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FACTORS INFLUENCING THE CO-PRODUCTION IN WATER MANAGEMENT POLICIES: A MULTI-CASE STUDY IN NAN PROVINCE AND PHAYAO PROVINCE, THAILAND

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ABSTRACT

The issue of sustainable development has garnered significant international attention, with the United Nations (UN) playing a central role in promoting this agenda through the establishment of the Sustainable Development Goals (SDGs). The objectives of this study were twofold. Firstly, it aimed to investigate the factors that influence co-production and assess their impacts on sustainability. Secondly, this study aimed to provide suggestions for policymakers and implementers on how to enhance co-production factors to achieve greater sustainability outcomes. The research focused on two case studies in Thailand: water management in Ban Tun sub-district, Mueang district in Phayao province, and water management in Rong Ngae village in Worranakorn sub-district, Pua district in Nan province. A qualitative research approach was employed, utilizing in-depth interviews, non-participatory observations, and focus group discussions. Triangulation was employed to ensure data validity, and semi-structured interviews were used as the data collection tool. Content analysis and qualitative data analysis software were employed for data analysis. The findings revealed co-production in both the formulation and implementation of water management policies relating to sustainable outcomes. These outcomes were influenced by societal norms, cultural factors, existing policies, and knowledge, which shaped the relationships among the communities, stakeholders, and agencies involved in water management. The factors affecting co-production and its sustainability in the multi-case study's sustainable development policy were identified as follows: 1) contextual factors, including societal standards, culture, and existing policies and knowledge; 2) inputs, comprising water management knowledge and collaboration involving resources, technology application, and legal regulations; and 3) outputs, encompassing the expansion of knowledge and the development of competencies. The study emphasizes the need to boost knowledge expansion and competency through collaborative knowledge-sharing and academic involvement. It suggests that promoting inclusive participation and equal collaboration among stakeholders enhances co-production and sustainable outcomes.

Keywords: Co-production; sustainability; water management; Nan and Phayao provinces; multi-case study

1. INTRODUCTION

Water resource management in Thailand has been in a state of long-standing crisis, significantly affecting the economic and social dimensions of the country. The recurring issues of drought and flooding have further exacerbated the urgency of addressing this issue. Droughts and floods may occur alternately or simultaneously within a single year, with their occurrence attributed to both geographical and human-induced factors. Additionally, challenges persist concerning access to water sources and storage for consumption purposes. Ensuring sufficient water supply for the population, encompassing clean drinking water and proper sanitation, is a fundamental public service that the government must provide. Adequate water availability for agricultural purposes is also crucial. To achieve effective water management, it is imperative to emphasize community and civil society participation. The primary focus of this research was to explore processes and methods that can enhance community-level participation, thereby improving the efficiency of government water management efforts.

To investigate the co-production of water management policies, this research employed a multi-case study approach. The objective was to examine the factors influencing co-production among the government sector, service users, and various stakeholders. A modified holistic conceptual framework of co-production design was utilized to provide a conceptual foundation for this study. The significance of community and stakeholder involvement in water management has been increasingly recognized in the academic literature (Rakyutidharm, 2015; Mankhong, 2017). Rakyutidharm (2015) studied the management of small watersheds in the Mae Tia-Mae Tae watershed area, Chom Thong district, Chiang Mai province. He provided recommendations for watershed control in two crucial aspects: the management of community organizations and understanding of the river basin network. In addition, Wises and Chanthima (2016) examined the legal framework in natural resource management, analyzing the principles and guidelines in developing the Kwan Phayao Constitution. They also scrutinized the process of formulating the Kwa Phayao Constitution, encompassing laws governing natural resource management, local regulations by government organizations, and social measures in the public sector that blend local wisdom with modern management. Moreover, Nuamcharoen and Settakorn (2023) investigated the application of the network governance approach in the implementation of the Water Management School, an innovative initiative launched by the Phrae Provincial Administrative Organization (PAO). Specifically, in Nan and Phayao provinces, challenges have arisen concerning the equilibrium between water demand and supply, along with the influence of climate change on water resources (Khamsorn et al., 2019; Chuenchum et al., 2016).

However, there is a need for a deeper understanding of the specific processes and strategies that can enhance community-level participation in the context of water resource management in Thailand. By investigating co-production in policy formulation and implementation, this research aimed to contribute valuable insights into improving the efficiency and effectiveness of government water management practices. The research focused on two case studies in Thailand: water management in Ban Tun sub-district, Mueang district in Phayao province, and water management in Rong Ngae village in Worranakorn sub-district, Pua district in Nan province. The success of both hinged on active community participation and effective policy implementation processes, where individuals and public service users played pivotal roles. Preliminary data from the two case studies revealed both similarities and differences in the co-production patterns within the community's water management policy. Understanding these patterns and formulating guidelines for policy implementation served as the motivation for conducting this research study.

2. CO-PRODUCTION AND WATER MANAGEMENT

The concept of co-production in policy-making and public service refers to the collaboration between professional service providers and service users or community members, where they contribute essential resources to the service delivery process (Bovaird, 2007; Brudney & England, 1983). It involves government representatives and citizens working closely to organize public services based on professionalism, aiming to expand the quality or quantity of government services (Wyborn et al., 2019). Co-production can take various forms, both at the individual and collective levels of citizen participation (Brudney & England, 1983). The roles and interactions between professional service providers and service users manifest in different ways, with full co-production characterized by a close relationship and joint delivery and design of public services (Boyle & Harris, 2009). In the context of public service delivery, there has been a shift from a clear separation between the production and the consumption of public services. Public service is an activity organized by the government to meet the needs of the people, and it has evolved to involve service users as co-shapers, co-producers, and evaluators (Boonratmaitree, 2016; Radnor et al., 2014).

Water management, as a public service, requires an integrated approach involving various sectors, such as public, private, and community, to collectively address challenges. Collaboration and commitment across these sectors are essential for successful water management, including ensuring sufficient water sources for consumption and agriculture, fair allocation and efficient use of water, conservation of watersheds, and addressing water quality and flood-related issues (Maiklad, 2014). Studying co-production is important as it is an essential principle in various sustainability science research studies and involves creating incentives to foster collaboration among diverse actors in research related to policy and social change. The researchers examined the literature on sustainability science in public administration, encompassing theoretical and empirical aspects of science and technology. This review aimed to advance theory and practice in the field of co-production within the context of sustainability science. The findings suggest that co-production is evolving toward new institutional arrangements that reflect power dynamics, scientific and social knowledge, and the role of citizens (Wyborn et al., 2019). Consequently, this research focuses on a multi-case study approach to investigate the factors of co-production in the formulation and implementation of water management policies. The study aims to explore co-production among the government sector, service users, and other stakeholders, utilizing a modified holistic conceptual framework of co-production design as a guiding framework displayed in Figure 1.

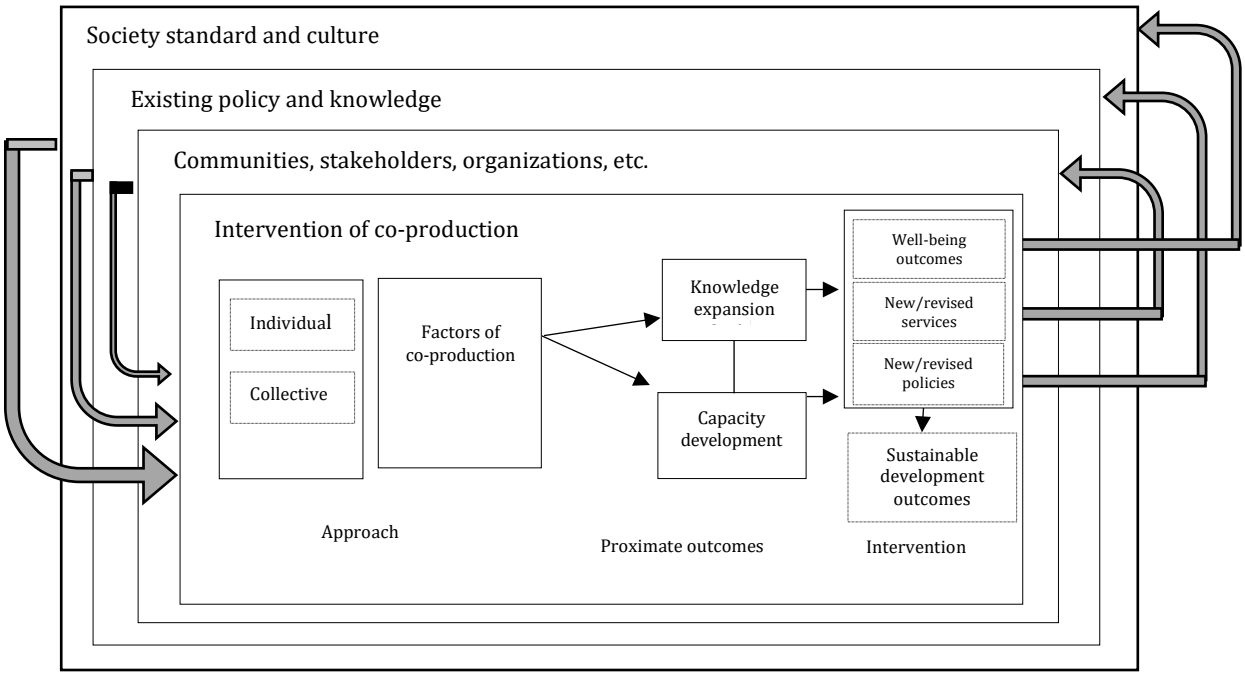

Figure 1: The research framework showing the relationship of factors of co-production and water management adapted from Wyborn et al. (2019)

The above diagram shows how the fundamental relationships in co-production that result in sustainable development come from co-production processes that provide good public services, good new services, and policy reviews. The outcome of the process shows that the sustainable development and the feedback of the review lead to the sustainability of the policy. The phenomenon according to the framework was explored in the research within the contexts of the multi-case study; furthermore, the researcher investigated in more depth what factors of co-production could enhance the outputs and outcomes.

3. METHODOLOGY

Employing a qualitative research design, this study utilizes various techniques, such as in-depth interviews, non-participant observation, and focus groups. To ensure data validity and accuracy, triangulation was applied as a methodological approach. The interviews conducted in this research were semi-structured, and the collected information was transcribed into text format for further analysis. The data analysis employed NVivo, a qualitative data analysis software, utilizing cluster analysis to establish relationships among content groups, frequency, and word similarity. The following steps were undertaken to facilitate this analysis:

3.1 Participants

The selection of key informants was done by purposive sampling and using the snowballing method. The researcher specifically chose to participate directly in the community water management, through the village water management committee, community leaders, villagers, etc., by allowing the first key informant to guide the selection of the next informants. The researcher divided the study participants into three groups, namely, the public administrators; the group of practitioners and public service users; and the group of other public service contributors. Twelve participants in total were invited to participate in the in-depth interviews and focus group discussions on the two case studies.

3.2 Instruments

The study instrument was developed through a literature review and the formulation of a research framework. A semi-structured interview format was employed for the in-depth interviews, and the insights gathered were utilized to formulate a set of semi-structured group discussion questions. This approach ensured flexibility, allowing informants to share significant information. The interviews were conducted by the researcher. After completing the interview process, the obtained results were validated through a focus group discussion.

3.3 Data collection

The data collection was divided into two phases. First, the researcher studied secondary data from documents on case studies in each aspect of the research. Next, in-depth interviews and group discussions were conducted while non-participant observations were carried out. In the second phase, the researcher used the data processed from the interviews to create a tool or a set of questions to conduct a focus group to identify the factors that affect the co-production and so influence the sustainability in the water management of the multi-case study. The researcher employed data triangulation to verify the accuracy of the obtained data, ensuring the authenticity of the information to answer the research questions. This involved cross-checking sources to determine if the information remained consistent when provided by different individuals. Verification was conducted primarily through human sources by soliciting information from diverse sample groups responding to the same questions.

3.4 Data analysis

The data analysis process commenced with typology and taxonomy, progressing to content analysis and inductive analysis. These approaches aimed to identify the co-production patterns in the formulation and implementation of the water management of the two case studies. Additionally, the analysis sought to uncover the factors influencing co-production and their impact on the sustainability of development policies. Qualitative data analysis was conducted using NVivo software, and the findings were presented through cluster analysis, demonstrating the relationships among content groups, frequency, and word similarity.

4. RESULTS AND DISCUSSION

The research explored the factors and attributes of co-production within the water management of the multi-case study. The findings revealed several key elements that were significant in both case studies, including knowledge expansion, technology, competency development, rules of law, collaboration, resources, and knowledge of water management. Figure 2 illustrates the frequencies of these elements.

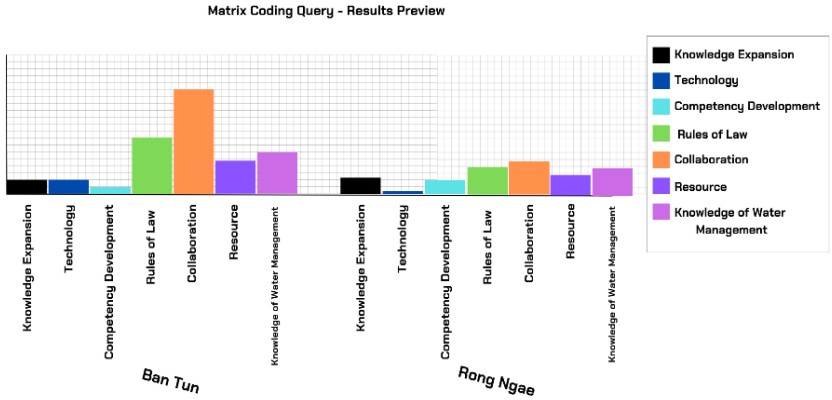

Figure 2: Matrix coding query created by the NVivo program shows the common factors of co-production that affect the sustainability of the policy for the sustainable development of the multi-case study

Considering the research framework outline, the researcher classified the key elements into three categories, namely, contextual factors, input factors, and output factors, and grouped the relevant keywords accordingly. It was found that none of these keywords aligned with the contextual factors category. However, water management knowledge collaboration, technology application, resource, and rules of law were well-suited for the input factors category. Furthermore, knowledge expansion and competency development were identified as output factors, as specified in the framework. It can be inferred that society standards, culture, existing policy, and knowledge are contextual factors that influence co-production. The interrelatedness of the five keywords (water management knowledge collaboration, technology application, resource, and rules of law) representing the input factors is depicted in the graph generated by the NVivo program in Figure 3.

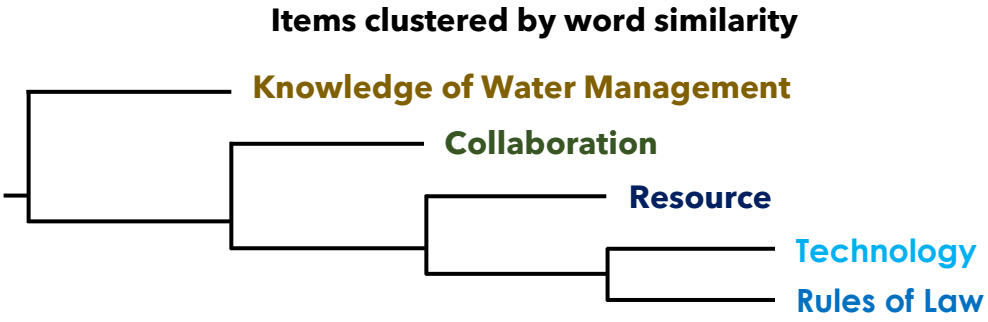

Figure 3: The graph created by the NVivo program shows the relationship of the input factors of co-production that affects the sustainability of the policy for sustainable development in water management of the multi-case study

Therefore, the factors influencing the co-production that affected the sustainability of the sustainable development policy of the multi-case study were 1) contextual factors: (i) society standards and (ii)culture, existing policy, and knowledge; 2) the input: (i) water management knowledge and (ii) collaboration with its sub-elements of resources, technology application, and rules of law; and 3) the output: (i) knowledge expansion and (ii) competency development as displayed in Figure 4.

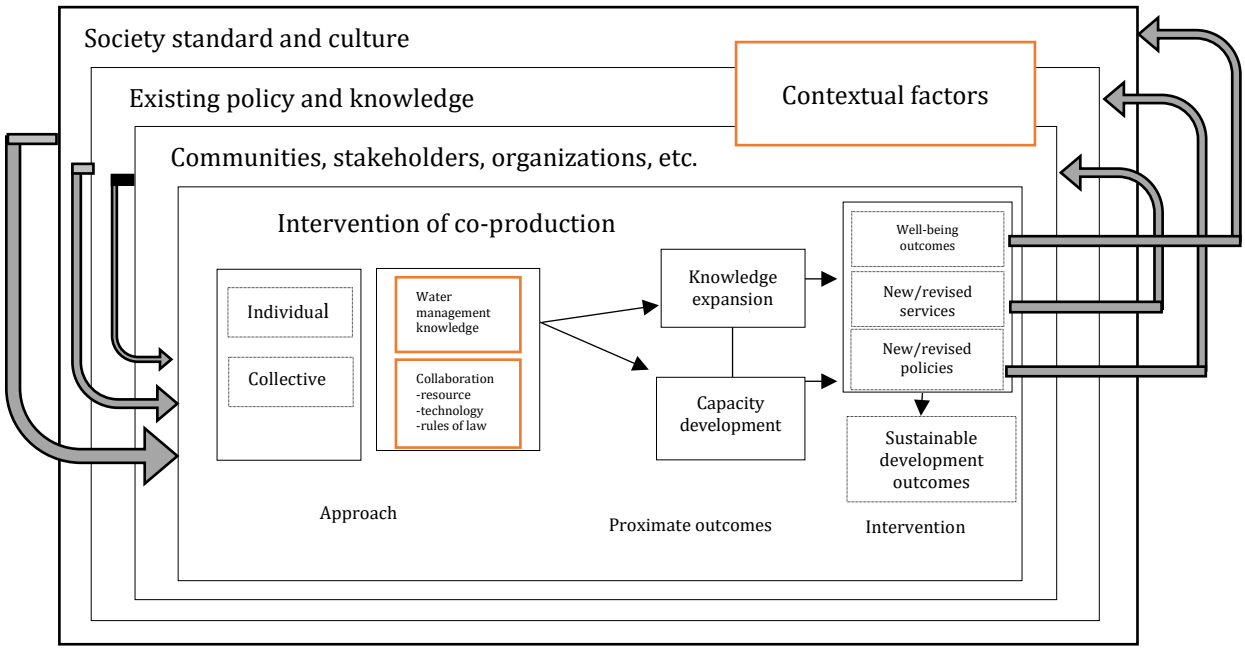

Figure 4: The research framework showing the factors of co-production in water management of the multi-case study

4.1. Contextual factors

In terms of contextual factors, the case subjects showed they had strong social norms and a long-established culture. Furthermore, they set rules for living together in their communities, which was beneficial to the success of water management. For example, in Ban Rong Ngae village, people adhered to their culture, namely, the Tai Leu culture, including adopting water management rules, which are called MungRai laws and

which have been established for a long time. The laws contributed to the community rules and regulations to manage the water supply and share similar characteristics to the attributes of co-production and sustainability. As Chandrangsu (2019) mentioned, the water management system according to MungRai law obliges people to respect the community rules to make use of their water supply. In addition, they collaborate to take care of the local water facilities, that is, both local natural and man-made irrigation channels. As a result, the irrigation system has been maintained in a good condition, and the water management loop and regulations have been sustained by the participation of the people.

In the community study in Ban Tun sub-district, there are strong social and cultural foundations, including traditions such as a forest ordination known as Khun Nam ghost raising, customs, and forest preservation strategies. This aspect of social capital is also linked to the existing policies and knowledge based on water management. In accordance with Mankhong (2017), a study on the cultural capital of communities in Ban Tun revealed the traditions and local wisdom through the handicrafts of bamboo weaving and water hyacinth basketry, traditional farming and organic farming, human capital from local philosophers, etc. Community leaders play a role in building the community and strengthening and developing groups. Kinship in the community showed a respectful relationship with elders that became a kind of social capital. The employment system for agriculture, that is, rice farming, still uses the "gathering for growing rice" system: harvesting with relatives and with the community with occasional assistance from hired workers from other villages. An investigation into cultural capital found that it played a role in community economic development in Ban Tun sub-district at a prominent level.

The case studies showed that government agencies, as responsible entities, and villagers and communities, as service users, would perform better if they worked in harmony. This finding corresponded to what Rakyutidharm (2015) recommended in that the key to success in both case studies was a good relationship among local administrative organizations and provincial government agencies in the study areas, especially informal relationships between stakeholders, as such relationships enhanced the cooperation mechanisms. These relationships may occur due to government policy formulation, government officers' attitudes, and opportunities to participate in the activities of government officers and villagers. The importance of local political contexts, especially the role of and relationship among villagers, communities, and public agencies, resulted from the social norms and community culture, which have an impact on building area ownership and a sense of community.

4.2 Input factors

The input consisted of 1) knowledge on water management and 2) collaboration factors. The constituent elements of the collaboration factors consisted of (i) resources, (ii) technology application, and (iii) the rules of law.

4.2.1 Knowledge on water management

The multi-case study showed the potential types of knowledge on water management: knowledge derived from existing knowledge bases in the community and new knowledge acquired by the experience of working with various agencies to develop competencies in this issue. This is a factor in communities and various sectors at both the community level and the national level. In addition, knowledge of water management is important for the sustainability of any water management policy. Expertise in water management, together with multidimensional cooperation, meant not only that the system could be sustained, but in addition, that expertise could be transferred and disseminated to others. This is mentioned in the excerpt from the interview:

> …Whether it's about the weir or taking care of the forest, or whether it's about a mine, we will focus on people who benefit from the water management at that point. They get to work it each year and absorb the experience of their work. Then, when there is work ahead, they will come together to plan and systematically carry out their work. In the past, it took two weeks to construct the weir, but after doing it four or five years ago, some completed it in just two days, while others took three days. December 1st, 2020, at Ban Tun sub- district, Phayao province.

The co-production process is therefore a process that can promote the integration of various stakeholders and experts to work together to achieve the objectives. In accordance with Wyborn et al. (2019), they linked the relationship between the science of sustainable development and the knowledge necessary to co-produce public services. The science of sustainable development focuses on bringing together diverse competencies and skills to produce and practice the activities and to expand the knowledge base for sustainable development outcomes. In public administration, planning to create co-production in public administration activities should pay attention to both the knowledge integration process and the knowledge outcomes. Public administration in relation to sustainable development therefore focuses on seeking ways in which the policies

of pre-existing systems promote the intervention process of the co-production of public services from different sectors. Furthermore, the administrators should have the capacity to reorganize institutions, policies, and knowledge. The result will be the creation of sustainability.

4.2.2 Collaboration

The factor of collaboration relied on the range of capitals available in the community, such as cultural capital, social capital, and human capital. The two case studies share the values of the people in the community forming a caring and self-reliant community. Based on the idea of unity, if there is cooperation, then success can be achieved and goals reached. Organizational culture is a significant element of this. This attitude is classified as a strong culture, that is, the organizational culture that is widely accepted by the members of the organization is the culture that the members of the organization strictly uphold. In addition, communication is also important to build good relationships. In both case studies, regular meetings were used as an important communication process and as a means of building this relationship. They also used negotiation and consensus to solve problems and settle disputes, resulting in cooperation. This was consistent with the findings by Rakyutidharm (2015), who stated that local governments and government agencies in the study area found that good relationships, especially informal ones, between stakeholders were one of the key factors in building a successful cooperation mechanism. Such a cordial relationship can be established through the formulation of government policies, the personal attitude of officials, and the opportunity to participate in activities between government officials and residents as witnessed by the excerpt from the focus group in Rong Ngae village, Nan:

> ...We have also developed a local plan, which is the village plan, and then aligned it with the SAO (Sub-district Administrative Organization) plan. In this regard, how many locations have you covered this year? Where are these activities taking place? The priorities are set by the village. Residents actively participate in community meetings to ensure that our resolutions are effective. The budget comes from multiple village agencies, including irrigation and local areas, covering two main aspects. The community has successfully implemented these plans once again, with a strong presence in three villages: group seven and group eight. We are now expanding our efforts to the sub-district level, involving volunteers from all over, with two individuals each coming together to assist one another. November 14th, 2021

In addition, the creation of new networks was also important for sustainability. New partnerships were needed to encourage future cooperation. Seeking alternatives was also encouraged by trying to do activities without being dependent on the budgetary and time constraints of the project/policy, such as finding alternative funding sources or integrating work with other projects. Moreover, emphasis should be placed on establishing communication systems and means of communication between the service authorities and other support agencies at a higher level (Wyborn et al., 2019).

The constituent elements of the collaboration factors consisted of (1) resources, (2) technology usage, and (3) mutual adherence to rules of law.

4.2.2.1 Resources

Resources played a pivotal role as a co-production factor influencing the sustainability of the multi-case study's policy on sustainable water management. The two selected cases exhibited significant geographic and locational advantages that contributed to their water resource availability and sustainability. Situated on slopes adjacent to watershed areas and bordering national parks, both locations benefited from their proximity to abundant forests and hills. These natural features facilitated rainfall capture and subsequently ensured a reliable water supply for the communities. The geographic advantages further fostered the development of collective knowledge among the communities regarding effective water management practices. By leveraging these resources and capitalizing on their potential, the communities were able to enhance their understanding and expertise in sustainable water management, thereby contributing to the long-term viability and success of the policy (Moallemi et al., 2020).

4.2.2.2 Technology

The utilization of community water management technology in the multi-case study involves the application of suitable, locally adapted technology that aligns with the community's capacities and specific conditions. However, it is important to acknowledge that information technology is a rapidly evolving and dynamic field. Therefore, the pursuit of more appropriate and modern technologies becomes a crucial factor that influences improved water management practices. Adopting advanced technology not only enhances water management processes but also facilitates greater collaboration among stakeholders. Research by Wyborn et al. (2019) demonstrates that the implementation of technology in various projects has significantly facilitated co-production activities. This integration has not only transformed the provision of public services

but has also brought about broader changes in the overall approach. In numerous case studies, technology has been effectively employed to promote co-production, thereby generating new value for public service providers, particularly within the government sector. By harnessing the power of technology, water management initiatives can leverage its potential to enhance collaboration, knowledge-sharing, and decision-making processes. Advanced technologies can support data collection, analysis, and visualization, enabling stakeholders to make informed decisions and develop evidence-based policies. Additionally, technology-driven platforms and tools can facilitate engagement and participation, allowing for more inclusive and transparent co-production processes.

4.2.2.3 Rules of law

The factor of rules and laws plays a crucial role in facilitating efficient and sustainable co-production in water management. It is essential that these regulations are established through community participation, as emphasized by Wises and Chantima (2016). They discussed the Phayao Lake (Kwan Phayao) Draft, which exemplifies the importance of legal principles categorized to align with the social norms and way of life of the community. This inclusive approach promotes good governance, emphasizing integrity, transparency, and accountability. The process of drafting the Phayao Lake Draft highlighted the significance of participation as a sustainable development learning process, with mechanisms in place to encourage community engagement. Furthermore, the formulation and enforcement of good governance principles are equally important in ensuring the effectiveness of rules and laws. Chandrangsu (2019) provided an excerpt from the orders of Her Royal Highness Princess Bajrakitiyabha Narendiradebyavati that underscores the positive impact of the rule of law on sustainable development. By involving the community in the development of rules and laws, water management initiatives can align policies with local contexts and needs:

> …fair rules and regulations, and the laws cause development. Therefore, it can contribute to sustainable development. Rules of law and sustainable development are related. January 6th, 2018, at Rambhai Barni Rajabhat University, Chanthaburi province (cited in Chandrangsu, 2019).

This participatory approach not only enhances the legitimacy and acceptance of regulations but also fosters a sense of ownership and responsibility among stakeholders. By emphasizing good governance principles, such as transparency and accountability, the rule of law becomes a catalyst for sustainable development, promoting equitable access to water resources and ensuring the long-term viability of water management practices.

4.3 Output factors

For the output factors consisted of two sub-factors, namely, knowledge expansion and capacity enhancement.

4.3.1 Knowledge expansion

A knowledge system encompasses values, standards, epistemology, and structures that influence the utilization of knowledge. In the realm of sustainability science, there is a challenge of transforming the structure and dynamics between data owners and policy decision-makers. It entails shifting the role of data collectors and creators to becoming knowledge accumulators and creators through co-production processes. The new knowledge generated through co-production holds great potential, but collaboration and a redesigned support system are required to effectively utilize it. Expanding the knowledge base through co-production is intricately linked to the resulting co-production itself. As highlighted by Rakyutidharm (2015), community organizations endeavor to enhance knowledge levels within regional organizations. This effort is focused not solely on preserving the value of existing knowledge but also on raising awareness and acknowledging the potential and capacity of the community. By fostering co-production and knowledge-sharing, both the public and private sectors can recognize the significance of community knowledge. This recognition goes beyond the preservation of traditional knowledge and extends to embracing its value and capabilities. It becomes crucial to promote understanding and acceptance of the community's potential, empowering them as active contributors in decision-making processes related to water management and sustainable development.

4.3.2 Capacity enhancement

The capacity enhancement of water management in both case studies remains significantly limited, and no clear pattern emerges in addressing this issue. However, efforts have been made to enhance water management capabilities through various strategies. These strategies include developing the potential of water management systems, such as increasing water storage capacity and establishing systems to distribute water more efficiently for agricultural purposes. Additionally, collaborative initiatives, such as forming large groups and expanding working networks, have been implemented. These efforts align with the definition McClelland (1993, cited in Rassameethammachot, 2006) gave of competence as the fundamental characteristic of an

individual that contributes to superior performance based on predetermined criteria. Competence comprises motives, traits, self-concepts, attitudes, values, and content knowledge, as well as cognitive and behavioral skills. To strengthen water user organization competency, support can be provided by the Irrigation Management Committee through various methods, including information dissemination, meetings, training, community forums, and study visits. Additionally, indicators related to the management strength of irrigation water user groups, along with internal management practices within the water user group, can serve as a framework for guiding their work.

All in all, these factors significantly influence the sustainability of water management policies by ensuring the uninterrupted continuation of policies through effective knowledge management and resource utilization. Additionally, the establishment of communication networks and alliances between organizations is essential to facilitate smooth and gradual transitions during the participation or co-production process, ultimately leading to continuous operations and sustainable development. However, it is important to recognize that co-production does have its limitations. In the multi-case study, various aspects of co-production were affected by the roles and responsibilities assigned to each agency, limited authorities and rules, and laws and regulations governing water management. These limitations hindered the delivery of certain public services, particularly in areas such as budget utilization and compliance with state laws, where full co-production could not be realized.

Furthermore, the availability of human resources poses a challenge. As society ages and new generations hold different values, the transfer of various types of knowledge within the community becomes less seamless, which can affect the future sustainability of water management practices. Additionally, community water management requires knowledge of diverse topics, such as agricultural practices, including planning water consumption for farming and contextual resource conservation to maintain soil quality. Conflicts may arise between modern knowledge and the community's existing beliefs and practices. Overcoming these challenges necessitates a cooperative approach that relies heavily on understanding and educating the community to foster consistent and sustainable development. These limitations highlight the importance of addressing challenges related to agency roles, human resources, and conflicting knowledge systems to achieve effective co-production and ensure the long-term sustainability of water management practices. By addressing these limitations and fostering understanding and education within the community, it becomes possible to forge a collaborative path toward consistent and sustainable development in water management.

5. CONCLUSION

The researcher conducted a document study and a field study using in-depth interviews and non-participant observation to assess the co-production in policy formulation and policy implementation in sustainable water management. The case studies identified there is co-production in the community water management process through both policy formulation and policy implementation. The nature of co-production varied according to different activities. However, it can be implicitly concluded that policy formulation and policy implementation, and community management is a form of full co-production. The existing policy and knowledge base of water management in Ban Rong Ngae village and in Ban Tun sub-district were formed from social and cultural norms. The existing policies and knowledge bases are characteristic of the water rules that the communities adhere to. However, when the physical and social environments change, water management cannot be done by the community alone. Policies in water management occur on both national and international levels. Therefore, there was the need for co-production, which would provide a move toward new practices or services. This gave rise to new groups of stakeholders. Co-production takes place in both the policy formulation and policy implementation processes, and the nature of the co-production varies according to different activities. The expected outcomes of the co-production include knowledge base expansion and capacity building. The results will be fed back into the communities, stakeholder groups, and agencies by them having sufficient water. Then, there will be a policy review, which will include issues regarding the rules for water use and a model of community collaboration. Finally, the results will influence the existing policies and knowledge system and ultimately become social and cultural norms.

The elements of expanding the knowledge base and increasing capacity should be developed with help from networks, public agencies, and private organizations to produce a system to expand the knowledge base and increase capacity in a systematic way. It can attract participation from educational institutions, universities, and academics in knowledge management and community potential development. These processes should be promoted by co-producers of the service from the beginning, that is, the development of inputs through the co-production process, which will result in concrete knowledge transfer and the development of water management capabilities and stakeholders in a concrete way. Multi-case studies should

expand co-operation networks and then manage networks effectively to achieve the characteristics of equal partnerships in operations. The findings can be concluded as shown in Figure 5.

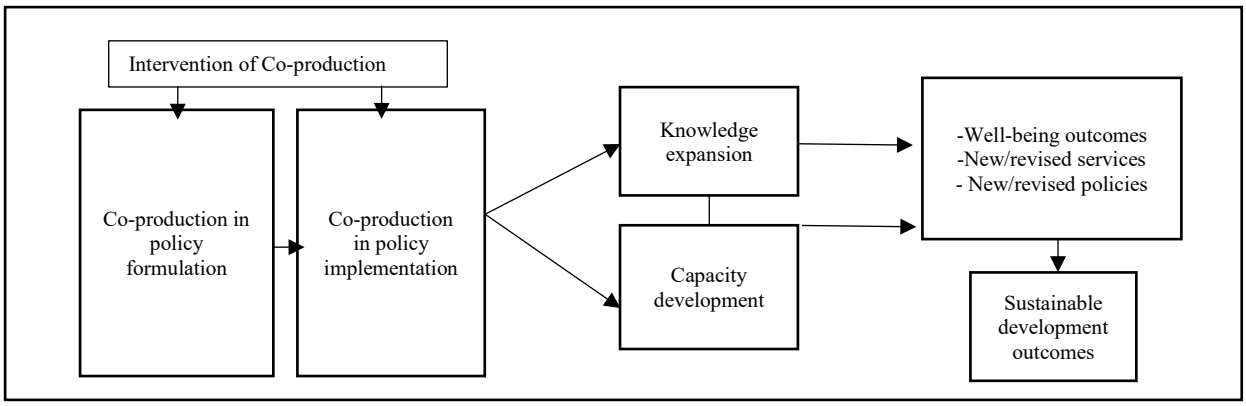

Figure 5: The conclusive diagram illustrates the co-production intervention, process, and outcomes in the water management of the multi-case study.

6. RECOMMENDATIONS

The application of the research findings will directly benefit local communities and local government organizations involved in providing public services for water management in each respective area. The recommendations emphasize the importance of inclusive co-production, transparency, and strong collaboration in water management to achieve sustainable development goals:

1) Promoting inclusive participation and equal collaboration among all stakeholders fosters strong co-production and sustainable outcomes.
2) Commencing participation from the early stages and maintaining it throughout the process is crucial for successful co-production.
3) Adhering to set goals and maintaining inclusive processes facilitate the achievement of desired outcomes.
4) Shifting leadership roles to facilitators and promoting horizontal relationships and cooperation among members enhance co-production.
5) Embracing transparency and employing a participatory deliberative democracy approach aids in the development of inclusive public policies that align with community needs and concerns.
6) Strengthening the working relationships and efficiency of government agencies in water management improves service delivery and responsiveness to community needs.

This community-level multi-case study on water management provides unique results specific to the examined cases. To enhance generalizability, future research should include diverse case studies to enable comparative analysis and gain a broader understanding of water management practices. Comparative studies help identify factors influencing co-production effectiveness, aiding policymakers, and practitioners in adapting strategies to local contexts for more sustainable outcomes. Strong co-production among stakeholders is crucial for practical implications in local communities and government organizations. In summary, conducting diverse case studies enables comprehensive insights for water management practices, benefiting stakeholders and facilitating more sustainable outcomes.

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