Design and Development of a Web-Based Church Information System for a Protestant Church under the Synod in East Java

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Abstract— The rapidly-evolving nature of information technology is both a challenge and an opportunity for non-profit organisations, as they seek to apply digital solutions to their administrative processes, as it does for organization XYZ Church in East Java. As the XYZ Synod of East Java is developing a more and more networked local church, managing congregation data has never been so sophisticated. Because the systems are not integrated, church data is often managed in a fragmented manner, making it difficult to track congregation data, use church activities intelligence, and provide adequate pastoral services. This research has the purpose to create a church information system in a web-based environment so that it can solve these problems, manage centralized but flexible in gathering the congregations data in a web-based, and can access in different churches. It proposes a cloud-based system that will be cost-effective, ensuring scalability, security and removing the need for expensive IT infrastructure while still ensuring data is available and protected. SSM, in conjunction with problem structuring methods, also means we can identify not only the primary challenges and stakeholder perspectives among the members of Church XYZ, but also explore the core system functionalities to ensure the solution fits the operational and pastoral needs of Church XYZ as it seeks to engage East Java. It is hoped that the thorough model formulated will significantly improve administrative effectiveness, increase data accuracy, refine pastoral care methodology and safeguard privacy of ministry while allowing efficient integration between local churches. This study combines contemporary solution of digital transformation with structured methodological analysis to appropriately support the digital transformation of church management while maintaining the core values and mission of Church XYZ in East Java.

Keywords—*church;information systems; regional;syndod;digital*

I.INTRODUCTION

Digital transformation has become an integral driver of organizational growth, providing organizations with the tools to increase operational efficiency, improve decision-making and raise the bar for service delivery. By embracing Digital Technologies, institutions can become more agile, responsive, and effective in meeting their mission and stakeholder expectations in an increasingly connected world.
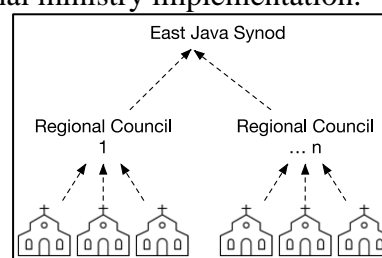
Church XYZ is a religious organization that coordinates nearly 50 local churches across East Java and Bali under the governance of the XYZ Synod of East Java. Within these churches, a substantial amount of data is generated, which, if properly managed, can significantly enhance service effectiveness. However, Church XYZ currently lacks a unified and integrated information system at the synodal level. Existing church management systems operate independently in each local church with varying data formats and non-standardized structures, leading to inconsistent and unreliable data. This fragmentation hinders comprehensive congregation analysis and limits the ability

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to assess the overall spiritual and administrative conditions across the entire coordinated network of churches.

Previous research on church information systems dates back to 1975, with an early study from Louisiana State University proposing a standalone church management model that was not designed for synodal integration[1]. Other Recent studies have also highlighted gaps within the nonprofit sector, particularly in faith-based communities, regarding their strategic use of ICT to support mission-critical services. Many nonprofit organizations struggle with a lack of knowledge, technical capability, and financial resources to adopt digital solutions effectively, which hinders their ability to optimize operational and strategic processes[2]–[5]. Within Church XYZ, these obstacles become particularly apparent, as the lack of a unified information framework generates significant inefficiencies across administrative operations, congregation data evaluation, and leadership decision processes.

Subsequent research conducted in 2014 and 2019 brought forth web-based church information platforms offering enhanced flexibility and accessibility, enabling church administrators to conduct more thorough congregation profile analyses. This research gap indicates an opportunity to explore more sophisticated solutions that address the complex interconnections between multiple church locations within a regional ecclesiastical structure.[6]–[8]. This research gap presents an opportunity to design a comprehensive information system offering expanded data-driven insights into church operations. Such a system would enable church leadership to make informed decisions based on detailed, real-time congregation data within the organizational structure. The coordination framework of churches within the synodal system, as illustrated in Figure 1, demonstrates the interconnected nature of ecclesiastical institutions requiring advanced information

management solutions for effective regional ministry implementation.

Figure 1. Coordination Structure of Church XYZ Synod

As depicted in Figure 1, the ecclesiastical organizational structure demonstrates a hierarchical arrangement wherein multiple local churches operate under the governance of a Regional Church Council, while several Regional Church Councils function under the coordinating authority of the East Java Synod. This multi-tiered governance framework necessitates a sophisticated approach to information management.

II. METHOD

The development of Church XYZ's integrated information system employs Soft Systems Methodology (SSM) as an analytical framework to address complex organizational challenges within this ecclesiastical context. SSM represents a methodologically robust approach for examining ill-structured problems that resist purely technical definition, particularly within social and organizational environments. The framework sets out a systematic approach to examine the complex aspects of information management in spiritual organizational contexts[9]. Systemic Security Modeling (SSM) will be applied to draw insights because it views information systems as socio-technical systems and allows researchers to analyze interrelations between the technological infrastructure, organizational processes, and stakeholder perspectives holistically. This integrated analytical framework proves particularly valuable when addressing multifaceted information management challenges within ecclesiastical institutions, where

technological solutions must align with established organizational practices and institutional values. [10].

In Church XYZ's operational context, characterized by autonomous local churches with non-standardized data management practices. A principal advantage of SSM lies in its capacity to bridge decision-making gaps within non-profit organizations, ensuring diverse perspectives are systematically incorporated into system design architecture and implementation processes. [11], [12].

SSM follows a structured, seven-stage iterative process that facilitates problem structuring, stakeholder engagement, and model validation[13], [14]. Step one is to identify and become familiar with the trouble, taking all necessary elements into account. The next step involves visualizing the problem by using visual information/knowledge mapping tools such as Rich Picture, which is useful to explore complex systems and to take note of the major challenges that need to be addressed. After you understand the big picture, a root cause analysis comes, using CATWOE (Customers, Actors, Transformation, Weltanschauung, Owners, and Environment) which is a structured tool that helps you introduce the key factors enabling the system. A conceptual model is then created, guided by these insights, identifying the key components and exploring potential solutions. This model is then tested against real-world dynamics to see if it is geographically feasible, if work can be done by the organization, or if it can be blocked.

SSM establishes right linkages between qualitative and systematic analysis makes it one of the primary reason for usage in Non-profit organizations, Religious organizations etc [14]. This research seeks to take a Digital Solution based on SSM Applied to Church XYZ that is Flexible and User-Centered-Based, aiming Commitment to Improving the Management of Congregation Based Data

to Improve Decision Making and better coordination in the Regional Church Council and the East Java Synod. In addition, Figure 2 below depicts the SSM process used in the current study.
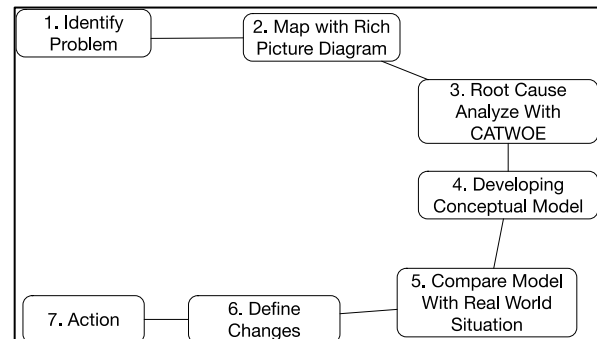

Figure 2. SSM Process for Church XYZ Synod

III. RESULTS AND DISCUSSION
A. RESULT

To address this problem, the first part of this study conducts an investigation of congregation data management challenges through interviews with stakeholders in the church hierarchy, i.e. the Regional Church Council, East Java Synod, and local churches. The subjects of this study are congregational elders, church administrative staff, local church pastors, leaders of the Regional Church Council, and Synod executives. The findings gained from these interviews offer a thorough insight into the current field challenges and operations limitations found in the Church XYZ Synod.

Upon reviewing the findings from interviews, most of the field challenges about the lack of an integrated information system have been addressed. This study will discuss the key features that should be prioritized for initial development. The prioritization of these features is determined based on the impact they generate, ensuring that the most critical functionalities are implemented first to enhance system effectiveness and usability. The interviews were conducted with 10 key stakeholders, including congregational elders, church administrative staff, local church pastors,

Regional Church Council leaders, and Synod executives. A summary of the identified features and their corresponding impact is presented in Table 1 below.

Table 1 Features Summary

No	Features	Impact
1	Church member database	From local churches to the national synod.
2	Church member summary report	From local churches to the national synod.
3	Attendance Report	Local
4	Financial	Local and regional
5	Asset Management	Local
6	Reverend/ Pastor database	Council

Based on Table 1, it is evident that the development of a comprehensive congregation database, along with the recapitulation of congregation data, holds the highest strategic significance and should be prioritized as the primary focus for system implementation.

This analysis presents the current situation depicted in the Rich Picture diagram below, which visually illustrates stakeholder relationships, system dynamics, and principal difficulties in church administration within the East Java Synod [15], [16] .Rich Picture diagram for this research is displayed in figure 3 below.
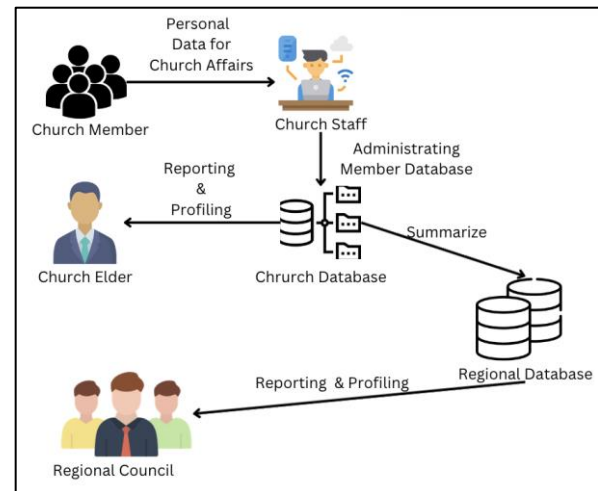

Figure 3. Rich Picture Diagram for Propose Systems

After the situation has been illustrated using a Rich Picture diagram, the next step involves conducting a CATWOE analysis, which systematically examines key components of the system to ensure a comprehensive understanding of its operational and strategic dimensions. The analysis is outlined as follows [10], [11], [17]. This study employs CATWOE analysis to systematically assess essential players, transformation processes, and external limitations in the development of an integrated church information system. This strategy guarantees coherence between technical progress and organizational requirements, tackling the issues encountered by churches within the East Java Synod. The comprehensive analysis is presented in the subsequent paragraphs.

Customer (C) – Congregation Members, Church Administrators, and Ecclesiastical Leadership

- The principal beneficiaries of the system transformation are congregation members.
- Church administrative staff at both local and synodal.
- Ecclesiastical leadership, comprising synodal executives, regional church council representatives, and local pastors.

Actor (A) – Church Administrative Personnel, IT Specialists, and Church Leaders

- Administrative professionals
- IT specialists.
- Church leaders, comprising pastors, elders, and representatives from regional church councils, oversee the system's implementation, governance, and conformity with ecclesiastical teachings and administrative policies.

Transformation (T) – Transitioning from Decentralized, Manual Data Management to a Cohesive, Digital Church Information System

- The transformation process involves transitioning from disjointed and manually maintained congregation records to a standardized, consolidated, and web-based information system.
- Pre-transformation conditions:
  - o Local churches utilize disparate record-keeping methods.
  - o Lack of real-time data synchronization, resulting in ineffective inter-church coordination.
  - o Obstacles in monitoring congregational demographics, financial management, and pastoral services.
- Post-transformation improvements:
  - o Deployment of a cloud-based congregation database to provide real-time accessibility and data uniformity.
  - o Improved transparency and data-informed governance at regional and synodal tiers.
  - o Enhancement of ecclesiastical administrative operations, encompassing membership monitoring, fiscal management, and event organization.

Weltanschauung (W) – Organizational and Theological Justifications for Digital Integration

- The implementation of an integrated church information system is based on the conviction that technological progress should augment,
- The system must maintain ethical data stewardship, openness, and inclusivity..
- The system reduces administrative inefficiencies.

Owner (O) – Synodal Leadership and Regional Church Councils

- The leadership of the East Java Synod.
- The Regional Church Councils.

Environmental Constraints (E) – Institutional, Technological, and Regulatory Challenges

- Compliance.
- Technological inequalities.
- Resistance to Change.

CATWOE is a systematic study to understand the key stakeholders, transformation processes, and external constraints in the development of a solid church information system. The next step based on these insights is to transform the outcomes from this insight-driven exercise into a conceptual model that lays the foundation of systematic architecture, data flow, and functional components. This model ensures that the proposed method is more efficient administrative, provides decision-making, and in accordance with the theological and organizational principles of the church in the East Java Synod. Figure 4 shows the model developed in this study.
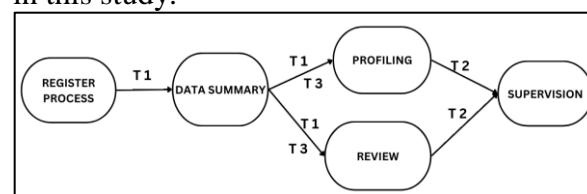

Figure 4. Conceptual Model for Integrated Information Systems

The fifth and sixth stages of Soft Systems Methodology (SSM) focus on assessing and improving the conceptual model by ensuring that it can be applied successfully. Stage 5: The proposed model

is then evaluated with respect to current church operational systems by comparing it with existing administrative practice and theology to explore its feasibility and compatibility. This comparative study helps highlight discrepancies and room for advancement. Stage 6: System functionality, viability for adoption, and overall efficacy improvements. The changes entail optimizing the system framework, refining implementation techniques, and maintaining alignment with stakeholder expectations to enable seamless integration across church levels. The principal conclusions and suggested enhancements from these phases are encapsulated in Table 2.

Table 2 Propose of Changes

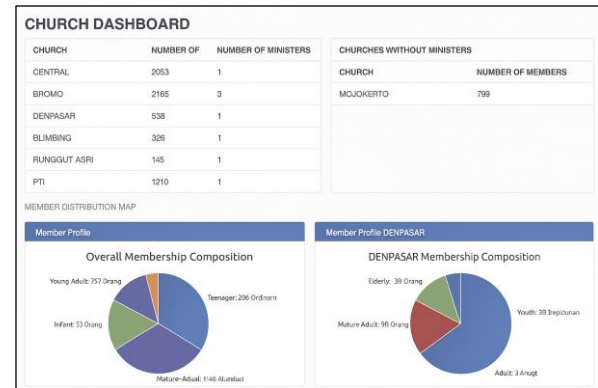| Conceptual Model Activity	Real Conditions	Propose Changes
Register Process	Local churches employ various record-keeping techniques, such as manual records, spreadsheets, and independent databases.	Creating a standard information system for all local churches while still maintaining each church's data privacy. It will be, for the purposes of profiling, only recapitulated and summarized data that is accessible to the Regional Church Council and Synod.
Data Summary	The data summarizing process is performed manually and is deficient in accuracy.	
Profiling	Profiling relies on data supplied by local churches, resulting in diminished accuracy.	
Review	The review process depends exclusively on available data, without a system for validating its accuracy and reliability.	Establish a data recapitulation system for regional church councils and synods to facilitate review and supervisory processes
Supervision	The lack of data makes supervising impossible for best performance.	based on existing data, enabling implementation at any time.

After reviewing the gaps between the conceptual model and real-life conditions, as shown in Table 2, the final step of the Soft Systems Methodology (SSM) is the identification of desirable actions which is actionable and improve the situation concerning the problems. This step must consider the execution of proposed changes in a pragmatic manner, consistent with stakeholder expectations. The enhancement in this large-scale study refers to the time-efficient building, design, with the thought going into potential data privacy processes, such as remembering users versus sessions, user-information types, open network access to churches, and a privacy-safe church information system, which starts on the basis of members, marking, data summaries, and profiling capabilities. These measures aim to provide solutions to the salient challenges in the field without creating redundancy in existing church structures and administrative workflows, or going against theological values.

After the domain analysis through the stages of SSM (Soft Systems Methodology) in a more comprehensive view guided by the petri-net modelling, an application is designed and developed to solve the main issues of the system in question. This approach aims to respond to the results of previous stages by promoting better data management, administration and decision-making in church´s context. Table 3 below lists the primary components and functionalities for the proposed application.

Table 3 Propose Application

Application	Scope	Transformation Related in Conceptual Model
Church Information System with Data Summary Synchronization	Local churches	T1 and T3
Regional Synod Dashboard	Regional Synod	T2

Following the suggested modifications found in Step 6 of the Soft Systems Methodology (SSM), a prototype was created in Step 7 as shown below. The prototype design—which consists of two primary components—is presented in the section following. Designed for usage at the local church level, the data entry interface (see Figure 5) guarantees consistent and orderly input of congregation data. Designed at the Regional Church Council and Synod levels, the dashboard component (shown in Figure 6) offers condensed data and visual insights to assist supervision and strategic decision-making. Both elements complement the organizational structure and requirements of Church XYZ and represent the gains outlined in the past phases of research.

Figure 5. Local Church Data Entry Interface

Figure 6. Church Dashboard for Regional Council and Synod

After the prototype was developed, it was tested among about twenty people. Table 4 below captures the results of this study.

Table 4 Validation Result

Question	0	2	3	4
How closely does the planned information system fit the goals, vision, and mission of the church?		1	15	19
In what ways does the vision, mission, and goals of your company help to assist the Church Information System's deployment?		1	15	19
How much do the goals, vision, and mission of your company help the Church Information System to be developed or implemented?		4	15	16
How effectively do your organization's vision, mission, and goals complement strategic elements of regional Church Information System deployment?		5	14	16
How much of the strategic demands of the company are openly reflected in the vision, mission, and goals?		2	15	18
How much of the Church Information System's design and planning reveal regarding organizational needs and information technology for their application?		3	16	16
How much does the function of the church organization seem to influence the needs analysis and planning of the		4	13	18

Question	0	2	3	4
Church Information System suggested in this paper?				
How clearly the creation and suggested deployment of Church Information Systems reflect the participation of subject matter experts from relevant fields (church and information technology)?		2	3	30
In this study, how does the suggested Church Information System take into account organizational needs and the technology possibilities for its development?		1	7	27
How clearly top leadership is involved in designing and implementing the Church Information System?		7	2	26
How effectively does the Church Information System's development aim meet operational goals and information technology requirements of your company?			18	17
How much does your company gain practically from the technical advancement of the Church Information System?		1	21	13

The outcomes of the prototype evaluation are delineated in Table 4, with the scoring criteria specified as follows: 0 signifies that the solution is not aligned, 2 indicates not applicable, 3 represents partially applicable, and 4 identifies applicable. The prototype underwent testing at multiple synods on the island of Java. The data indicates that most replies are predominantly found in the "3" (Partially Applicable) and "4" (Applicable) categories across all evaluation criteria. The results demonstrate that the proposed Church Information System is predominantly congruent with the organization's vision, mission, and strategic requirements.

B. DISCUSSION

The prototype aligns well with the organizational structure and strategic objectives; nonetheless, its successful implementation depends on a robust data governance system. Due to the complex structure of church administration, well delineated access rights and data duties are essential to protect data privacy, integrity, and institutional responsibility.

A primary concern that arose is the necessity for role-based access control, wherein local churches oversee individual member data, while synod-level organizations access only aggregated summaries. This underscores the necessity for further study in developing context-specific data governance frameworks that address both practical requirements and ethical limitations.

Additionally, further examination is required to assess organizational preparation, change management, and user acceptance techniques, especially within non-profit and religious entities characterized by decentralized governance. These domains offer considerable prospects for forthcoming research focused on improving the scalability, sustainability, and contextual relevance of Church Information Systems.

IV. CONCLUSION

This study designed a Church Information System fit for the East Java Synod using the Soft Systems Methodology (SSM), therefore addressing the architecture of churches. With a dashboard for regional control and a consistent data entry interface for local churches, the proposed solution solves important data management problems. Testing prototypes throughout numerous synods in Java revealed that the system is generally relevant and suitable to organizational demands. The results, however, underline the need of a well defined data governance system to control access rights and guarantee consistency and privacy. The approach has promise overall for raising

strategic control and administrative efficiency. Future studies should examine the evolution of governance structures and evaluate preparedness for more general application.

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