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KMS for overcoming stunting in early childhood and pregnant women using the Soft System Methodology (SSM) with the Learning Lesson System (LLS) approach

Erly Krisnanik[1], Muhammad Adrezo[2], Kraugusteeliana[3], Bambang Saras Yulistiawan[4], I Gede Susrama[5]

[1,2,3,4]Faculty of Computer Science, Universitas Pembangunan Nasional Veteran Jakarta, RS. Fatmawati, Pondok Labu, Jakarta Selatan, 12450, Indonesian

[5] Faculti of Computer Science, Universitas Pembangunan Nasional Veteran Jatim, Jl. Raya Rungkut Madya, Gunung Anyar, Surabaya, Jawa Timur, 60294

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ABSTRACT

This study addresses the concerning prevalence of stunting among early childhood and pregnant women in Indramayu Regency, which reached 18.4% in 2024, exceeding the national target of 14%. It aims to develop a Knowledge Management System (KMS) to support integrated stunting control efforts by employing Soft Systems Methodology (SSM) for comprehensive problem identification and the Learning Lesson System (LLS) to incorporate proven best practices. The KMS is designed to optimize information distribution regarding the causes, impacts, and interventions for the stunting issue, while enhancing collaboration among government, community, and families. The integration of SSM and LLS allows the system to adapt to changing local conditions and needs, providing relevant, evidence-based information. This research result suggests that the implementation of KMS can significantly improve the effectiveness of health policies and intervention programs at reducing stunting, particularly among vulnerable populations. However, questions remain regarding the specific features of the KMS, the implementation strategy within communities, and the evaluation measures for assessing its long-term effectiveness in combating stunting.

Corresponding Author:

Erly Krisnanik,
Faculty of Computer Science,
University of Pembangunan Nasional Veteran Jakarta,
RS. Fatmawati, Pondok Labu, South Jakarta, Indonesia
Email: erlykrisnanik@upnvj.ac.id

1. INTRODUCTION

Stunting remains a persistent global public health challenge, particularly in low- and middle-income countries, where governance fragmentation, weak knowledge integration, and limited institutional learning mechanisms continue to hinder effective intervention strategies[1]. Despite decades of implementing nutrition-specific and nutrition-sensitive programs, reductions in stunting prevalence have remained slow and uneven, suggesting the presence of systemic weaknesses that extend beyond clinical nutrition and dietary intake alone [2]. These weaknesses are increasingly associated with deficiencies in governance coordination, cross-sectoral knowledge integration, and the absence of sustained learning mechanisms within public health systems [3].

This study is grounded in the conceptualization of a Knowledge Management System (KMS) as an enabling platform for addressing such systemic limitations in stunting governance[4]. As illustrated in the proposed system diagram, the KMS supports structured knowledge management processes related to stunting by integrating educational resources, discussion forums, monitoring tools, and interactive learning features based on best practices and real-time data[5]. These functionalities are designed to support stakeholders in preventing stunting among children while simultaneously promoting maternal health through informed decision-making and collective learning.

Stunting during early childhood constitutes a critical public health issue due to its long-term adverse effects on physical growth, cognitive development, and human capital formation [6]. In the context of Indonesia, the challenge remains substantial. In Indramayu Regency, for example, stunting prevalence reached 18.4% in 2024, exceeding the national target of 14% [7], [8]. Empirical evidence consistently indicates that stunting is not solely attributable to inadequate nutritional intake but is also strongly influenced by a range of environmental, social, and institutional factors, including parental education, sanitation conditions, household socio-economic status, and access to quality health services [9][10][11]. Consequently, effective stunting management requires a comprehensive and integrated approach that actively involves multiple stakeholders, including healthcare professionals, educators, parents, community organizations, and policy actors[12].

Within this context, the implementation of a Knowledge Management System (KMS) offers a strategic mechanism for strengthening stunting governance [4]. A KMS facilitates the systematic collection, storage, dissemination, and utilization of knowledge related to stunting, encompassing epidemiological data, causal determinants, intervention outcomes, and best practices [13]. By enabling structured knowledge flows across institutional boundaries, a KMS supports evidence-informed decision-making and enhances coordination among stakeholders operating at different governance levels [8].

To address the inherent complexity of stunting as a socio-technical and socio-health problem, this study employs Soft Systems Methodology (SSM) as a foundational analytical approach. Originally developed by Checkland, SSM is a qualitative methodology designed to explore complex, ill-structured problems by incorporating multiple stakeholder perspectives and recognizing the socially constructed nature of problem definitions [14][15]. SSM facilitates holistic understanding by encouraging participatory inquiry into problem situations rather than prescriptive solution design[16].

The theoretical foundations of SSM encompass six key aspects. First, its human-centric orientation emphasizes stakeholder participation and acknowledges the plurality of worldviews that shape problem perceptions. Second, the use of rich picture techniques enables the visualization of complex relationships among actors, processes, and contextual constraints [14], [15]. Third, SSM employs root definitions and conceptual models to articulate system purposes from different perspectives and to map the activities required to achieve desired transformations [16] [17]. Fourth, the methodology adopts an iterative process of modeling, reflection, and revision, allowing insights to evolve through stakeholder engagement. Fifth, SSM explicitly promotes learning and adaptation by encouraging collective reflection on experiences. Finally, its inherent flexibility allows SSM to be adapted across diverse organizational and community contexts, including public health systems.

However, classical SSM has been widely criticized for its limited operational guidance in complex health system settings, particularly in translating rich qualitative insights into sustained learning mechanisms and institutionalized knowledge practices [18][19]. In many empirical applications, SSM interventions terminate at the level of conceptual modeling, without ensuring that insights are systematically captured, codified, and embedded into organizational memory or governance routines.

Despite the extensive use of Soft Systems Methodology (SSM) in organizational and health systems research[20][21], and the growing interest in learning-based systems for addressing complex public health challenges, a critical gap remains in the availability of context-aware Knowledge Management Systems (KMS) that explicitly integrate SSM with a structured and institutionalized learning loop for stunting governance[22][4]. Most existing studies employ SSM primarily as a

problem-structuring tool, without extending its outputs into continuous organizational learning and cumulative knowledge accumulation mechanisms. This study addresses this gap by proposing an integrated SSM–Learning Lesson System (LLS) framework, in which SSM provides a holistic understanding of the stunting problem context, while LLS operationalizes continuous reflection, lesson codification, and iterative adaptation to support long-term, evidence-informed stunting governance in the health sector.

The Learning Lesson System (LLS) is an approach that emphasizes learning from past experiences as a systematic means of improving practices and outcomes across sectors, including education, healthcare, and organizational management[23][24]. At its core, LLS promotes structured knowledge sharing and collaboration by encouraging stakeholders to document, exchange, and synthesize lessons learned from both successes and failures [25][26]. Reflective practice constitutes a central component of LLS, enabling critical examination of actions and outcomes to identify underlying causal mechanisms and areas for improvement[27].

Furthermore, LLS supports continuous improvement through iterative learning cycles in which lessons are captured, evaluated, and reintegrated into planning and implementation processes. By bridging theory and practice, LLS facilitates the operationalization of conceptual frameworks within real-world contexts, enhancing the practical relevance of theoretical insights. Its holistic perspective recognizes the interdependence of health, nutrition, education, and socio-economic dimensions in addressing stunting, while embedded evaluation and feedback mechanisms ensure that learning outcomes inform future decision-making. In this study, LLS is positioned not merely as a knowledge-sharing tool, but as an epistemic learning mechanism that institutionalizes reflection, lesson codification, and adaptive governance. By complementing SSM, LLS extends the learning cycle beyond problem structuring toward continuous organizational memory formation and sustained system improvement.

2. RESEARCH METHOD

This study adopts a qualitative design science research approach combined with a case study in Indramayu Regency. The unit of analysis is the stunting governance system involving health workers, cadres, pregnant women, and parents of early childhood. The development of the KMS system uses two methods, SSM and LLS. Here is Table 1 illustrating the relationship between Soft System Methodology (SSM) and Learning Lesson System (LLS) in the development of a Knowledge Management System (KMS) aimed at addressing stunting in early childhood and among pregnant women. [28], [29].

Table 1. Relationship Between SSM and LLS

Aspect	Soft System Methodology (SSM)	Learning Lesson System (LLS)
Purpose	Identify and analyze complex problems related to stunting.	Facilitate learning from past experiences and practices.
Approach	Adopts a holistic and participatory approach by actively involving stakeholders in the identification of problems.	Collaborative learning encourages the sharing of experiences.
Problem Identification	Focus on understanding the underlying causes of stunting through systems thinking.	Leverage insights from previous interventions to inform current practices.
Data Collection	Utilizes rich pictures and conceptual models to visualize issues and stakeholder perspectives.	Gather lessons learned from various stakeholders and best practices.
Solution Development	Encourages multiple perspectives to devise effective and context-specific solutions.	Promotes the adaptation of solutions based on collective learning and experiences.
Implementation	Systems thinking helps in designing adaptive strategies for KMS development.	Ensuring that solutions are based on practical results and feedback.
Stakeholder Engagement	Engages diverse stakeholders (e.g., healthcare, education, community) in the process.	Involves all relevant parties in sharing insights and learning from each other.

Aspect	Soft System Methodology (SSM)	Learning Lesson System (LLS)
Outcome Evaluation	Continuous monitoring and evaluation to assess the effectiveness of solutions.	Systematic assessment of the implementation of learned lessons to improve practices.
Adaptability	Allows for dynamic responses to emerging challenges and changing conditions.	Encourages iterative learning and adjustment to strategies based on new insights.
Long-term Impact	Aims for sustainable change in reducing stunting rates through informed decision-making.	Enhance community awareness and proactive engagement in addressing stunting through shared knowledge.

Figure 1 below explains the stages of KMS system development, which are connected to the SSM and LLS methods. Implications for KMS Development are: a) Integration of SSM and LLS: Combining SSM and LLS in KMS development allows for a comprehensive approach to tackle the multifaceted issue of stunting. SSM provides a structured method for understanding the complexities of the problem, while LLS emphasizes the importance of learning from past experiences; b) Enhanced Collaboration: By engaging multiple stakeholders through both methodologies, the KMS can boost a collaborative environment where knowledge sharing is prioritized, ultimately leading to more effective strategies in stunting prevention; c) Informed Decision-Making: The integration of these methodologies ensures that decisions made within the KMS are grounded in both theoretical frameworks and practical insights, promoting evidence-based interventions that can effectively address stunting.

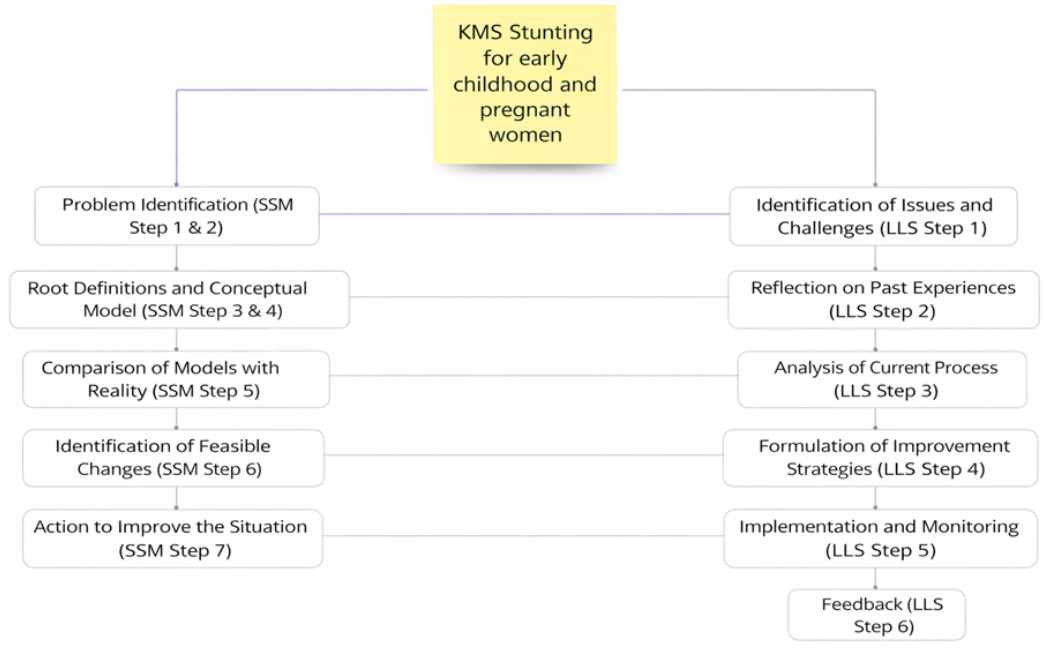


Figure 1. Research Stages of KMS Stunting Application in Indramayu

The research design of this study is an exploratory qualitative systems design grounded in Soft Systems Methodology (SSM) and extended through a Learning Lesson System (LLS) as an embedded learning mechanism within a Knowledge Management System (KMS). As illustrated in Figure 1, the study adopts a design-oriented and learning-based research framework, rather than a conventional hypothesis-testing design.

The research design follows a two-layered methodological structure: (a). Problem structuring and system conceptualization layer, operationalized through SSM Steps 1–7 (problem identification, root definition formulation, conceptual modeling, comparison with real-world conditions, and identification of feasible changes). (b). Institutionalized learning and adaptation layer, operationalized

through LLS Steps 1–6 (issue identification, reflection on past experiences, process analysis, strategy formulation, implementation, monitoring, and feedback).

This combined SSM–LLS design enables the study to systematically explore complex stunting governance problems, translate qualitative insights into actionable system improvements, and embed continuous learning within the KMS. Therefore, the research design is explicitly process-based, iterative, and system-oriented, aligning with established qualitative systems research paradigms in public health and information systems research.

The unit of analysis in this study is not the individual child or household, but rather the stunting governance knowledge system operating at the organizational and inter-organizational level. Specifically, the unit of analysis is defined as: The Knowledge Management System (KMS) for stunting prevention and maternal–child health, including its embedded decision-making, learning processes, and stakeholder interactions.

As depicted in Figure 1, the unit of analysis encompasses: (a). Knowledge processes related to problem identification, conceptual modeling, decision-making, and learning cycles; (b). Stakeholder interactions among health workers, local government agencies, community actors, and caregivers; (c). Institutional learning loops operationalized through the integration of SSM and LLS.

This system-level unit of analysis is consistent with prior applications of SSM and learning-based frameworks in complex health and governance contexts, where the analytical focus is placed on processes, structures, and learning dynamics, rather than on individual-level outcomes alone.

Data collection in this study is qualitative, multi-source, and process-oriented, consistent with the epistemological foundations of SSM and LLS. Based on the framework shown in Figure 1, data collection is conducted across two complementary domains:

SSM-based data collection, including: (a). Stakeholder narratives, problem perceptions, and experiential knowledge elicited during problem identification (SSM Steps 1–2); (b). Documentation and analysis of organizational practices used to formulate root definitions and conceptual models (SSM Steps 3–4); (c). Comparative assessments between conceptual models and real-world stunting management practices (SSM Step 5).

LLS-based data collection, including: (a). Records of past stunting intervention experiences, program reports, and institutional documentation (LLS Step 2); (b). Observational and reflective data on current operational processes (LLS Step 3); (c). Monitoring and feedback data generated during implementation and evaluation phases (LLS Steps 5–6).

These data sources are systematically captured, codified, and stored within the KMS, enabling iterative analysis, cross-case comparison of lessons learned, and continuous system refinement. Thus, data collection is embedded within the methodological workflow and directly supports the learning and adaptation objectives of the study.

3. RESULTS AND DISCUSSIONS

The development of the Knowledge Management System (KMS) is aimed at improving access to relevant information on stunting among pregnant women and young children. As a platform for collecting, storing, and disseminating knowledge, the KMS is designed to foster collaboration among stakeholders including healthcare professionals, educators, parents, and the community in addressing stunting. This system supports better decision-making by providing evidence-based data and information on stunting trends, risk factors, and the effectiveness of intervention programs. KMS serves to enhance public awareness and understanding of the importance of proper nutrition for children and pregnant women, while also functioning as a tool for monitoring and evaluating implemented programs. By providing a comprehensive understanding of the factors contributing to stunting and engaging all stakeholders, KMS supports the formulation of sustainable and adaptive solutions to improve community conditions. Furthermore, KMS promotes innovation in addressing stunting through the exchange of ideas and best practices, as well as by facilitating research and development in the fields of nutrition and child health. Thus, the development of the KMS system is expected to create an ecosystem that supports comprehensive, efficient, and sustainable stunting

management in Indramayu Regency. The application of the SSM method enables a holistic and participatory process in identifying stunting-related problems and relevant stakeholders. The engagement of multiple stakeholders in this process enhances the understanding of existing issues while simultaneously fostering the collaboration required to design and implement effective solutions. The outcomes of this stage will serve as the foundation for the creation of the Knowledge Management System (KMS), which will be utilized to combat stunting in Indramayu Regency.

3.1 Problem Situations Considered Problematic and Rich Picture Technique

In developing the Knowledge Management System (KMS) for stunting control in Indramayu Regency, many crucial problems must be considered. First, limited access to information and knowledge about the factors that cause stunting is a major obstacle, especially among medical personnel and the community. Limited access to information on appropriate nutritional patterns, health interventions, and effective parenting practices continues to hinder efforts to prevent and control stunting. Second, low public awareness and knowledge about the importance of balanced nutrition and maternal health during pregnancy and early childhood also exacerbate this condition. Insufficient collaboration among government, healthcare institutions, educational sectors, and families poses challenges to the effective coordination of stunting interventions. Lastly, the lack of systematization and management of data and previous experience in handling stunting causes knowledge to be poorly documented and difficult to reuse as a guide in the future. Table 2 explains the problems in Indramayu Regency related to stunting status in early childhood and pregnant women.

Table 2. Main problem stunting in indramayu

No	Main Problem	Description	Prevention Efforts
1	Lack of Nutritional Intake	Children experience limited access to nutritious food, especially in low-income families.	Increase food variety and nutritional quality in family diets.
2	Lack of Nutritional Knowledge	Many parents do not understand their children's nutritional needs, including the types of food and their frequency.	Educate parents about the importance of balanced nutrition and the frequency of children's meals.
3	Pregnant Women's Health	The nutritional condition of pregnant women affects fetal growth; maternal malnutrition can inhibit fetal growth.	Monitoring and nutritional education for pregnant women and optimal prenatal care.
4	Limited Health Services	Access to quality health services is limited in some areas, hampering early monitoring of stunting.	Ensuring easy access to health services, including immunization and growth checks.
5	Unhealthy Eating and Hygiene Practices	Poor eating and hygiene practices, such as unhygienic food, contribute to stunting.	Public awareness about healthy and hygienic eating practices.
6	Sanitation and Clean Water	Limited access to sanitation and clean water can have a negative impact on children's health.	Improving access to adequate sanitation and clean water.
7	Poverty and Limited Access	Poor families face difficulty in accessing nutritious food and necessary health services.	Economic support and food subsidy programs for low-income families.
8	Unbalanced Diet	Eating habits that are low in vegetables/fruit and high in processed foods affect children's growth.	Providing public socialization about the importance of a balanced diet rich in vegetables, fruit, and protein.
9	Cultural and Social Factors	Several cultural practices influence child feeding and care patterns, impacting growth.	Providing education to the community about the importance of balanced nutrition and proper child care practices.
10	Limited Parental Knowledge	Parents who have limited access to information about nutrition and childcare have difficulty preventing stunting.	Nutrition counseling and childcare through community awareness programs.

Based on Table 2, a rich picture of the problem situation can be described.

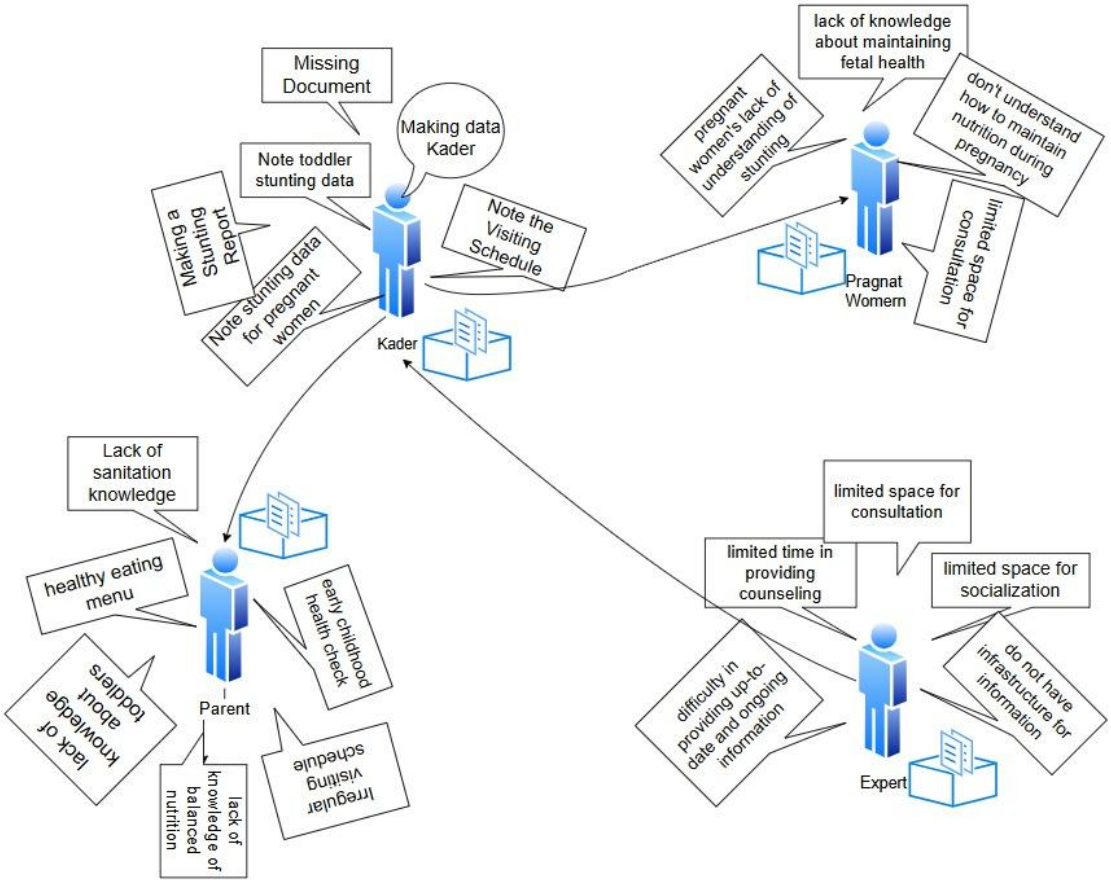


Fig. 2. Rich Picture Problem Situation

3.2 Root Definitions and Conceptual Models

Based on data from Rich Picture (RP), health experts face challenges in providing counseling and conducting consultations related to stunting due to space and time constraints. Most people in Indramayu do not fully understand the dangers of stunting, both for child development during infancy and during pregnancy. The Root Definition (RD) for the development of this system was designed using the CATWOE (Customer, Actor, Transformation, World View, Owner, and Environment) approach, which aims to identify the needs and expectations of stakeholders. This CATWOE approach helps formulate a KMS-based information system that allows the community to learn independently and provides expert knowledge on stunting prevention and treatment, to optimize health services at the Community Health Center. [30], [31]

Table 3. Ablcatwoe Analysis

Elemen CATWOE	Description
Customers	Parents, Pregnant Women
Actor	Cadre, Expert
Transformation	The manual system for addressing stunting among toddlers and pregnant women is being transformed into an information system that records individual experiences, which can serve as a reference for developing effective strategies to overcome stunting.
World View	Through the KMS application, parents and pregnant women are able to engage in independent learning based on expert knowledge. The system also enhances service delivery by enabling access to comprehensive information on stunting prevention and management.
Owner	Puskesmas Pabean Udik

Elemen CATWOE	Description
Environment	Initial data recording procedures, system usage manuals, registration procedures to obtain an account, and IT infrastructure support.

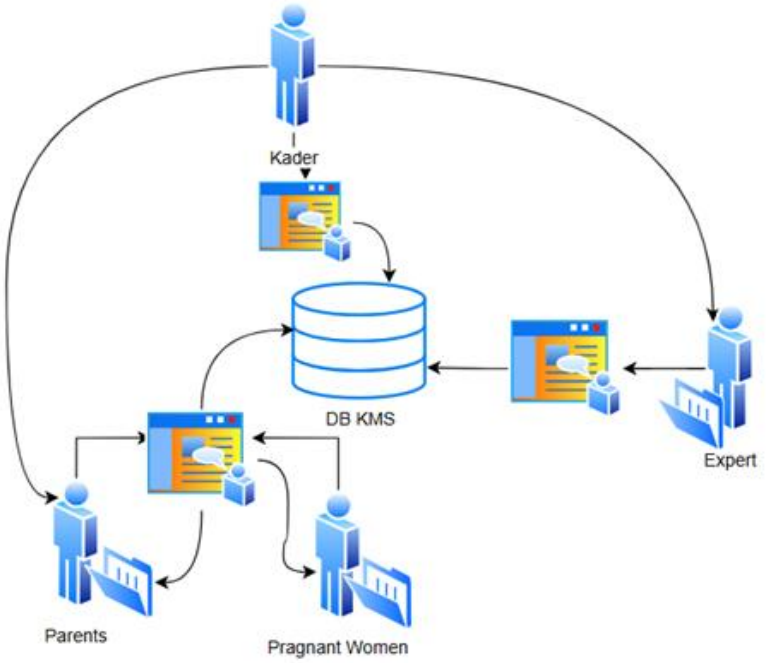


Fig. 3. Conceptual KMS Model

Figure 3 explains the conceptual model design for the KMS Stunting system for early childhood and pregnant women.

3.3 Comparison of Model with Reality

At this stage, a comparative analysis is conducted between the conceptual model and real-world conditions that are in accordance with the activities carried out in the KMS system application using the soft system methodology (SSM) and Learning Lesson System (LLS) method to facilitate the system to be developed according to needs. See Table 4. Based on the data in Table 4, a model design for the KMS system will be obtained that describes the needs of the users involved. Figure 4 illustrates the relationship between the conceptual model and the real world to describe the KMS Stunting.

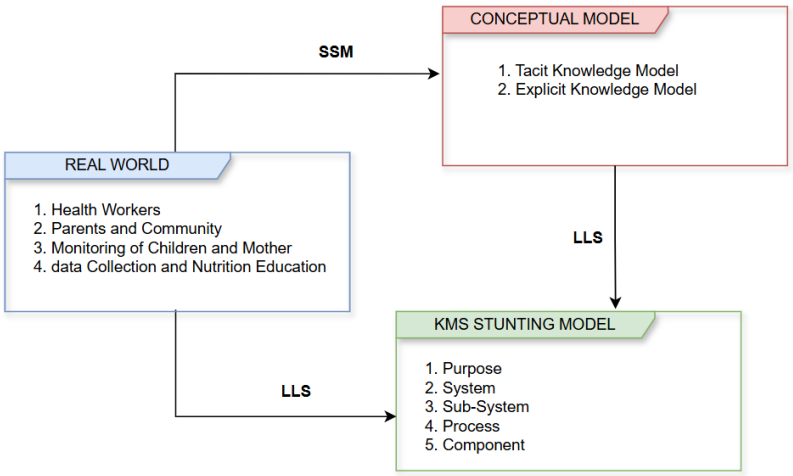


Fig. 4. KMS Model using SSM and LLS Method

3.4 Identification of Feasible and Desirable Changes

In the Identification of Feasible and Desirable Changes stage in the development of the Knowledge Management System (KMS) using Soft Systems Methodology (SSM), the main focus is to identify changes that are not only applicable but also desired by all stakeholders. This process begins with collecting information from various sources, including stakeholders such as medical personnel, pregnant women, and health cadres, to understand the existing problems and their expectations of the KMS system. By using techniques such as Rich Picture and CATWOE, it is possible to map the existing situation and discuss the changes needed to improve community understanding of stunting and improve access to health information and services.

3.5 Taking Action to Improve the Situation

At this stage, the development and implementation process of the system is explained to the users directly involved. The Knowledge Management System (KMS) for addressing stunting in early childhood and pregnant women comprises a series of strategic steps aimed at applying the identified changes and ensuring the system's successful implementation. The stages of designing the KMS system model for stunting in early childhood and pregnant women are as follows: (a) Database Design: The KMS system produces ten data tables consisting of: parent profile, community educational program, health worker, child profile, community organization, nutrition assessment, growth monitoring, dietary guidance, nutrition intervention, and consultation history. The relationship between these tables has a degree of cardinality of one-to-one, one-to-many, and many-to-one, as seen in Figure 5 class diagram of the KMS Stunting system for early childhood and pregnant women.

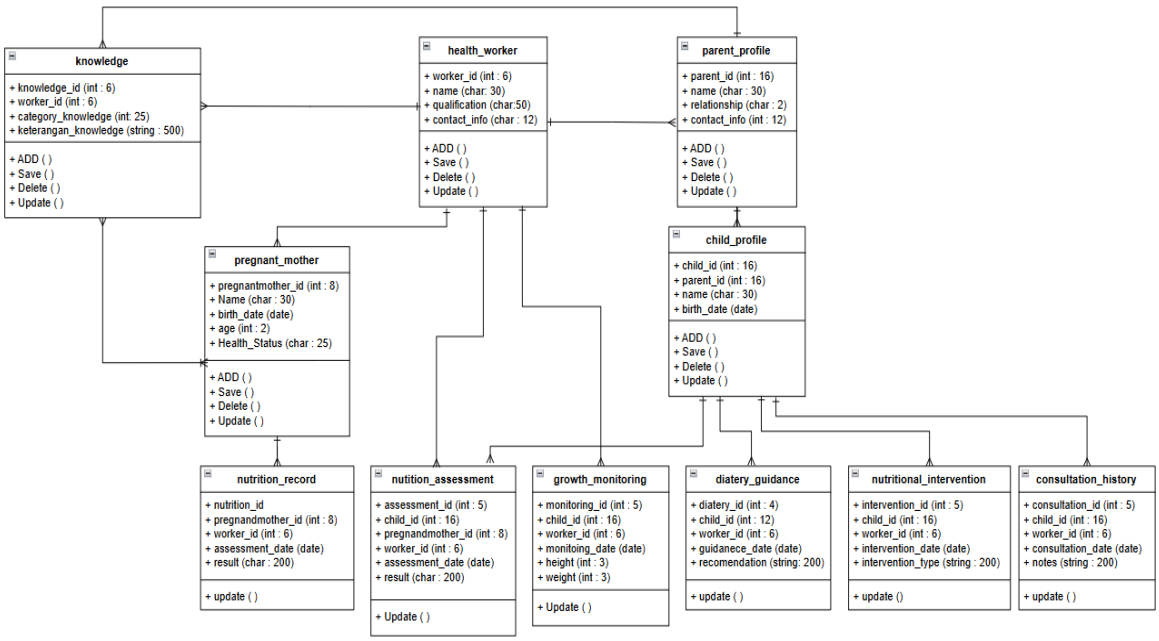
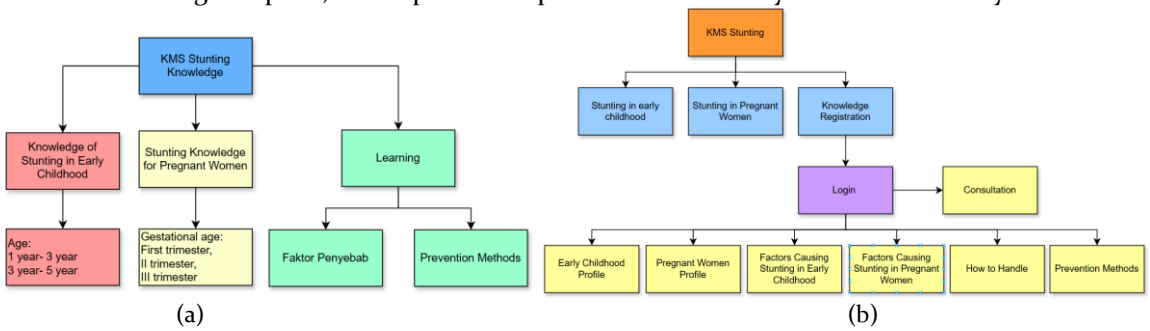


Fig. 1. Class Diagram KMS

KMS Architectural Design, the design of the KMS Stunting system for early childhood and pregnant women can be seen in Figure 6 regarding the KMS Stunting knowledge map and Figure 5 regarding the KMS Stunting blueprint, which provides a picture of the KMS system hierarchically.



(a) (b)

Fig. 2. (a) KMS Knowledge Map, (b) Blueprint KMS Stunting

Figure 6(a) and Figure 6(b) collectively illustrate the architectural and functional design of the Knowledge Management System (KMS) for stunting prevention in early childhood and pregnant women, which serves as the core solution proposed in this study to address fragmented knowledge, limited access to information, and the absence of continuous learning mechanisms in stunting governance. Figure 6(a) presents the KMS Stunting Knowledge Map, which conceptualizes how stunting-related knowledge is structured, categorized, and interconnected within the system. At the highest level, the KMS integrates three primary knowledge domains: stunting knowledge in early childhood, stunting knowledge for pregnant women, and a learning domain that embeds the Learning Lesson System (LLS). This structure reflects the study's recognition that stunting is a life-cycle problem requiring differentiated knowledge based on developmental stages and maternal conditions. The early childhood stunting domain is organized according to age groups (1–3 years and 3–5 years), acknowledging that nutritional requirements, growth monitoring indicators, and intervention strategies vary significantly across these stages. This design directly responds to the problem identified in the study, where parents and caregivers often lack age-specific understanding of child nutrition and growth, resulting in ineffective prevention practices. Meanwhile, the stunting knowledge domain for

pregnant women is structured according to gestational stages (first, second, and third trimesters), emphasizing the critical influence of maternal nutrition and health on fetal growth and future stunting risk. The learning domain in Figure 6(a) represents the integration of the Learning Lesson System (LLS) within the KMS. This domain encompasses knowledge related to causal factors of stunting and prevention methods, functioning as a continuous learning loop where experiential knowledge, expert insights, and best practices are systematically captured, evaluated, and redistributed. Through this mechanism, the KMS moves beyond static information provision and becomes a dynamic learning system that institutionalizes reflection and knowledge reuse. Figure 6(b) complements this conceptual structure by presenting the KMS Stunting Blueprint, which operationalizes the knowledge map into a functional system architecture. The blueprint illustrates how users interact with the KMS and how knowledge flows from registration and validation processes to consultation and learning services. At the top level, the system provides access to three core services: stunting knowledge for early childhood, stunting knowledge for pregnant women, and knowledge registration. The registration and login mechanisms ensure data validity, controlled access, and role-based interaction among parents, pregnant women, health cadres, and experts, thereby addressing governance and data reliability issues identified in the problem analysis. Once authenticated, users can access consultation services that enable interaction between the community and health experts, mitigating limitations of time and space that often constrain face-to-face counseling in community health centers. Below this layer, the blueprint details functional modules such as early childhood profiles, pregnant women profiles, causal factors of stunting, handling strategies, and prevention methods. These modules directly correspond to the key problems identified in Table 2, including limited nutritional knowledge, inadequate health services, and poor preventive practices. Importantly, Figure 6(b) demonstrates how the KMS embeds learning and feedback mechanisms into routine operations. Knowledge generated through consultations, monitoring activities, and intervention experiences is recorded and reused within the system through the LLS framework. This ensures that past experiences inform future decisions, addressing the critical gap identified in the literature regarding the lack of institutionalized learning in conventional stunting intervention programs. Taken together, Figures 6(a) and 6(b) demonstrate that the proposed KMS functions not merely as a technological repository, but as a socio-technical governance system that integrates Soft Systems Methodology (SSM) for holistic problem understanding with a Learning Lesson System (LLS) for continuous learning and adaptation. Figure 6(a) answers the question of what knowledge is required and how it is structured, while Figure 6(b) explains how that knowledge is operationalized and utilized in practice. Through this integrated design, the KMS directly addresses the core research problem by improving knowledge accessibility, strengthening stakeholder coordination, and enabling adaptive, evidence-informed stunting management in Indramayu Regency.

Table 4. Comparision Conceptual Model with Real World

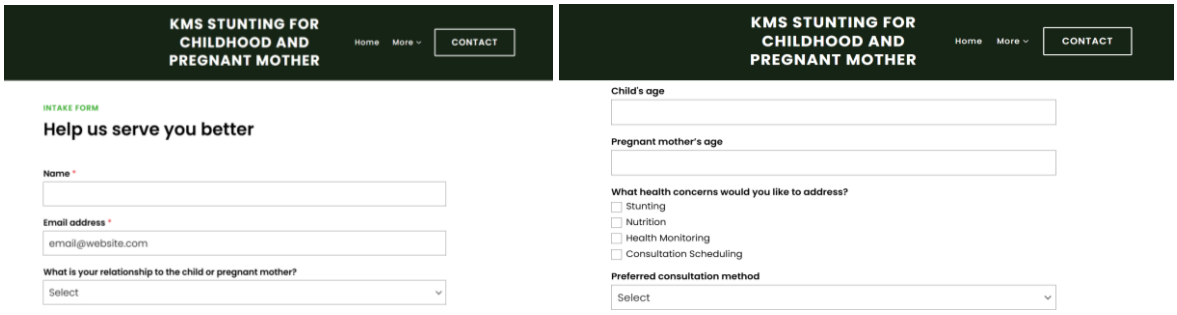
No.	*Activity*	Real World					
		Condition	Devive	Step	Result		Objectives
					Tacid	*Explicit*	
1.	Preparation of profile data for early childhood and pregnant women affected by stunting	Collection of toddler and pregnant women data from integrated health posts and community health centers that have been approved.	1. Database of early childhood and pregnant women affected by stunting 2. Web-based Stunting KMS Information System.	Cadres will input data on early childhood and pregnant women affected by stunting after obtaining approval.	Information on the profile of early childhood and pregnant women affected by stunting	Digital document of profiles of toddlers and pregnant women affected by stunting.	early childhood and pregnant women profile data can be saved in the KMS application as master data that can be reused if needed in the future.

2.	Preparation of knowledge data on stunting in toddlers	Collection of data on stunting knowledge in children under five	1. Database of stunting knowledge in early childhood. 2. Web-based Stunting KMS Information System.	Midwives and experts will input knowledge data about stunting in early childhood.	Information about knowledge of stunting in early childhood	Digital document of knowledge of stunting in early childhood	1. Data on stunting knowledge in toddlers is stored in the KMS application as a basis for knowledge to parents of toddlers. 2. Ease of providing additional knowledge to parents of early childhood by using the experiences of other people and experts as material for preventing and dealing with stunting.

Table 4 presents a comparison between the conceptual KMS model and real-world stunting management practices in Indramayu Regency. The table demonstrates how tacit knowledge derived from field activities such as data collection by cadres, health workers, and experts is systematically transformed into explicit knowledge through the web-based KMS application. Activities that were previously conducted manually and stored in fragmented formats are formalized into structured digital documents, including profiles of early childhood and pregnant women as well as knowledge repositories on stunting. This transformation enables data reuse, improves knowledge accessibility, and supports evidence-based decision-making. Overall, Table 4 highlights the role of the KMS in bridging the gap between conceptual system design and practical implementation by integrating real-world practices into a sustainable, reusable, and learning-oriented knowledge system.

a. User Interface (UI) Design

The user interface (UI) design is developed to facilitate users directly involved with the KMS system and is aligned with the program modules within the system. Figures 7 present intake forms utilized to collect data from parents and pregnant women regarding the services provided through the KMS. Once the data are collected, the system generates the required information. Figure 10 illustrates the UI for the services delivered by the KMS Stunting system for early childhood and pregnant women.



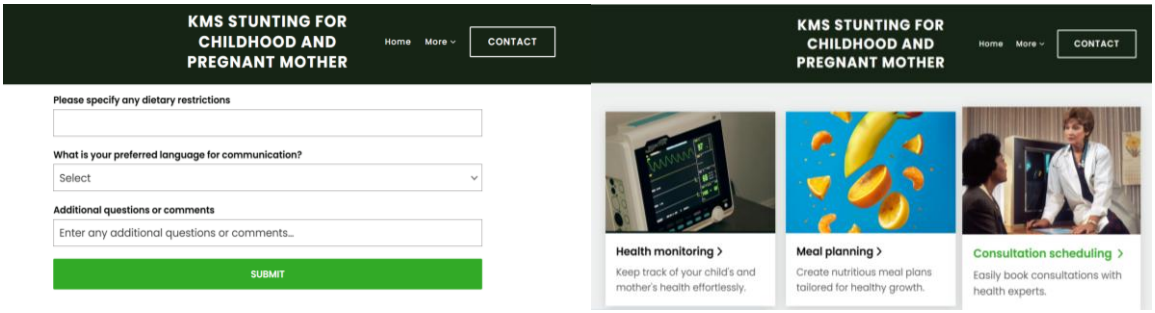


Fig. 7. Blueprint KMS Stunting

3.6 Discussions

This study contributes to the growing body of research on stunting governance by positioning Knowledge Management Systems (KMS) not merely as technological repositories, but as socio-technical infrastructures that mediate learning, coordination, and decision-making across heterogeneous health stakeholders. Rather than focusing on individual-level nutritional outcomes, the findings emphasize the structural and systemic dimensions of stunting management, particularly the role of knowledge integration, institutional learning, and adaptive governance.

The application of Soft Systems Methodology (SSM) in this study demonstrates its continued relevance for addressing complex and ill-structured public health problems such as stunting. The use of rich pictures and CATWOE-based root definitions enabled the articulation of multiple stakeholder worldviews, revealing that stunting in Indramayu is not perceived solely as a biomedical issue, but as a multidimensional problem shaped by fragmented information flows, limited experiential knowledge reuse, and weak inter-organizational coordination. This finding aligns with previous studies that highlight the limitations of reductionist, program-based approaches in addressing persistent public health challenges.

However, the study also reinforces existing critiques of classical SSM applications in health systems research. While SSM proved effective in problem structuring and conceptual modeling, it became evident that, without an explicit mechanism for institutionalizing learning, SSM alone risks remaining at a diagnostic or exploratory level. In many prior implementations, SSM interventions conclude once conceptual models are produced, leaving insights insufficiently translated into sustained organizational practices. This study addresses that limitation by extending SSM through the integration of a Learning Lesson System (LLS), thereby transforming problem understanding into an ongoing learning and adaptation process.

The integration of LLS within the SSM-informed KMS framework represents a key theoretical contribution of this research. Unlike conventional knowledge-sharing practices that emphasize information dissemination, LLS functions as an epistemic learning mechanism that systematically captures, codifies, and reuses experiential knowledge derived from stunting interventions. By embedding reflective practices, lesson documentation, and feedback loops into the KMS architecture, the proposed framework operationalizes learning as a continuous governance function rather than an ad hoc activity. This integration responds directly to gaps identified in the knowledge management literature, where public health KMS often lack mechanisms for tacit knowledge retention and cumulative learning.

From a governance perspective, the findings suggest that the effectiveness of stunting interventions is closely linked to the quality of stakeholder coordination and knowledge alignment. The conceptual models reveal that health workers, cadres, parents, and local institutions operate within partially disconnected knowledge domains, leading to inconsistencies in intervention practices and decision-making. The proposed KMS, informed by SSM and reinforced by LLS, provides a structural means to bridge these domains by enabling shared problem representations, common learning references, and iterative adjustment of practices based on collective experience.

Importantly, this study reframes the role of technology in stunting management. Rather than treating the KMS as an outcome in itself, the system is conceptualized as an enabling environment that supports organizational learning, sense-making, and adaptive responses to evolving local conditions. This perspective resonates with contemporary views in information systems research that emphasize the co-evolution of technology, organizational practices, and institutional contexts, particularly in complex public sector environments.

Nevertheless, the study also acknowledges its limitations. The absence of quantitative outcome evaluation and user-based performance testing means that the findings should be interpreted primarily at the conceptual and design level. The proposed framework does not claim immediate reductions in stunting prevalence, but rather offers a theoretically grounded and context-sensitive model for strengthening the learning capacity of stunting governance systems. Future research should therefore extend this work by empirically examining system adoption, usability, learning outcomes, and long-term impacts on policy effectiveness and program coordination.

4. CONCLUSION

This study concludes that addressing stunting requires a fundamental shift from fragmented, program-based interventions toward learning-oriented governance systems capable of integrating diverse forms of knowledge and stakeholder perspectives. By conceptualizing stunting as a complex socio-technical and governance challenge, this research demonstrates that the integration of Soft Systems Methodology (SSM) with an institutionalized Learning Lesson System (LLS) within a Knowledge Management System (KMS) provides a robust framework for strengthening coordination, reflection, and adaptive decision-making in maternal and child health contexts. SSM enables a holistic understanding of the stunting problem through participatory problem structuring, while LLS extends this process by embedding continuous learning, experiential knowledge codification, and organizational memory into the governance system. Rather than claiming immediate reductions in stunting prevalence, the study contributes a theoretically grounded and context-sensitive model that enhances the learning capacity of stunting governance systems, thereby creating conditions for more coherent, evidence-informed, and adaptive interventions over time. Future research is encouraged to empirically evaluate system adoption, learning outcomes, and long-term governance impacts to further substantiate the role of learning-based digital infrastructures in addressing persistent public health challenges such as stunting.

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