Kasetsart Journal of Social Sciences 46 (2025) 460114

Kasetsart Journal of Social Sciences

journal homepage: http://kjss.kasetsart.org

Community engagement to PM 2.5 in Thailand: A case study of Khon Kaen Province

Nonglak Yodmongkol*, Darunee Phukao, Pattarachit Choompol Gozzoli

Department of Social and Health, Faculty of Social Sciences and Humanities, Mahidol University, Nakhon Pathom 73170, Thailand

Article Info

Article history:
Received 14 December 2023
Revised 25 January 2024
Accepted 5 February 2024
Available online 28 March 2025

Keywords:
case study,
community engagement,
participatory public policy process (4P),
Particulate Matter (PM2.5),
public policy

Abstract

The objective of this study was to investigate the model of the participatory public policy process for regulating Particulate Matter (PM 2.5) policy at the local level, using Khon Kaen Province as a case study. The qualitative research was employed, including a literature review and an in-depth interview. Fifteen key informants participated in the study, and another fifteen persons contributed to the focus group discussion, all whom were significant stakeholders selected by the criteria. The findings indicated a five-step participatory public policy process (4P) for managing PM 2.5, which involved (1) policy formation, (2) policy formulation, (3) policy implementation, (4) policy evaluation, and (5) policy continuation, termination, and replacement. The engaging in those implemented 4P gained community collective lessons learned by a collaborative learning mechanism for the network's and the public's success. Additionally, policies were reviewed and altered to reflect the local environment, having a clear coordination mechanism acknowledged by the network, a factor encouraging involvement in the network's public policy process. The collaborating process created a network structure cultivating partnerships and developing the network to other advanced policies. Organizing of learning process, network knowledge sharing, and network communication to continue keeping network active were encompassed. It was confirmed that 4P of Khon Kaen PM 2.5 model took into account a social policy process, social capital, and knowledge. It was an important social tool for creating participation among government agencies, private sector, and the public sector in the management of PM 2.5. This knowledge could apply in creating multispectral engagement for multifactorial challenges.

* Corresponding author.
E-mail address: unonglak3@gmail.com (Yodmongkol, N.).

https://doi.org/10.34044/j.kjss.2025.46.1.14
2452–3151/© 2025 Kasetsart University.

Introduction

In recent years, the issue of pollution arising from particulate matter has emerged as a significant health concern. Particulate matter of a diameter of 2.5 micrometers (PM 2.5) has the potential to be inhaled into the alveoli of the lungs, where it can collect or permeate into the bloodstream, subsequently disseminating throughout the entire body. According to the World Health Organization (World Health Organization [WHO], 2018), PM 2.5 has been categorized as a carcinogen based on a growing body of academic and clinical evidence. In 2018, the United Nations made an announcement on the classification of air pollution as the fifth risk factor contributing to the development of chronic non-communicable diseases. In addition to maladaptive dietary patterns, tobacco use, and alcohol consumption, insufficient physical activity and a sedentary lifestyle have been identified as contributing factors to the development of several health conditions, including heart disease, stroke, chronic lung disease, cancer, diabetes, and neurological disorders (United Nations [UN], 2018). According to a study conducted by Cohen et al. (2017), PM 2.5 emerged as the fifth most significant contributor to global mortality in 2015. According to the World Health Organization's estimation for the year 2016, the global death toll resulting from air pollution amounted to 7 million individuals. Among these fatalities, 4.2 million were attributed to outdoor air pollution, with a significant proportion of 91 percent concentrated in Southeast Asian nations.

Like other developing countries, these issues in Thailand persist and tend to escalate in severity. Such is evident from the prevalence of smog in the northern region, which has escalated over the years, with the concentration level of dust particles measuring less than 10 microns (PM 10) consistently rising. Subsequently, PM 2.5 particulate matter was recognized as a contaminant that the Pollution Control Department incorporated into its processing framework as a quantifiable parameter. The Air Quality Index (AQI) serves as a means for the general public to comprehend the extent of PM 2.5. Addressing the issue of dust pollution has become a prominent item on the national agenda, according to the Thailand Clean Air Network (2019) and the Pollution Control Department (2019). The key principles in tackling this complex challenge are directive policy, control sources of emission, information and innovative approach, and local level management, with the latter particularly needing several agencies' engagement. The establishment of network partnerships for source management, both within Khon Kaen and neighboring provinces, together with the implementation of proactive surveillance measures, and the establishment of a collaborative network among pertinent sectors are crucial factors in ensuring the long-term sustainability of efforts aimed at addressing the issue of PM 2.5.

According to Harvey (2009), a notable aspect absent in the public participation process is the provision of forums dedicated to deliberation and discourse. In the realm of public policy, the opportunities for debate and discussion are frequently constrained by rigid structures of formal discourse. The focus is directed at discussing scholarly evidence that possesses objectivity to a sufficient extent, so enabling the articulation of individuals' sentiments, cognitions, and affective states.

The Participatory Public Policy Process (4P) encompasses a series of five participatory health public policy procedures and corresponding milestones. Firstly, policy formation involves doing an analysis of the nature of the public problem and identifying its core components. According to Kim and Darnall (2016), while establishing policies and regulations with potential societal impact, it is possible to do an analysis of the respective roles stakeholders may assume in the policy formulation process. Secondly, policy formulations, which can be considered as the starting point, which will cause political behavior and other administrations. Currently, public policy formulation is not a monopoly mission that belongs exclusively to the state. Howlett (2020) explains that policy formulation is a type of activity that emphasizes the application of knowledge to create alternative policy. It is expected that the government's goals and ambitions will be achieved effectively. Thirdly, policy decision means selecting the most appropriate path or policy approach, which can achieve the objectives as desired, in which ethical principle or morality is so important to the values that underpin policy choices. According to Sabatier (1999), the principle of majority and social satisfaction is elucidated. The majority decision model is a widely employed approach in the field of decision-making. Fourthly, policy implementation; the public policy process extends beyond the enactment of legislation by the legislative body. This pertains to the implementation of policies originating from the executive offices of national leaders within the bureaucratic framework. According to Khan (2016), policy implementation is conveyed to many agencies. The nature of the operation holds significant importance in the policymaking process. Finally, policy evaluation is one crucial stage within the policy process that involves the provision of information pertaining to the execution of the policy and its subsequent outcomes. This information serves to assess whether the policy

effectively meets the demands and holds value, or conversely, falls short in these regards. According to Rossi and Freeman (2018), policy evaluation entails the systematic application of research methods derived from the social sciences. In this analysis, we aim to assess the theoretical framework, design, implementation, and usefulness of social programs. Specifically, we will evaluate the conceptualization of the theoretical framework, the design of the program, the implementation of policies, and the resultant utility of the social intervention program.

In terms of social theories, the increasing concern over PM 2.5 pollution has prompted a growing body of literature exploring the role of social theories in shaping effective environmental policies. Social constructivism (Vygotsky, 1978) posits that societal perceptions and shared meanings influence policy outcomes. Research suggests that involving communities in decision-making processes enhances policy effectiveness by addressing local concerns and fostering collective responsibility. Additionally, the social ecological model underscores the interconnectedness between environmental issues and various social determinants. Bronfenbrenner (1979) developed the social ecological model, which suggests that individuals are influenced by multiple nested environmental systems. This model emphasizes the importance of considering these interconnected systems when addressing environmental issues. Studies advocate for policies that go beyond immediate environmental factors, acknowledging the influence of socioeconomic and cultural aspects on PM 2.5 exposures. In addition, the environmental justice framework emphasizes the need for equitable distribution of environmental benefits and burdens, urging policymakers to address disparities in PM 2.5 impacts among marginalized communities. The framework advocates for fair treatment and meaningful involvement of all people, regardless of race, color, or income, in the development, implementation, and enforcement of environmental laws, regulations, and policies (Bullard, 1990).

Israel et al. (2019) outlined a systematic methodology for implementing participatory techniques in the collection and analysis of both quantitative and qualitative data pertaining to community involvement. The study demonstrates the collaborative efforts between researchers, and community partners, and the successful establishment and sustenance of equitable relationships through the utilization of community-based participatory research methodologies. Community-Based Participatory Research (CBPR) is a collaborative approach aimed at enhancing understanding and enhancing the overall health and well-being of individuals within communities.

This study aims to explore the advancements in formats and innovative approaches for managing the PM 2.5 problem, with the intention of establishing a model that may be utilized in Khon Kaen Province for future solutions to the PM 2.5 issue. On February 7th, 2019, the districts of the province were affected by PM 2.5 dust particles, as reported by the Air4Thai website of the Air Quality and Noise Division, Pollution Control Division, at midnight. The analysis revealed that the concentration of PM 2.5 in the atmosphere was as high as 99 micrograms per cubic meter, while the concentration of PM 10 was 163 micrograms per cubic meter. As a consequence, the air quality index (AQI) reached a maximum value of 209, indicating a red color code (Workpointtoday, 2019). Currently, the municipality has compiled a report on PM 2.5 particulate matter in response to public discussions on the significant levels of dust, which the authorities have promptly addressed inside the agency. The genesis of dust has been examined, including two primary factors: automobiles and open burning. The primary source of dust pollution in Khon Kaen is the practice of open-air burning. The act of burning in an exposed area is comprised of three primary components: (1) The practice of burning sugar cane is widespread in the northeastern region; (2) Forest burning is common in the northern region; and (3) Weed burning is also seen, among other activities. Khon Kaen has challenges regarding the combustion of sugarcane (Sakunkoo et al., 2020).

We mainly analyzed the various elements that influence the attainment of success, challenges, and barriers encountered in the public participation process and to develop a framework to facilitate collaboration among agencies and network partners engaged in the management of dust-related issues, aiming for formulating comprehensive public health policies at the local level, and utilize the acquired knowledge to construct a framework applicable in the formulation of policy recommendations pertaining to the mitigation and resolution of the PM 2.5 issue, alongside other public policy concerns.

Methodology

The researcher has opted to employ qualitative research methodologies, namely, utilizing documentary research, in-depth interviews, and focus groups with 15 key informants, selected by a purposive sampling, including five participants from the governmental sector, five from the academic sector, and the other five from public, private, and mass media sectors, to examine the procedural aspects and outcomes associated with the involvement of network partners in the public policy process.

1. The researchers explore theories pertaining to the structure and dynamics of network partners' involvement in public policy processes, both at the local and international levels. There exist several notions and theories pertaining to the field of policy science. This paper included the social science concepts and theories that pertain to public involvement in the realm of public policy and examined the theoretical framework of network ideas and their application in the management of air pollution concerns caused by PM 2.5 in a specific case study location.

2. The researchers conducted in depth interview in this study of the network and members of the Khon Kaen Provincial Health Assembly as the target informants. The sample of 15 individuals was purposively selected including the government and political agencies; academics from educational institutions, universities, and research institutes; private sector/public sector, and NGOs; and mass media.

3. The researchers conducted a focus group discussion by selecting people who assumes responsibility for formulating and advancing policies aimed at addressing the issue of air pollution caused by PM 2.5 in Khon Kaen Province. This function entails collaborating with various public sector networks at the provincial level. The researcher chose a cohort of primary sources. The classification is based on the network of several sectors, namely: (1) government and politics, (2) academic and professional sectors, and (3) civil society and the corporate sector. Key informants of each sector are comprised of five individuals, resulting in a cumulative total of fifteen individuals.

Semi-structured interview protocol and relevant topics for focus group discussion were the main research instruments of this study. Both were divided into five sections, including networks, management, innovations, surveillance, and policy formation. To ensure the reliability and validity of the collected data, the researchers employed a triangulation procedure, including methodological, researcher and data triangulations. All raw data were transcribed and analyzed by a content analysis method.

Results

Section 1: Establishment of the Network Cooperation Council for Addressing PM 2.5 Dust Concerns in Khon Kaen Province

The subject of discussion is the province of Khon Kaen, a province now grappling with the issue of pollution resulting from the presence of particulate matter. The primary source of causation is from open burning, accounting for 54 percent of the total. This practice is predominantly observed in monoculture regions, in particular, the practice of setting fire to sugarcane fields as a means of gaining access to sugar plants. Nevertheless, Khon Kaen has already implemented a program aimed at effectively addressing the issue of PM 2.5 pollution, which has yielded tangible results. For example, (1) The present study involves the implementation of an experimental smart hybrid solar cell PM 2.5 vacuum cleaner, sometimes referred to as the "green giant." The spatial region situated in front of Khon Kaen City Hall; (2) Navigational aspects of the application for the quantification of dust levels. In order to address the issue of PM 2.5 on a daily basis, it is advisable to employ the Air Quality Index (AQI) as a means to assess the air quality in Khon Kaen; (3) Establishing a provisional facility for disaster aid purposes for individuals who are impacted by the issue of PM 2.5; and (4) Creating a social network to reduce air pollution concerns among Khon Kaen residents.

The Health Assembly Network is a platform that facilitates collaboration and knowledge sharing among healthcare professionals and organizations. A convened assembly was organized to deliberate over the preliminary proposal of the public policy development initiative aimed at addressing the issue of air pollution caused by PM 2.5, which poses health risks. The network partners in Khon Kaen have collaboratively developed public policy recommendations on the aforementioned challenges. (1) Challenges pertaining to the administration of origins originating from external regions; (2) Challenges pertaining to the administration of origins within the province; and (3) Matters pertaining to proactive monitoring. The topic of concern pertains to the formatting support difficulties. Nevertheless, in a multitude of areas as previously indicated, there remain unresolved gaps and complex challenges in addressing the issue of PM 2.5, both in terms of source management within Khon Kaen Province and in other regions, as well as the implementation of proactive surveillance measures. The draft paper of the proposed resolution, titled "Public Policy Assembly on the Issue of Sustainable Clean Air in Khon Kaen, 2021," aims to explore the advancement of formats and innovations in managing the PM 2.5 problem. This exploration is intended to provide a model for addressing the PM 2.5 in a more effective manner.

In addition, there are other agencies and networks at the regional level, such as the Provincial Agricultural Offices. The local government organization refers to the administrative body responsible for governing and managing affairs at the local level within a certain geographic area. The entities involved in this study

include the Provincial Disaster Prevention and Mitigation Office, the Provincial Industry Office, the Provincial Transport Office, and academic institutions. In order to collectively address the issue of cross-border dust pollution, it is imperative to devise effective solutions (Figure 1).

The study examines the policies implemented by government entities to address the issue of PM 2.5 in Khon Kaen Province as to the stipulations outlined by the Khon Kaen Clean and Sustainable Network, as seen in the accompanying visual representation:

1. Issue in managing origins from other areas

1) A committee has been constituted for the purpose of overseeing the operations of the Wildfire Incident Command Center. The focus of this study is to investigate the issue of open burning, smog pollution, and the presence of PM 2.5 in Khon Kaen Province. Khon Kaen University has established collaborations with private sector entities. Civil society refers to the collective body of individuals and organizations that operate independently from the government and the private sector. It encompasses a wide process of doing research, formulating strategies, and implementing surveillance and precautionary measures pertaining to health and the environment. In order to address the issue of PM 2.5 at the provincial group level, it is imperative to establish coordination among neighboring provinces. This collaborative effort aims to identify effective strategies for mitigating the problem and subsequently ensure the practical implementation of these measures.

2) Developing a comprehensive approach to address the persistent issue of PM 2.5 entails formulating a research plan that emphasizes long-term solutions, with a particular focus on source management, specifically targeting challenges associated with fuel combustion. The utilization of renewable energy sources, clean energy technologies, and associated methodologies is advocated for, alongside the promotion of knowledge application derived from research endeavors.

2. *Issues in origin management in the province*

1) Khon Kaen University (KKU) is a renowned institution of higher education located in the northeastern region of Thailand. It engages in partnerships with nearby educational institutions and affiliated organizations, encompassing both public and private entities within the vicinity. Collaboratively devise a comprehensive approach aimed at facilitating research endeavors to address the persistent issue of PM 2.5 in the atmosphere, with a primary emphasis on source management strategies, particularly those pertaining to the resolution of challenges associated with fuel combustion. The utilization of renewable energy sources, as well as the implementation of clean energy technology, together with the facilitation of knowledge transfer from research, is advocated for.

2) The financial institutions operating in Khon Kaen Province encompass the Agricultural Bank and Agricultural Cooperatives, as well as the Government Savings Bank, among others. These institutions offer specific financial products that come with stipulations aimed at reducing interest rates on loans. This strategic approach is designed to provide more support to the agricultural sector when compared to other financial institutions, encouraging businesses to allocate investments towards machinery, technology, and innovation in order to mitigate burning practices within the agriculture industry.

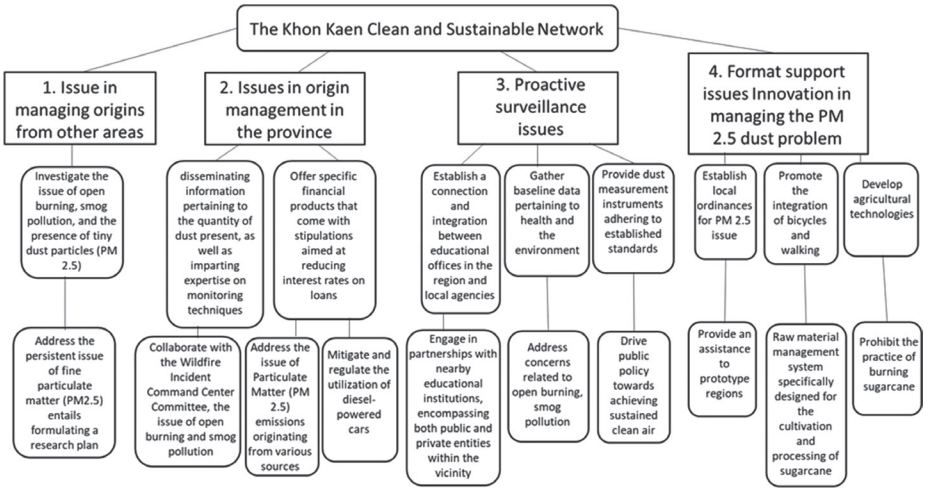

Figure 1 The policies implemented by government entities to address the issue of PM 2.5 in Khon Kaen Province

3) In collaboration with the Wildfire Incident Command Center Committee, the issue of open burning, smog pollution, and the presence of PM 2.5 in Khon Kaen Province is being addressed. This collaborative effort involves several stakeholders, including local government organizations. The network of public health volunteers (VHVs) took part in preparing standards for prevention practices, taking care of citizens of air pollution problems caused by PM 2.5 appropriately.

4) The Governor of Khon Kaen Province has established objectives, aspirations, and tactics for the province in addressing the issue of fine particulate matter (PM 2.5) emissions originating from various sources. In the year 2026, it is anticipated that Khon Kaen would no longer engage in open burning activities, among other changes.

5) The Khon Kaen Provincial Transport Office is an administrative body responsible for overseeing transportation-related matters within the province of Khon Kaen. Also, The Khon Kaen Provincial Industrial Office is an administrative body responsible for overseeing industrial activities within the province of Khon Kaen. The Khon Kaen Provincial Chamber of Commerce, The Khon Kaen Urban Development Company, together with the private sector, serve as exemplary entities in the implementation of strategies aimed at mitigating and regulating the utilization of diesel-powered cars, with a predetermined duration and distinct objectives for each department,

3. Proactive surveillance issues

1) It is important for educational institutions that are interconnected or have a shared affiliation to incorporate the topic of PM 2.5 inside the educational curriculum at all levels. It is imperative to establish a connection and integration between educational offices in the region and local agencies. This collaboration is essential in formulating a comprehensive public communication plan aimed at raising awareness and preparedness for addressing the challenges posed by PM 2.5. The plan should encompass strategies for promoting effective management practices, prevention measures, and monitoring techniques.

2) The Regional Environmental Office 10, located in Khon Kaen, is responsible for overseeing environmental matters in the province. It collaborates closely with the Khon Kaen Provincial Public Health Office to ensure the well-being of the local community. To facilitate surveillance during crises or instances where the PM 2.5 levels in a region exceed the limit, it is essential to gather baseline data pertaining to health and the environment. This baseline data will serve as fundamental information, providing a foundation for monitoring and analysis.

3) The entities mentioned the collaborative building of a public communication plan and delivering correct understanding about the PM2.5. In the region including Khon Kaen province, efforts have been undertaken to establish effective communication channels with community agencies. These endeavors primarily focus on disseminating information pertaining to the quantity of dust present, as well as imparting expertise on monitoring techniques, and ensure the well-being of the general population's health. There are public relations, communication, and campaign to inform the public. Moreover, the program centers focus attention on the adolescent demographic within educational institutions and utilize community news towers as a means of communication.

4) The entities of focus in this discussion are Provincial Administrative Organizations, Municipalities, and Sub district Administrative Organizations. The provision of dust measurement instruments adheres to established standards. The installation of various facilities has been implemented in sub district health promotion hospitals, schools, temples, and enterprises located in regions identified as high-risk zones, at both the district and sub-district levels.

5) The committee responsible for overseeing the Wildfire Incident Command Center in Khon Kaen Province is now addressing concerns related to open burning, smog pollution, and the presence of PM 2.5. The Khon Kaen province Public Health Committee, along with the province and district emergency operations centers and the Committee of the Command Center, collaborated in 2020 to develop integrated work plans aimed at addressing the issue of PM 2.5 in Khon Kaen Province.

6) The operational committee responsible for driving public policy towards achieving sustained clean air in Khon Kaen is appointed by the Governor of the province, comprising governmental entities, scholars, the public sector, and the mass media. This collective undertakes operational responsibilities, promoting awareness. The objective is to prevent and resolve the issue of PM 2.5 in Khon Kaen Province throughout the year 2020.

4. Format support issues of innovation in managing PM 2.5

1) Local government organizations play a crucial role in facilitating the formulation and implementation of public policies at the local level, including the establishment of local ordinances. The implementation of a health constitution aimed at regulating and overseeing the issue of PM 2.5 at the grassroots level within local communities.

2) The concept of a sub district Health Promoting Hospital refers to a healthcare facility that operates at the sub district level and is dedicated to promoting health and well-being within its community, advocating for and endorsing the development and use of innovative strategies and knowledge to mitigate the adverse effects of PM 2.5. This may involve implementing measures such as afforestation to establish green areas and employing the special technique to minimize the combustion of leaf litter. Also, the campaign aims to promote the integration of bicycles and walking as viable modes of transportation in individuals' everyday routines.

3) The province of Khon Kaen actively fosters and advocates for the advancement of innovation. In order to mitigate and address the issue of PM 2.5 at several administrative levels, including province, district, sub-district, and community levels, the business sector, including the Federation of Thai Industries, actively participates in the development of agricultural technologies aimed at mitigating and resolving the adverse impacts of PM 2.5.

4) The Environmental Office of Khon Kaen Province in Region 10, Khon Kaen, collaborates with many government entities. The private sector, which is closely associated, is of relevance, advocates and provides assistance to prototype regions. In order to effectively address and mitigate the issue of PM 2.5, it is imperative to focus on specific areas.

5) The sugar factory has implemented a comprehensive raw material management system specifically designed for the cultivation and processing of sugarcane in all pertinent aspects and made known to the general audience.

6) The entities under consideration in this discourse include the Sugar Factory, the Sugar Cane Traders Association, and individuals associated with these entities. A management and development structure exists that prohibits the practice of burning sugarcane for transportation to sugar plants.

Section 2: Participatory Public Policy Process (4P) for Managing the PM 2.5 Dust Problem

This research examines the framework of the 4P (Figure 2) as it pertains to the management of the PM 2.5, specifically focusing on a case study conducted in Khon Kaen Province. The data were collected through the in-depth interviews and focus group discussion with key informants. The purpose of this section is to describe the 4P for controlling the PM 2.5 in Khon Kaen province. The major focus of the research is to provide an overview of the phenomena and its implications.

1. Network participation in public policy processes to manage the PM 2.5 consists of 5 steps as follows:

1) Policy formation: formation from sub-areas

2) Policy setting: joint decision-making

3) Policy implementation: division of labor support each other

4) Evaluation: Summary of lessons learned and expansion.

5) Policy review and change: learning and adapting

Table 1 The public and private organizations playing a role in the issue

Organizations	Specific roles
The Provincial Agricultural Offices	Governing local affairs within a specific geographic area
Khon Kaen University collaborates with the private sector, including Agricultural Bank and Agricultural Cooperatives	Offering financial products with conditions to reduce loan interest rates
Public health volunteers (VHVs)	Establishing standards for preventing air pollution problems caused by PM 2.5
The Provincial Chamber of Commerce and Khon Kaen Urban Development Company	Implementing strategies to regulate diesel-powered cars
The Regional Environmental Office 10	oversees environmental matters in the province
Khon Kaen Provincial Public Health Office	Working to ensure the local community's well-being
Provincial Administrative Organizations, Municipalities, and Sub-district Administrative Organizations	Adhering to dust measurement standards and implement facilities in high-risk zones
The Public Health Committee, emergency operations centers, and the Command Center	Collaborating on integrated work plans to address PM 2.5 in Khon Kaen Province
Local government organizations	Formulating and implementing local public policies
Health Promoting Hospitals	Focusing on community health and well-being
The sugar factory	Managing sugarcane cultivation comprehensively, with a structure preventing burning for transportation
The Sugar Cane Traders Association and affiliated individuals	Following a management structure that prohibits burning sugarcane for transport to sugar plants

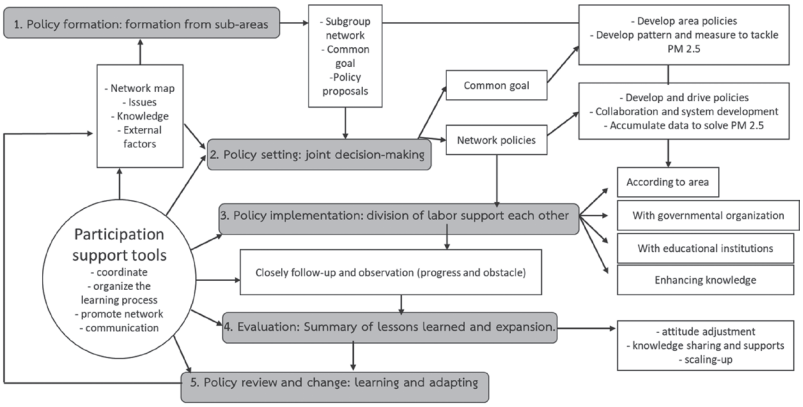

Figure 2 Model of the participatory public policy process for managing the PM 2.5 dust problem in Khon Kaen Province

1. Policy formation: Formation from sub-areas

This subgroup comprises the notions. One relevant concept is Concept 1, which involves the utilization of networks, knowledge, and external influences. The cost associated with resolving the issue is a significant factor to consider. An input component in the policy making process from the sub-area is being discussed. The salient aspect that is evident pertains to the existence of a knowledge management method. The present study aims to elucidate the key insights derived from the model area's experiences in addressing and effectively managing the issue of PM 2.5 in Khon Kaen Province. With the assistance provided by Khon Kaen University, a monitoring system has been designed to track the extent of pollution and gather data on the health and disease-related impacts. In essence, the notion under consideration is a significant factor or circumstance in the development of policies, arising from several sub-domains, specifically pertaining to the utilization of a network. The expenses associated with problem-solving encompass both knowledge and external factors.

The products that occur include (1) knowledge management documents, case studies on managing the PM 2.5; (2) information on monitoring the level of PM 2.5 and information on health effects; (3) prototype area for dealing with and managing the PM 2.5 in Khon Kaen Province; (4) guidelines for developing an information system to monitor pollution levels and health impact information; and (5) proposals for guidelines and models for dealing with and managing the PM 2.5 to stakeholders and agencies directly involved in order to lead to action plans at the policy level, including the emergence of guidelines for dealing with and managing the PM 2.5 obtained from the case study.

2. Policy formulation: Joint decision-making

This entails the arrangement of sub-assemblies within regional divisions. The area is populated by individuals that serve as representatives of the local community, as well as government entities that are pertinent to the region. This helps convene in order to collectively identify prevalent challenges encountered in the progress and enhancement of the region. The event takes place in each district, and considers suggestions from all sub-stages.

3. Policy implementation: division of labor support each other

This method entails the execution of a prescribed set of guidelines or principles. The concept entails the organization of the operational mechanism, comprising the primary mechanism and auxiliary mechanisms that facilitate operations in many domains. Additionally, a coordination mechanism is established to effectively manage the communication process and facilitate the exchange of information. Every location serves as the primary focal point, including considering the operational potential of that mechanism as well.

The public sector network serves as a catalyst for addressing and overseeing the issue of PM 2.5, with the key entities within this network being the Provincial Health Assembly Network. The focus of this paper is to analyze the potential development of the Khon Kaen network over the course of the next ten years, collaboratively devising a comprehensive approach aimed at bolstering research efforts to address the persistent issue of PM 2.5, with a particular emphasis on source control measures, including the resolution of challenges associated with fuel combustion. The utilization of renewable energy sources, as well as the adoption of clean energy technology, together with the facilitation of knowledge transfer from research, are crucial aspects in the pursuit of sustainable energy solutions.

Subsequently, cooperative activities are subsequently pursued, accompanied by regular exchange of information, including network meetings aimed at monitoring operations and facilitating coordination.

4. Policy evaluation: summary of lessons learned and expansion

This aims to provide an evaluation of adaptability and collaborative learning in educational settings. The focus will be on assessing the effectiveness and benefits of these approaches in enhancing student learning outcomes. The evaluation will include several factors such as student engagement, knowledge acquisition, and critical thinking skills. Additionally, the notion may be divided into two sub-components: the assessment of operational success based on the network's shared objectives, and the variety of approaches used to evaluate the performance of individual organizations.

5. Policy continuation, termination, and replacement: learning and adapting

The process of reviewing and modifying policies is intricately linked to the task of summarizing lessons acquired to assess the effectiveness of a network. The Health Assembly Network will undertake concurrent implementation of several measures to address the issue of PM 2.5 management. After summarizing the operational lessons learned, the policy will be continuously reviewed. Part of the summary of operational lessons learned is to review the relevant situation both inside and outside affecting operations positively. It is an additional part that makes operations successful, and has a negative effect, which is an obstacle in work. This will lead to the process of reviewing the policy to be consistent with the changing situation.

To disseminate network policy modifications to the local area network, it is imperative to effectively communicate the changes to all relevant stakeholders. The policy and operational strategy will be modified to align with the evolving policies of the sub-mechanisms. However, it is important to note that alterations in the policies of the overarching network can also impact the sub-area networks. Hence, the implementation of multi-level networks becomes imperative; spatial networks and problem networks, along with other networks, are therefore, present in Khon Kaen Province. To incorporate it inside the consultation process, there may be necessary modifications to the operational norms in the respective domains to provide consistency.

Discussion

The participatory public policy process aimed at regulating PM 2.5 in Khon Kaen Province has five distinct steps: (1) Policy formation by creating policies by integrating many sub-areas; (2) Policy formulation by engaging in collaborative decision-making to develop policies; (3) Policy implementation by dividing tasks and providing mutual assistance to effectively put policies into action; (4) Policy evaluation with the comprehensive assessment of outcomes, including the synthesis of lessons learned and the potential for further expansion of achieved results; and (5) Policy continuation, termination, and replacement for acquisition of knowledge and flexibility.

The formulation process of policymaking involves collaborative decision-making, utilizing the network as the foundational framework. By integrating sub-area networks, the integration of both community and sub-district levels is consolidated into a provincial network. All stakeholders possess an equitable standing, hence attributing significance to the leaders within the collective or entity, utilizing the full capacity of leaders from diverse groups to the maximum degree. Collaborative governance is a novel conceptual framework for comprehending the presence of several stakeholders in the realm of public affairs. The examination of certain attributes within actor connections is of paramount significance, therefore necessitating the undertaking of a joint investigation (Saleh et al., 2021). Participation in policy implementation is an essential component of the public policy process. The results of this study support the proposition of Cuthill and Fien (2015), which suggests that collaboration between community groups and between different levels of government provides opportunities for sharing resources and information. Supporting these learnings and relationships will help citizens survive in a rapidly changing world.

In order to enhance productivity and foster collaboration in implementation, it is imperative to distribute tasks, facilitate the sharing of knowledge, and provide mutual assistance within a group or organization. The network allocates tasks by incorporating them into the primary operations of each respective business. The facilitation of efficient information exchange among partners is a crucial catalyst for fostering joint endeavors and enhancing overall performance (Prajogo & Olhager, 2012). Furthermore, network collaboration places significant emphasis on the use of adaptable working approaches. In order to provide mutual assistance in their respective endeavors, it is significant to modify one's own approach to work in order to provide assistance to others. In order to facilitate collaborative problem-solving inside the workplace, individuals might engage in mutual assistance to address a range of issues that may arise. Julian and Ross (2013) present a conceptual framework that places significant emphasis on the pivotal role of planning and policy creation. The Julian and Ross approach places significant importance on the management of the problem-solving process, facilitating the collaborative achievement of goals.

The assessment and analysis of policy modifications are to assess the performance of organizations, including government agencies who conduct annual assessments to appraise the execution of their plans and initiatives. There is a strong focus on quantitative data. One research by Johnson and Johnson (1991) has shown that groups exhibit several advantages over individuals in various cognitive tasks. Firstly, groups tend to create a greater number of ideas compared to individuals. Additionally, groups are more adept at identifying and rectifying errors, possess a superior collective memory, and employ a more extensive range of material when formulating conclusions.

Conclusion

The evidence from Khon Kaen case study confirmed that the endorsement of the bottom-up approach in public policy facilitates the inclusion of diverse sectors in the collaborative decision-making process, hence fostering chances for involvement. The process of policy creation begins with the inception of an issue, which then leads to the development of policies and programs by government agencies and local administrative bodies. The primary drivers of public policy, with a focus on social enforcement, are the organizations and networks within the public sector, which aim to serve the interests of the general public, with the active involvement of government agencies.

One potential avenue for enhancing participative public policy processes is the cultivation of local social capital, which serves as a foundational element for fostering robust involvement, assisting in the selection of tools that are suitable for the specific context of the given region. The public communication is aimed to generate awareness and encourage active engagement, particularly among the younger generation. This entails fostering the growth of a new cohort of individuals who are well-informed and actively involved in societal matters. It is essential to be vigilant and recognize the significance of engaging in the public policy process, as it plays a crucial role in shaping our societal framework.

Conflict of Interest

The author declares that there is no conflict of interest.

References

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design.* Harvard University Press.

Bullard, R. D. (1990). *Dumping in dixie: race, class, and environmental quality*. Westview Press.

Cohen, A. J., Brauer, M., Burnett, R., Anderson, H. R., Frostad, J., Estep, K., & Dandona, R. (2017). Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: An analysis of data from the Global Burden of Diseases Study 2015. *The Lancet*, *389*(10082), 1907–1918. https://doi.org/10.1016/S0140-6736(17)30505-6

Cuthill, M., & Fien, J. (2015). Capacity building: Facilitating citizen participation in local governance. *Australian Journal of Public Administration*, *64*(4), 63–80. http://dx.doi.org/10.1111/j.1467-8500.2005.00465a.x

Harvey, M. (2009). Drama, talk and emotion: Omitted aspects of public participation. *Science, Technology & Human Values*, *34*, 39–161.

Howlett, M. (2020). Challenges in applying design thinking to public policy: Dealing with the varieties of policy formulation and their vicissitudes. *Policy & Politics*, *48*(1), 49–65.

Israel, B. A., Schulz, A. J., Coombe, C. M., Parker, E. A., Reyes, A. G., Rowe, Z., & Lichtenstein, R. L. (2019). Community-based participatory research. *Urban health*, 272–282. http://dx.doi.org/10.1093/oso/9780190915858.003.0029

Johnson, D. W., & Johnson, F. P. (1991). *Joining together: Group theory and group skills.* Prentice-Hall, Inc.

Julian, D. A. & Ross, M. (2013). Strengthening infrastructure and implementing functions to support collaborative community problem solving. *Journal of Planning Literature*, *28*(2), 124–134.

Khan, A. R. (2016). Policy implementation: Some aspects and issues. *Journal of Community Positive Practices*, *3*, 3–12.

Kim, Y., & Darnall, N. (2016). Business as a collaborative partner: Understanding firms' sociopolitical support for policy formation. *Public Administration Review*, *76*(2), 326–337.

Pollution Control Department. (2019). *Action plan to drive the national agenda. "Solving the problem of dust pollution".* Pollution Control Department Ministry of Natural Resources and Environment, Bangkok: photocopy document.

Prajogo, D., & Olhager, J. (2012). Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics*, *135*(1), 514–522. https://doi.org/10.1016/j.ijpe.2011.09.001

Rossi, P. H., & Freeman, H. E. (2018). *Evaluation: A systematic approach* (8th ed). Stage Publications, Inc.

Sabatier, P. A. (1999). *The need for better theories. sabatier, P. A. theories of the policy process* (pp. 3–18). Westview Press.

Sakunkoo, P., Sarakarn, P., Soroschinda, K., Deesurakul, O., Tangfaikunnatam, A., & Keerativorasakul, C. (2020). Academic discussion "PM 2.5 dealing and management approach prevention guidelines and PM 2.5 in the current situation". *KKU Journal for Public Health Research*, *13*(3).

Saleh, C., Hendrik, E., Zauhar, S., & Nuh, M. (2021). Collaborative governance in public administration perspective. *Journal of Southwest Jiaotong University*, *56*(6), 655–665. https://doi.org/10.35741/issn.0258-2724.56.6.58

Thailand Clean Air Network. (2019) *Clean air white paper*. Clean Air Network.

United Nations [UN]. (2018). *Political declaration of the third high-level meeting of the general assembly on the prevention and control of non-communicable diseases*. https://digitallibrary.un.org/record/1648984?ln=en

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

World Health Organization [WHO]. (2018). *Ambient (outdoor) air pollution*. https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health