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Exploring network governance in sustainable beekeeping management in the Mekong subregion and its challenges

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This research paper aims to explore a network governance in sustainable apiculture management and identify its challenges to government and non-governmental policy makers. Qualitative data was collected through participant observation during field visits and Focus Group Discussions (FGDs) with regional apiculture management. The research results show that each country in the Mekong subregion has different network governances in supporting a sustainable apiculture management. Some countries have a collaborative network between the government, the civil society, entrepreneurs, and scholars. In contrary, some countries lack a policy framework from the government. This difference becomes challenges for the six governments of the Mekong subregion countries to commonly support the sustainable apiculture management in the subregion. The identified challenges in the paper are: (1) a capacity gap between the six countries of the region; (2) no common policies and regulations that would facilitate local beekeepers' access to wider regional bee products; (3) no support for inter-regional transport of bees and honey for academic purposes; (4) inadequate native bee species preservation and pesticides use; (5) local beekeepers' limited access to a regional bee diseases and pesticides use database; and, (6) a lack of regional standards for general honeybee product support.

KEYWORDS

sustainable development, sustainable development goals, beekeeping management, Mekong subregion, apiculture

1 Introduction

Honeybees are the most important plant and tree pollinator, and as such are crucial for the ecological system and economic growth of many countries—including the six countries in the Mekong subregion (China, Thailand, Myanmar, Lao PDR, Vietnam, and Cambodia) (see Figure 1). This subregion currently supplies 33% of the world's harvested honey (Informant no. 3), while China is "the largest jelly producer in the world" (Zheng et al., 2018), and Vietnam is considered the "second largest honey exporter in Asia" (Thai and Toan, 2018). The six species of bee found in the region are: *Apis cerana, Apis andreniformis, Apis florea, Apis dorsata, Apis mellifera, and Apis laboriosa.* Local beekeepers have their own traditional knowledge, culture, and methods of bee hunting (Chantawannakul and Ramsey, 2018; Guerin, 2020). They always attempt to conserve native bee species and harvest their products in the form of honey, pollen, and royal jelly as a continuous source of income.

FIGURE 1
The Mekong subregion map.

Recently, global apiculture has faced two challenges. The first is the environmental degradation resulting from global climate change. This has given rise to negative impacts on bee lifecycles, pollination, and more significantly, the actual number of honeybees (Wild et al., 2021; Landaverde et al., 2023). The second challenge is caused by human activities. Guerin (2020) contends that Southeast Asian deforestation, agriculture intensification, increased pesticide use, and changing local beekeeper hunting practices have caused ever increasing damage to the native bee populations. These challenges and treats can be the so-called "wicked problem" of beekeeping management. In response, the Food and Agriculture Organization of the United Nations (FAO) has strongly encouraged better sustainable beekeeping practices via the publication of "Good beekeeping practices for sustainable apiculture" (Food and Agriculture Organization of the United Nations, 2021). This practice is applicable for stakeholders in beekeeping management. Sustainable beekeeping is a concept well accepted in policy discussions in many countries, including the Mekong subregion.

Even though the mere notion of sustainable development is debatable and seems abstract (Faucheux et al., 1998; Johnson et al., 2007), it has already had substantial practical impact through the Sustainable Development Goals (SDGs). These 17 goals effectively represent four national dimensions: economic development, environmental sustainability, social inclusion, and good governance (Sachs, 2012; Sachs, 2015). Without a doubt, the SDGs has also shaped the practice from the FAO mentioned above, as it notes that "beekeepers can contribute to the achievement of the United Nations Sustainable Development Goals" (Food and Agriculture Organization of the United Nations, 2021). These dimensions influence the extent to which sustainable beekeeping requires high state participation. Consequently, sustainable beekeeping in low-capacity countries will be rather difficult to implement. Those countries usually lack experts, technicians, government organizations, and sufficient budget to implement its practice.

This is the difficulty with the Mekong subregion countries which are considered to be least developed (Cambodia, Vietnam, Myanmar, and Lao PDR), since they are ineffective at implementing public policy in general (Vannarith, 2010; Punya, 2022). On the other hand, Thailand is defined as a developing country, and China is an economic giant whose richness of resources and manpower far outweigh the rest of the region. This capacity gap is seen as another challenge to regional sustainable beekeeping. To narrow the gap, the governments have sought to integrate themselves economically, cooperate developmentally, and rely on development assistance from the international community (e.g., international organizations, financial institutions, non-government organizations (NGOs) as well as the developed nations) (Asian Development Bank, n.d.; Lancang – Mekong Cooperation, 2017; Mekong – U.S. Partnership, 2021). We argue that subregional network governance can be a catalyst for sustainable regional apiculture. This argument is from the fact that there are many platforms (e.g., the Lancang – Mekong Cooperation and the Mekong River Commission) for the government from the six

countries to enhance this sort of governance. By fostering standardized policies, governments and local beekeepers can increase honey production, boost intra-regional trade, and enhance ecological conservation. This approach not only contributes to economic growth in the region but also supports the long-term health of bee populations and the ecosystems they inhabit.

However, the specific form of network governance in sustainable beekeeping management within each Mekong subregion country remains largely unexplored. This paper aims to address this gap by examining network governance practices in sustainable beekeeping management across the region. We also analyze and compare the stakeholders in the network governance and how those stakeholders can contribute to the sustainable beekeeping management in each country. Through this analysis, we seek to provide valuable insights for policymakers seeking to strengthen network governance at the subregional level to ensure the long-term sustainability in beekeeping management. Our approach involves a detailed investigation of existing network governance frameworks, networks, and implementation practices in each country, followed by an identification of the challenges hindering effective regional collaboration.

2 Conceptual framework and methods

2.1 Conceptual framework: a network governance

The focal point of the conceptual framework is a network governance for public policy process and public governance. A basic assumption for the network governance derives from the fact that the local, national, and transnational issues nowadays are in dynamic, uncertain, and complex. Many scholars believe that the state actor alone cannot deal with the issues thoroughly (Kenis and Schneider, 1991; Knoke, 1990; Peterson, 2003; Jones et al., 1997; Junki, 2006; Zafarullah, 2015). Therefore, the network governance is seen as a new paradigm of the public governance and is variously defined by many scholars. Torfing (2007), for example, defines the network governance as "A relative stable, horizontal articulation of independent, but operationally autonomous actors." These actors are connected together "as co-producers where they are most likely to identify and share common interests," according to Junki (2006).

Without a doubt, the network governance is a horizontal collaboration and interdependencies between the state and non-state actors (e.g., civil society, citizens, and private sector) in national, local, and transnational level to deal with wicked problems (Agranoff and McGuire, 2001; Zafarullah, 2015). This paper posits that network governance can be a powerful tool to address the complex challenges facing beekeeping management in the Mekong subregion. For instance, the detrimental effects of pesticide use on honeybee ecosystems can be mitigated through collaborative efforts between government agencies and local beekeepers. By working together, these stakeholders can develop and implement strategies that promote sustainable beekeeping practices and protect the health of bee populations. The network governance and policy network are somehow interchangeable. However, it should be noted that the focal points, nature of exchanges, institutionalization, democratic impacts, and power and politics between the network governance and policy network are different. It could be concluded that the network governance is a collaboration to deal with the wicked problems resulted by the socio-economic transformation and globalization. Moreover, the network governance allows the non-state actors to initiate the collaboration and support people's participation to deal with the wicked problem together (Blanco et al., 2011).

How does the network governance work in the public policy process? Torfing (2007) provides the answer to this question. He seeks to identify aspects of the network governance to enhance public governance and public policy process. He contends that the actors in the network governance are autonomous, but "mutually dependent on each other resources and capacities." They interact through negotiation within "a relatively institutionalized framework" and "can make their own rules and decision within limits set by external political agencies." Lastly, the network governance is helpful for the state actors as it can address public purposes and contribute knowledges, ideas, and normative orientation in the network for policy formulation and implementation process. To create the network governance, hence, it should have an institutional framework that enhances power of non-state actors (e.g., civil society, Non-governmental Organizations [NGOs], and citizens) to express their opinions, share their ideas, resources, and capacities.

After that, this framework has been widely accepted in many studies in public policy. It can be categorized into three groups of literature. The first group is the study of the collaboration between the state and non-state actors in a particular local, national, transnational issue, such as medical issue, tourist issue, and environmental issue (e.g., Romiti et al., 2020; Breslin and Nesadurai, 2018). The second group places emphasis on the roles of the non-state actors in supporting the network governance in local, national, and regional level (e.g., European Environment Agency, 2011). The last group sheds light on how the network governance can support the 17 goals in the Sustainable Development Goals and sustainable development in general (e.g., Dedeurwaerdere, 2005; Kapucu and Sean, 2020). The latter is explored here under the sustainable apiculture management scheme.

There are a few convincing reasons why this concept is useful to analyze the network governance of the sustainable beekeeping management. As mentioned already, first, the governments in the six countries in the Mekong subregion have different capacity to promote and mobilize the sustainable beekeeping management effectively. The network governance thus is crucial. Second, it is convincing that the network governance is also important to concretely support a notion of the sustainable development into a practice. Unlike the studies mentioned above, this paper seeks to explore a form of the network governance in the beekeeping management by using frameworks of Kenis and Provan (2009). Their frameworks include shared governance, lead organization, and network administrative organization networks. Each framework can be further described as follow:

The first framework is the shared governance form. This form emphasizes on the network that consists of "multiple organizations." They "have shared" or "participant governance" and "work collectively as a network but with no distinct governance entity." The second form is the lead organization governance. It occurs when "one organization has sufficient resources and legitimacy to play a lead role." The last form is the so-called network administrative form. This form is to "separate administrative entity to set up specifically to manage and

coordinate the network and its activities." Administrative actor in this form of network can be informal or formal ones. These frameworks are invaluable for understanding the functions and actors involved in supporting beekeeping management in the subregion. Given the diverse range of actors playing different roles, these frameworks provide a clear overview of the intricate relationships and responsibilities within the subregion.

The three frameworks mentioned above is employed here to explore and analyze the network governance on beekeeping management, how it can support the sustainable beekeeping management in the Mekong subregion and its challenges. Before investigating these inquiries, the following topic sheds light on the research methods of the paper.

2.2 Research methods

This paper employs qualitative methods to obtain in-depth understanding on beekeeping in the region. The first step was to perform field visits to gain a comprehensive understanding of beekeeping practices and challenges across the Mekong subregion. From 2022 to 2023, we conducted field visits to local honeybee farms in six countries, including those managed by both government and non-government organizations. Through participant observation, we gathered insights into their management policies, resource capacities, and operational practices. Following these site visits, we held focus group discussions with local stakeholders in each country to identify specific problems and priorities within their respective contexts.

The initial focus group discussion (FGD) was conducted in Chiang Mai, Thailand in October 2022, bringing together beekeeping management stakeholders from all six countries in the Mekong subregion. Participants included representatives from government organizations, non-governmental organizations, honeybee exporters, local beekeepers, and academics (Table 1). It is important to note that some countries lacked experts on beekeeping management in both the public and private sectors. Some countries like China, additionally, some scholars also play a role as local entrepreneurs. To address this limitation, we carefully selected representatives who could identify challenges within their own countries. Despite the varying proportions of representatives from each sector, all participants were able to contribute valuable insights into their respective countries' policy frameworks, networks, and challenges related to beekeeping management.

The first inquiry of the FGDs was related to each country's capacity. Different capacity can lead to different potential for both domestic sustainable beekeeping and exporting honey to the markets. Furthermore, we also believe that policy frameworks and networks involving the public and private sectors can support local beekeepers and exporters and improve their capacity to do so. In the following part, we will summarize the interview information acquired from the FGDs and field visits. This summary will focus on the capacity of beekeeping management, policy frameworks and networks, and challenges intrinsic to each country in the subregion.

A second focus group discussion (FGD) was conducted with the same group of stakeholders who participated in the initial FGD, taking place in Chiang Mai, Thailand in August 2023. The primary objective of this second FGD was to shape policy recommendations for government and non-governmental organizations aimed at promoting more sustainable and compatible beekeeping practices. Prior to conducting the FGDs, research ethics guidelines, informed consent forms, and interview questions were shared with all participants. To maintain participant confidentiality, pseudonyms are used in this paper in place of their actual names.

TABLE 1 The participants of the FGDs.

Pseudonym	Country	Sector/role
Informant no. 1	China	Scholar
Informant no. 2	China	Scholar
Informant no. 3	China	Scholar
Informant no. 4	China	Scholar
Informant no. 5	China	Scholar
Informant no. 6	Cambodia	Scholar
Informant no. 7	Cambodia	INGO
Informant no. 8	Cambodia	INGO
Informant no. 9	Laos	Governmental department
Informant no. 10	Laos	NGO
Informant no. 11	Myanmar	Scholar
Informant no. 12	Myanmar	NGO
Informant no. 13	Myanmar	NGO
Informant no. 14	Myanmar	NGO
Informant no. 15	Vietnam	Scholar
Informant no. 16	Vietnam	Entrepreneur
Informant no. 17	Vietnam	Entrepreneur
Informant no. 18	Vietnam	Entrepreneur
Informant no. 19	Thailand	Governmental department
Informant no. 20	Thailand	Governmental department

3 Policy frameworks, network governance, and their implementations in supporting the sustainable beekeeping management in the Mekong subregion

According to the FGD, the region is currently supplying 33% of the world's harvested honey. Every country has different honey producing and exporting potential to international markets. For example, Vietnamese honey is harvested from coffee plant flowers, Myanmar honey is harvested from jujube trees, Thai honey is harvested from longan plant flowers, and Cambodian honey comes from rubber plants. For exporting to the international markets, it is not easy for low capacity countries to meet the 2001 revised CODEX Honey Standards. This standard is widely accepted for consumption and sale in many countries (International Bee Commission, 2001). Exporters and government organizations are responsible for testing for bee diseases, measuring honey quality, and diversifying bee products to access broader markets.

The participants' conceptualization on the sustainable beekeeping management is compatible with the Sustainable Development Goals. They believe that the sustainable beekeeping management should focus three dimensions—economic development, environmental sustainability, and social inclusion. The first dimension is from the fact that honeybee and its products are source of income for the governments and local beekeepers. With the environmental degradation and unsustainable pesticide usage, however, have become a wicked problem that has jeopardized native honeybee. This problem has pervasively appeared in the Mekong subregion. Their opinions on solving the problem are similar. They strongly agree that the social inclusion, the third dimension, is indispensable. As a result, each country has a policy framework and network governance on the beekeeping management to turn the notion of the SDGs into a practice. This can be concluded as follow.

3.1 Thailand

Thailand has a long history of beekeeping and has shaped many policy frameworks to support beekeeping management. Thailand's beekeeping industry is primarily comprised of family-run businesses. While women's ownership of honeybee companies is on the rise, accounting for 3.6% of registered businesses (Informant no. 20, group interview, 2022). The network governance of the sustainable beekeeping management in Thailand can be seen from a role of the governmental department like the Department of Livestock Development as the administrative actor. It plays a role in approving honeybee farms, setting a honeybee standard for domestic consumption, and providing essential knowledge on honeybee and native honeybee conservation to local beekeepers, and collaborating with non-governmental organizations (such as the Honeybee Association), entrepreneurs, and Thai scholars to improve a honeybee quality.

With this administrative role, Thai local beekeepers are able to produce diverse bee products, such as brood, propolis, bee's wax, royal jelly, bee pollen, and bee venom (Chantawannakul, 2018; Suwannapong et al., 2012). For this reason, Thailand gains more advantage from exporting bee products than some other countries in the subregion. Uniquely, exporters and local beekeepers do not have to test for disease or chemical contamination in honey (National Bureau of Agricultural Commodity and Food Standards, 2014). For diagnosing bee diseases and analyzing honey, moreover, Thailand is better equipped than other countries in the region. Thai beekeepers can send their honey samples for testing for diseases and chemical contamination to scientific laboratories located in many Thai universities.

Even though beekeeping management in Thailand seems to have advantages, the identification and control of honeybee diseases and parasites caused by or acquired during honeybee migration remain a main obstacle for Thailand to identify. This information represents that the Departments of Livestock Development is responsible as the network administrative organization to collaborate with other stakeholders (e.g., local beekeepers, entrepreneurs, and scholars) in Thailand's beekeeping management. Therefore, the network governance in beekeeping management in Thailand can be illustrated as follow (see Figure 2).

3.2 Lao people's democratic republic (or Laos)

According to Chantayod et al. (2017), honey in Laos is an important non-timber forestry product (NTFP) that has become a source of income for local people in rural areas. Beekeeping management in Laos has been mostly supported by Non-Profit Associations such as the Honey Bee Farmer Association. This association is woman-led which plays a role in providing knowledge from Laos's scholars on how to conserve native honeybees and how to extract products from them to local beekeepers. It also supports a role of women to produce honeybee products to earn income for their own households. With this support, there have currently been 50 percent of female participation in the sterile and package processes.

Information from the Lao participants obtained from the initial FGD reveal that there are a few challenges in beekeeping management. First, the country does not have sufficient equipment for diagnosing honeybee diseases and chemical contamination. Laos only has access to equipment for sugar tests and some honeybee diseases in honey. Second, the Laos government does not have a policy framework for supporting and strengthening beekeeping management in the country. They also lack government experts on beekeeping management so shaping that such a policy would be difficult. Moreover, there are no trade agreements between Laos and other countries for international honey exports. Within these constraints, many Lao beekeepers personally sell honey to local buyers, or to buyers from neighboring countries, and therefore cannot effectively diversify their bee products (Sengngam and Vandame, 2005; Informant no. 9 and 10, group interview, 2022). A final challenge is that many young local beekeepers are unable to implement modern beekeeping techniques. Many modern techniques nowadays could help these local beekeepers become more successful if they have a better understanding of bee ecology, adaptability, technology, and socio-economic contexts (Chantayod et al., 2017). It could be concluded that Laos has low capacity in knowledge, resources, manpower and budget to support sustainable beekeeping.

From this information, moreover, it could be concluded that Laos has low capacity to support beekeeping analyzed that the network governance of beekeeping management in Laos is a lead organization form. The NGOs or the so-called Non-Profit Associations (NPAs) in Laos have played a leading role in enhancing beekeeping management and providing knowledge on the sustainable beekeeping management to Lao local beekeepers. As they have a low-capacity to do so, financial and technical supports from the international organizations and the International Non-Governmental Organizations (INGOs) are crucial to strengthening the NPAs and Lao scholars' capacity in the sustainable beekeeping management. The Figure 3 illustrates the network governance of Laos.

3.3 Myanmar

In Myanmar, most beekeeping operations are family-run businesses, with women taking the role in honey product processing. A policy network for supporting the sustainable apiculture to them exists between government authorities and NGOs in the form of the Myanmar Apiculture Association (MAA), which is funded by the European Union

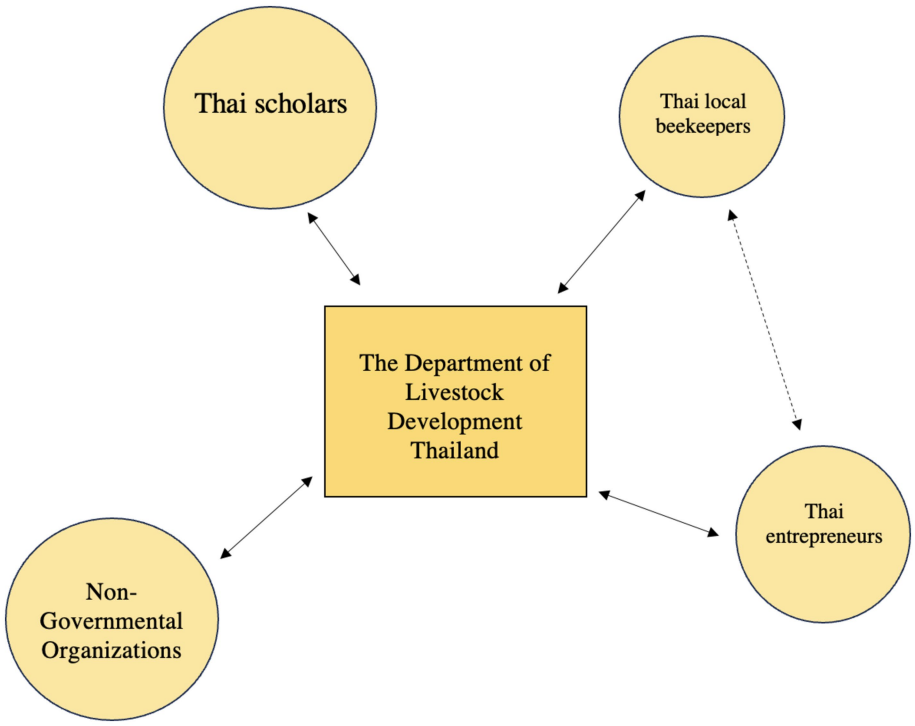

FIGURE 2
A network governance of sustainable beekeeping management in Thailand.

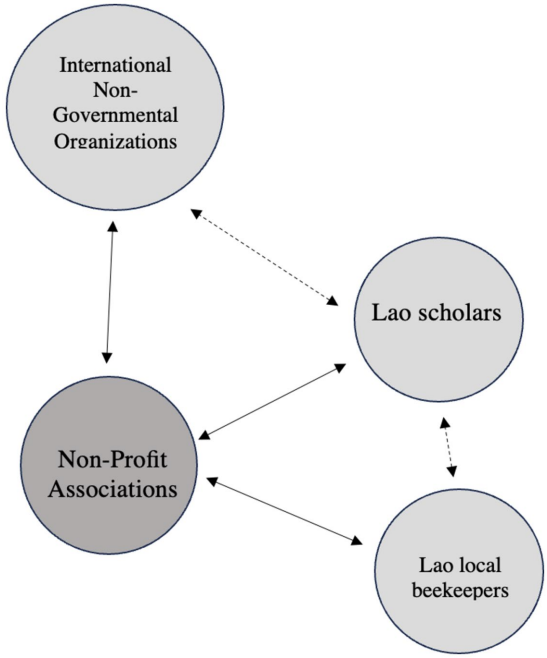

FIGURE 3
A network governance of sustainable beekeeping management in Laos.

(EU). The MAA plays a role in strengthening the capacity of Burmese beekeepers through workshops and trainings on CODEX standards for honey and Good Apiculture Practice (GAP) (see Food and Agriculture Organization of the United Nations, 2021). The MAA also liaises between beekeepers and government sectors by assisting beekeepers to send honey samples to the Department of Livestock of Myanmar. This department is responsible for diagnosing honeybee diseases. However, the equipment for inspecting bee diseases is insufficient in Myanmar. Thus, beekeepers and exporters have to send samples abroad to countries like Germany to diagnose honeybee diseases and product chemical contamination. This process always takes at least 2 weeks (Informant no. 11, group interview, 2022; Hlaing et al., 2023).

Restricting conditions in Myanmar are that they lack the ability to improve or control bee product quality to the degree that it meets the CODEX standard. Myanmar does not have sufficient equipment for diagnosing honeybee diseases and chemical contamination to meet beekeeper and exporter demands. Therefore, the MAA has been providing disease-related information to beekeepers and creating a regional data-sharing platform for beekeeping and breeding (Informant 12, group interview, 2022).

It could be seen that the network governance in Myanmar is compatible with the network administrative organization. The NGOs, such as the MAA, are crucial as an administrative platform to collaborate with the governmental department, Burmese local beekeepers, Burmese entrepreneurs, and the international organizations. The Figure 4 below illustrates such network governance.

3.4 Cambodia

Apiculture plays a vital role as an income source for numerous Cambodian households, with many women actively engaged in beekeeping management. One such honeybee business is owned by a female beekeeper. Cambodia boasts four native honeybee species and 13 stingless bee species, which are crucial for ecological conservation

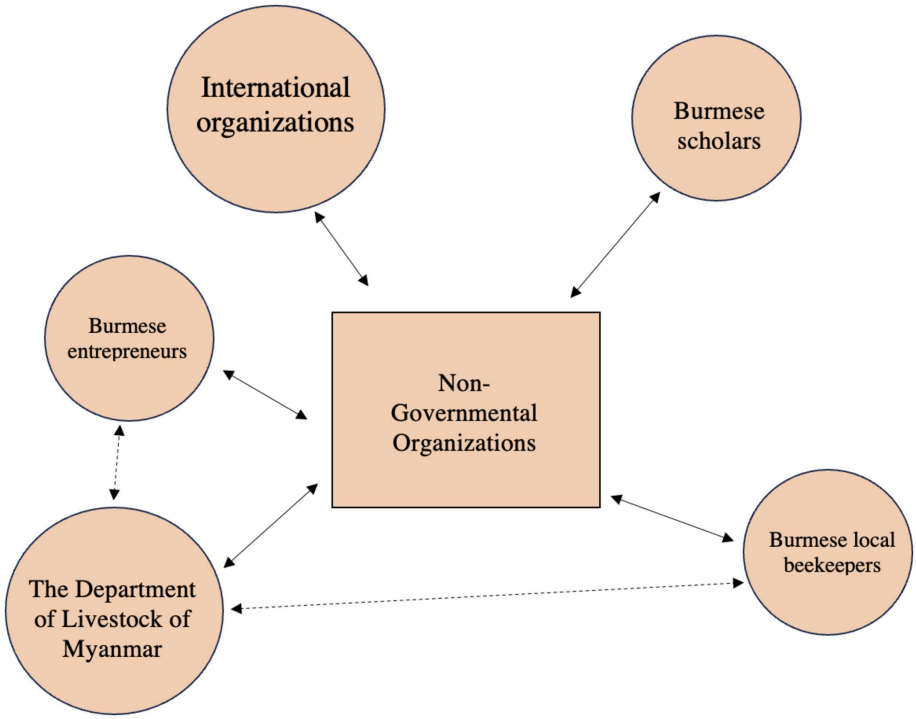

FIGURE 4
A network governance of sustainable beekeeping management in Myanmar.

and provide a source of income for local beekeepers in rural areas (UNESCO, 2023). To address the current capacity gaps in beekeeping management, the Cambodian Ministry of Environment and UNESCO collaborated in 2023 to develop a National Plan for Sustainable Beekeeping and Native Honey Bee Conservation. This initiative holds promise for both local beekeepers and the ecological system, as Cambodia currently lacks specific policies, regulations, or agreements on sustainable beekeeping. Additionally, government officials often have limited knowledge regarding sustainable beekeeping practices, including honeybee diseases, conservation, hunting practices, and CODEX standards. Most Cambodian beekeepers sell their home-extracted honey to local buyers, and there is no established platform for diagnosing honeybee diseases or assessing honey quality.

International NGOs like the Native Bees Conservation Sustainable Beekeeping Association contributes by creating training sessions and workshops for Cambodian beekeepers. The organization has provided knowledge on beekeeping in sustainable and environmental-friendly ways and chemical product usage to avoid chemical contamination in honey. Furthermore, it seeks to push the government authorities to improve its capacity to control bee diseases and improve the quality of honey to meet international standards. This, its members contend, can raise Cambodian beekeeping in Cambodia to a sustainable level (informant no. 7, group interview, 2022).

The network governance of beekeeping management in Cambodia is a leading organization form, as it is led by the INGOs. They have provided their technical supports to local beekeepers, scholars, and currently, the Cambodia government. The Figure 5 reveals that such the network governance.

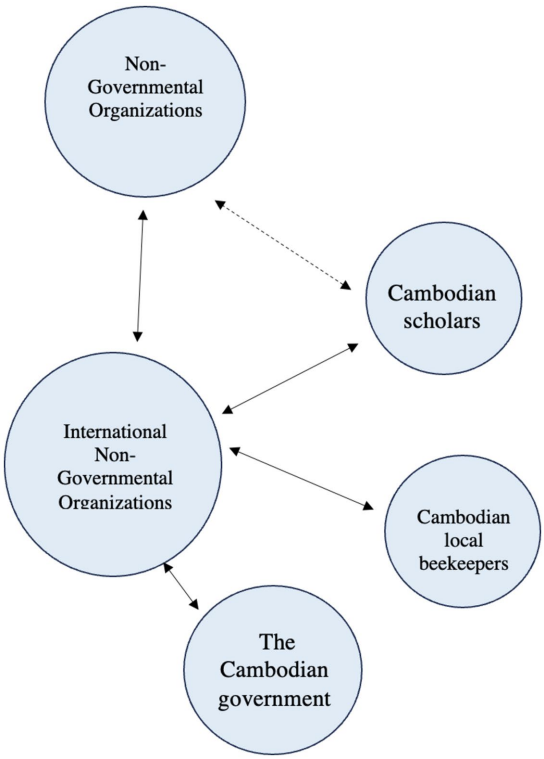

FIGURE 5
A network governance of sustainable beekeeping management in Cambodia.

3.5 Vietnam

Thai and Toan's study (2018) notes that "Vietnam is the second largest honey exporter in Asia." There are mainly family-run businesses with female participation around 20 percent. For this reason, currently, the Vietnamese government has strongly supported beekeeping management via their Research Center for Tropical Bees and Beekeeping at the Vietnam National University of Agriculture. This research center aids Vietnamese beekeepers in learning about honeybee diseases and environmentally friendly beekeeping in remote areas. Moreover, it plays a role in diagnosing honeybee diseases and honey quality by sending honey-samples for analysis to the U.S.A and Russia.

In Vietnam, private honey exporters also play a role in ascertaining the quality of honey and other honeybee products, improving honeybee breeding, and controlling chemical product usage. However, the Vietnam's main limitation is that the honey's quality control cannot be brought up to international export standards due to chemical contamination. In order to avoid such toxicity, thus, better knowledge about pesticide use is required for local beekeepers and other farmers (Informant no. 15, group interview, 2022).

Accordingly, the network governance of the beekeeping management in Vietnam could be seen that the Vietnamese scholars at the research institute in the Vietnamese universities plays a role as an administrative actor. Those scholars have collaborated with the Vietnamese government on the honeybee disease testing before exporting to external markets and have provided knowledge to Vietnamese local beekeepers and entrepreneurs. The role of the scholars is suitable with the network administrative organization, as a result. The Figure 6 illustrates the network governance in Vietnam.

3.6 China

China has practiced beekeeping since ancient times (Zheng et al., 2011; Zheng et al., 2018). It is not surprising that the country has a high capacity for bee product analysis and honey quality measurement with adequate equipment. The country's beekeeping industry is predominantly family-run, with significant female participation. Moreover, there is a coherent network that supports national beekeeping management which includes Chinese universities, the government sector, beekeepers, and exporters. Chinese scholars from those universities have advanced human development by creating a sustainable beekeeping management undergraduate program. China is the biggest country in the region that exports honeybee products to the international market, and beekeepers and exporters can diversify with many honey products.

The Chinese procedure for passing honeybee products through customs is convenient for beekeepers and exporters. The Chinese government has an online platform for uploading export data referred to as the "Customs Administrative Relative Unified Management Subsystem." Chinese exporters use it to register their information (e.g., number of bee colonies, list of products, beekeeping logs, etc.). In terms of domestic consumption, however, there is no procedure for measuring bee product quality. Currently, the challenges to beekeeping management in China are mainly from climate change, environmental degradation, and pesticides that jeopardize native bee lifecycles. Another challenge is that many Chinese wild bees have abandoned their own colonies causing their overall number to decline (Informant no. 1, group interview, 2022).

This information reveals that the network governance in China is compatible with shared governance form. Each actor has their own

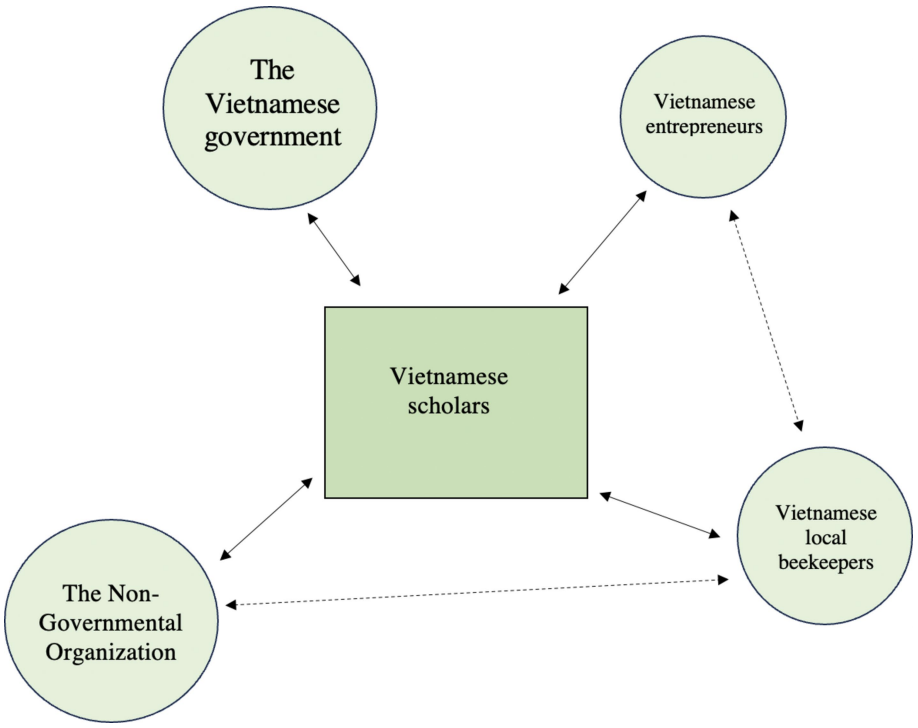

FIGURE 6
A network governance of sustainable beekeeping management in Vietnam.

resources and capacities to share and collaborate with each other. Therefore, the beekeeping management in China is quite different from other countries in the Mekong subregion. The following figure presents the network governance of beekeeping in China (see Figure 7).

4 Discussion

4.1 Identified challenges in sustainable beekeeping management in the Mekong subregion

According to information on beekeeping in each country in the region, both honeybee hunting and beekeeping are critical to the local economy. They have a long history and considerable knowledge about beekeeping for personal consumption as well as for commercial purposes. With their network governance explored above, however, it is challenging for those countries to enhance the sustainable beekeeping. Their challenges can be more accurately illustrated using this information. We concluded that five challenges based on policies-related issues and non-policies-related ones to effectively support the sustainable beekeeping in the subregion:

- Policies-related issues.
- A capacity gap in resources, financial support, and knowledge in beekeeping management in the region.

The first capacity gap stems from the fact that Thailand, China, Myanmar, and Vietnam have different levels of equipment available for diagnosing honeybee diseases, measuring honey quality, and diversifying honeybee products. Therefore, they have a broader market to which they can export their bee products. Beekeepers in Laos and Cambodia, however, mainly rely on financial and technical assistance from non-government sources and international organizations to improve their ability to produce and export bee products. There are also marked differences available between the six countries in terms of the government expertise availability, i.e., the number of specialists and experts with in-depth knowledge of beekeeping management, honeybee migration, honeybee diseases, and honeybee preservation who can be accessed. Another capacity gap is human capacity. Some countries in the region completely lack specialists and experts who have in-depth knowledge on beekeeping

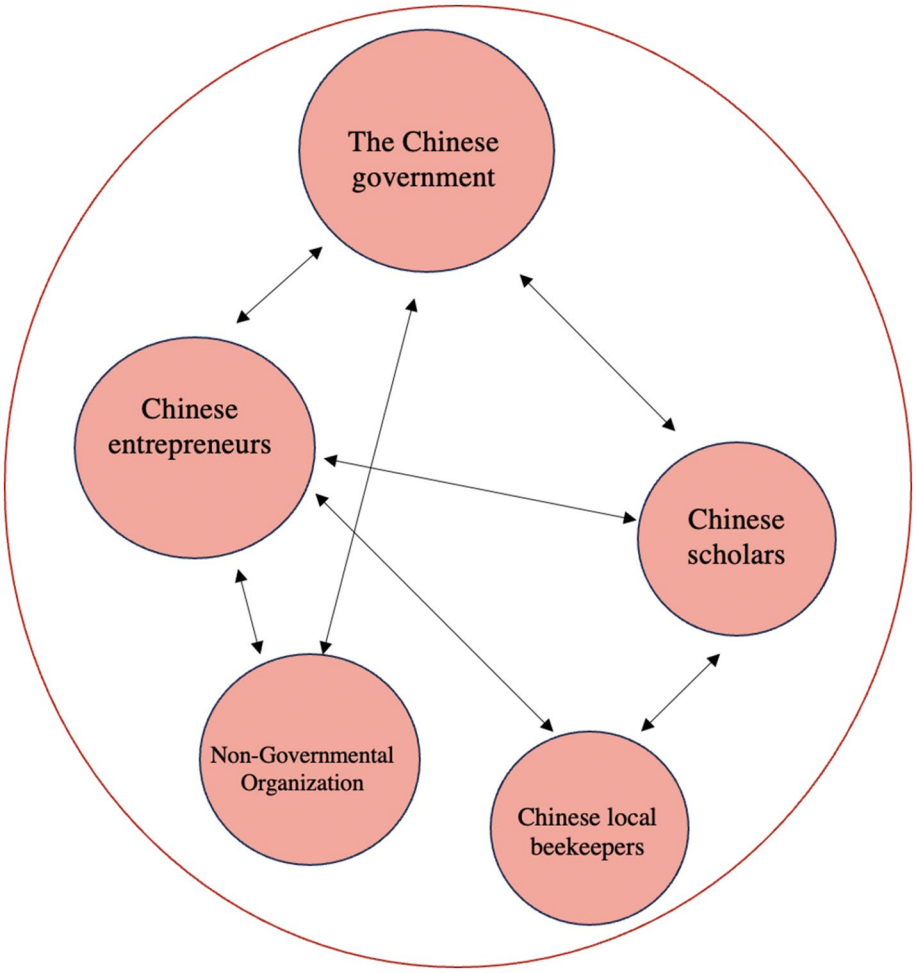

FIGURE 7
A network governance of sustainable beekeeping management in China.

management, honeybee migration, honeybee diseases, and honeybee preservation, in government sectors. Human capacity in the government sector is crucial to support the sustainability and efficiency of beekeeping management. Experts and specialists can apply their knowledge to shape policy frameworks on sustainable beekeeping management, and can disseminate their knowledge.

- Lack of a policy framework for supporting beekeeping management in some countries in the region.

According to information from the FGDs, Thailand, China, Myanmar, and Vietnam have policy frameworks for supporting beekeeping management and measuring honeybee quality before export. For example, the Thai government has recognized honeybees as an official component of their GDP calculations since 1940 (Seanbualuang, 2012). In contrast, Laos and Cambodia do not have national policies supporting beekeeping management and export. The underlying reason why some countries lack this sort of policy is related to the first challenge. Those countries lack the human capacity to shape the policy framework and lack the equipment to measure honey quality and test for honeybee diseases. Without a doubt, there is insufficient information for those countries to be able to shape beekeeping management policy. For this reason, it has so far proved impossible for the governments of all six countries in the region to shape effective policies on sustainable regional beekeeping management.

- Lack of agreement to reduce custom procedures and fees to send honeybees and honey as samples for academic purposes in the region.

Another challenge is that there is no agreement to reduce customs procedures and tariffs to import and export honeybees and honey for academic purposes within countries in the region. No specific documents and procedures currently exist to allow local private beekeepers, exporters, and government departments to send honeybees and honey as samples for academic purposes to research institutes in other countries in the region. Therefore, some countries categorize honeybees and honey as used for academic purposes the same as if used for commercial purposes. It takes time to quarantine honeybees and honey. Research institutes sometimes have to pay commercial-level customs tariffs to take the samples out of quarantine. Moreover, there is no agreement to standardize a list of honey quality attributes at the regional level, nor is there a list of diseases that are required to be tested for before honey and honeybees are exported to other countries in the region. Currently, the six countries in the region have diverging checklists of honeybee diseases and standards for honeybee product imports. This lack of cooperation at the regional level has become an obstacle for local private honeybee exporters wishing to access regional markets.

- Non-policies-related issues.
- Knowledge on correct pesticide usage and conserving native bee species.

A lack of information has led some apiarists to use pesticides that worsen bee ecology and destroy bee colonies. This could eventually have a seriously detrimental impact on the quality of honeybee products and exports. Moreover, some participants in the FGDs voiced their concerns that both the local beekeepers lack knowledge on honeybee importation and methods for native honeybee species conservation. Without suitable government regulations local apiarists import extra-regional honeybees to increase colonies and productivity. However, imported honeybees can either hybridize or compete with and put pure native bee species at risk of being outcompeted and possibly extinguished (Guerin, 2020). This has already happened in Africa and Europe (Research Centre Bees for Development, n.d.; University of Gothenburg, 2023). It could be concluded that greater understanding of appropriate pesticide usage and conservation of native honeybee species and colonies would support sustainable development of beekeeping and honeybee hunting practices.

- Lack of a shared database on the sustainable beekeeping management.

The last challenge identified by this paper is the lack of an extant shared database on the sustainable beekeeping management. It should include honeybee diseases, pesticide usage, native honeybee preservation, and international standards of honeybee quality at the regional level. A database would represent an important advance allowing government departments to shape policy and agreements that would support apiculture management. Moreover, the local beekeepers, honeybee producers, and exporters could use information from the database to improve their honeybee quality and acquire knowledge about pesticides that are not toxic to honeybee ecology.

These challenges as identified here currently present serious challenges to apiculture in the Mekong subregion. What should policy makers in both government sectors and NGOs do to deal with them? To answer this question, this paper offers two recommendations concerning more practical policy frameworks and network governance for supporting sustainable development that would be suitable to the subregion below.

5 Policy recommendations

In light of the aforementioned challenges, this paper proposes policy recommendations for both governmental and non-governmental stakeholders. The issues identified can be broadly categorized into three groups, each of which can be addressed with similar strategies. While the recommendations presented here are general, we believe they are effective and compatible with the current capacities of the countries involved.

According to the framework of this paper, the network governance for supporting sustainable beekeeping management is crucial for a cooperative network including international organizations, government sectors, non-government sectors, and local beekeepers in the region. The high capacity countries can play a role in supporting the lower capacity country. To make this network actually happen, furthermore, this paper proposes that international organizations should provide financial and technical assistance that would narrow the capacity gap between countries in the region.

International organizations can support government sectors by helping arrange regional training and workshops on sustainable beekeeping management. Moreover, research academics can play a role in supervising the government formulation of policy frameworks for sustainable beekeeping management. Researchers can also play a role in supplying honeybee disease and preservation data, and

pesticide usage related information to the database. This can ideally be shared network governance that each actor has a capacity and resources to share together. With this sort of network governance, we believe that it can support the sustainable beekeeping management as follows:

- Narrow the capacity gap in the Mekong – Lancang region.

To narrow the capacity gap, in particular human capacity, improvements should be made to the government departments involved in apiculture. Government officers and policy makers are crucial to reshaping policy frameworks in order to implement sustainable apiculture management and help supervise their local beekeepers throughout their own countries.

Therefore, international organizations, government departments or NGOs in countries that have high regional beekeeping management capacity should arrange workshops and training sessions, both on-site and online, for beekeepers and government staff in the low capacity countries. Governments can also prioritize women in vocational training, as beekeeping is often a women-led industry in certain countries. To strengthen human capacity building, especially among young people and women, governments in the region should consider establishing a Memorandum of Understanding (MOU) to support training initiatives. This could include providing grants for government officers and scholarships for graduate students to promote awareness of sustainable beekeeping practices.

- Creating a database on bee diseases, native bee species preservation, and bee quality control at the subregional level.

The proposed database could provide all stakeholders with the latest information on beekeeping management, honeybee diseases, and pesticide usage, while allowing them to share their own knowledge of beekeeping management. Thus, the database should be open-access, and available on many kinds of platforms (such as websites and applications). Experts and specialists from both government and non-government sectors would be able to upload new data to the database and beekeepers would easily be able to access the database. For importing honeybees from outside the region, the governments of all six countries should issue regulations controlling numbers and proper deployment of imported bees in order to best preserve the native honeybee species.

6 Conclusion

This paper aims to explore a network governance of the sustainable beekeeping management in the Mekong subregion and its challenge. It could be seen that each country in the subregion has different actors to support the sustainable development to the beekeeping management. Therefore, the network governance of the sustainable beekeeping management in the subregion is various. It includes: a network administrative form, leading organizational form, and shared governance network. From the different network government, it is challenging for the six countries to mobilize the sustainable beekeeping management in the subregional level. There are six challenges identified here. The first challenge is the capacity gap between the six countries of the region. Second, there are no common policies and regulations that can facilitate local beekeepers access to a wider intraregional bee products market. Each country has its own unique policies supporting beekeeping management and honeybee product exports. The third challenge is that there is no support for sending honeybees and honey within the region for academic purposes. The fourth challenge is that awareness of proper pesticide use by local farmers in some countries is often inadequate. Farmers' lack of knowledge about proper pesticide use has led to a worsening of the regional apiary ecology. This relates to the next challenge which is the limitation of local apiarist access to a regional database on bee diseases and pesticides. The last challenge is that it is rather difficult for the governments of all six countries to control honeybee and bee products prices in the region. Moreover, this paper provides a policy recommendation that supports sustainable beekeeping management. It offers many recommendations —yet the most important one is that each government should attempt to narrow the intraregional capacity gap through human development. Policy networks including governments, private sectors, scholars, local beekeepers and exporters, and international organizations, can be a practical means to effectively reduce this gap.

Author contributions

SP: Conceptualization, Writing – original draft, Writing – review & editing, Data curation, Formal analysis, Investigation, Methodology. CS: Writing – original draft, Writing – review & editing, Funding acquisition, Resources. PP: Resources, Writing – original draft, Writing – review & editing. TD: Resources, Writing – original draft, Writing – review & editing, Conceptualization, Funding acquisition, Project administration, Supervision.

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Conflict of interest

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