Traffy Fondue.

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