Information analysis and evaluation model (IAEM) of Thai economy sustainability based on SEP and SDGs

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ABSTRACT

The economic system of Thailand is predicated on cooperation between parties that are affected by economic decisions, partnerships between public and private entities, and robust relationships in the local community to foster sustainable development. Economic development in Thailand is managed by the community and government with support from the business sector. The economic system of Thailand aims to balance three conceptual pillars that can be described as ‘social, economic, and environmental’ dimensions. However, there is a lack of tools for data analysis and the evaluation of community well-being and economic functioning that can be applied to all relevant situations independent of external factors. In this paper, these authors produced an information analysis and evaluation model of the local economy (IAEM) that is based on the application of the Sufficiency Economy Philosophy (SEP) and Sustainable Development Goals (SDGs). Data were collected using a questionnaire that was evaluated by experts regarding the project’s capacity to meet economic, social, and environmental development goals according to the SEP for SDGs, which demonstrated a reliability of 0.88. For our statistical analysis, Multiple Linear Regression Analysis, Decision Matrix Analysis, K-Means, Percentage, and Average were performed for the analysis of data. The results showed that the SEP has a significant relationship to the SDGs at 89.60% (R² = 0.896, p < 0.001). IAEM provides a framework for analysis and evaluation of the local economy in six clusters that consist of water resources (WAT), human capacities and capabilities (HUM), economic stability (ECO), healthy communities (HEA), climate change (CLI), and the agricultural sector (AGR). Our results indicate that the IAEM can be used for the analysis and evaluation of the sustainability of a local economy based on the three pillars. The IAEM can be applied to policies and projects in sustainable development at each level of the local economy based on the SEP in a partnership with SDGs; this observation suggests that more implementation of development projects in accordance with the SEP will lead to increased development towards SDGs based on the three dimensions outlined.

1. Introduction

The economy of Thailand is a community-oriented economy that is predicated on cooperation between parties that are affected by economic decisions, partnerships between public and private entities, and the engendering of relationships in the local community with business interests. This economic model transfers development and management decisions to the role of the community and government which takes a primary role, with support from the business sector. An economic system such as this allows for a strong and sustainable national growth, which is a goal in Thailand. Beyond being an abstract concept, an economy is a part of the society, culture, and way of life of the people in the community that an economy affects. A primary purpose of an economic system is to allow people with a less fortunate financial means to be able to live sustainably and independently. Thereby, the economic policy of Thailand focuses on the principle of self-sufficiency, employment for productive purposes, a reduction of expenditure in government costs, and an emphasis on production systems that administer in an internal market rather than relying on imports from an external market. It is the belief of these authors that local economic development will allow for nations to survive a crisis that spurs the need for economic development in the first place; i.e. this is the case for all dimensions we study (economy, society, culture, and environment) in Thailand. The growth of the local economy is predicated on factors of social capital dependency that support an

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efficient allocation of resources. Policy-makers are benefited by developing a self-sufficient economy, by establishing group and network matrices, by fostering relationships between people involved in production and consumption, which can be done without a conflict of interest and while still maintaining traditional society and culture; furthermore, using the SEP and a concept of sustainable development as guidelines will facilitate this goal (Berry, 2001; Glaser, 2003; Rossi, 2012; Emas, 2015; CDDI, 2016; Pear, 2017; Sithisuntikul et al., 2019).

In 1950, His Majesty King Bhumibol Adulyadej, Rama IX laid out the concept of the sufficiency economic philosophy (SEP) that he wished for his people to adhere to as a way of life, and as a middle path that links three dimensions through integrated development as society, economy, and the environment (Wibulswadi et al., 2010; Rossi, 2012; Suthasinobol, 2013; Jitsuchon, 2018). The use of the SEP covers two conditions (i.e. knowledge, morality) and is predicated on three related characteristics (i.e. modesty, reasonableness, and immunity) (Phanlertphani, 2018; Inprom, 2018; Chomsoda et al., 2017; Bhanthumnavin, 2017; Samukkhethum, 2018). King Rama IX carried out Royal Development Projects (RDPs) which are grouped into eight categories that consist of the following items: development of water sources, agriculture, environment, occupational promotion, public health, transportation and communications, public welfare, and other projects that cover economic, social, and environmental dimensions and are consistent with the Sustainable Development Goals (SDGs). RDPs aim to help all people obtain “well-being and happiness,” and its results can be used in the form of learning centers for people from within and outside of Thailand to put into practice themselves (Hak et al., 2016; Lu et al., 2017; Hashemi and Ghaffary, 2017; ORDPB, 2019; ORDPB, 2020a,b; Nations, 2020).

Policies of the government of Thailand are intended to strengthen administrative organizations from the local to the national level by assisting with the furthering of sustainable development. The government has applied a development strategy that can be summarized as “understand, reach out and develop,” that is based on the SEP (Jitsuchon, 2018; Chan-o-cha, 2019). However, there are problems in the development and strengthening of a community-oriented economy based on the bio-diversity of each area including economic, societal, human, communal, cultural, and environmental diversity, and regarding diversities related to natural resources and changes in internal and external pressures over time. There exist standardized indicators that are used to cover various levels of evaluation in an area: individual/member, community/village, sub-district, and province, which measure metrics related to quality and quantity. However, there is a lack of tools for data analysis and evaluation of a community-oriented economy that can be applied to all situations regardless of changes in external factors.

Based on the above-mentioned importance of measurement of local economic performance, these authors developed an information analysis and evaluation model for the local economy [IAEM] based on the application of SEP to be used in the analysis and evaluation of a community-oriented economy in order to assess the problems of the community in each area for the purposes of planning, developing, and strengthening the community based on the SEP and SDGs. The analytical data from this model can be used as a guideline for determining the direction of national development in each dimension such as to privilege development towards SDGs. This research was conducted according to the methodology we describe in the next section.

2. Literature review and research hypotheses

2.1. The local economy concept with the SEP as it relates to sustainable development

The local economy of an area is coupled with the main economy of the nation, which is similar to how the concepts of economic culture and community culture are differentiated. A local or community-oriented economic system focuses on distributing economic betterment such that communities can be ‘immunized’ and self-developed (Sithisuntikul et al., 2019). The concept of a community-oriented economy (Gibbs et al., 1998) which is consistent with the SEP (Jitsuchon, 2018), is focused on managing capital within a community creatively without an expectation of profit; this promotes immunity in a system by enhancing the well-being of members of the community (Wibulswadi et al., 2010; Elliott, 2013; Samukkhethum, 2018). Importantly, the concept of the community-oriented economy and the SEP is aimed at economic development and at improving the livelihoods of people in rural communities that is based on two principles—(1) knowledge, that is: having thorough understanding of various academic disciplines and related areas in order to plan for action (Phanlertphani, 2018); and (2) morality, that is: having awareness of ethics, honesty, patience, perseverance, and wisdom in living life; basic morality ensures that the individual does not encroach oneself upon others, and instead promotes human co-existence with the environment, and sacrifices individual benefits for common goals (Inprom, 2018)—and three related characteristics—(1) modesty, which is: a sensibility towards desiring what is neither too small or too large, and not hurting oneself or others (Chomsoda et al., 2017); or, the knowledge and understanding of oneself enough that one can think, listen, ask, write, and communicate properly (Inprom, 2018); (2) reasonableness, which is: the ability to make rational decisions by taking into account the expected outcomes of these decisions, and to be able to think critically in order to understand the causes and effects of things that lead to sufficiency (Bhanthumnavin, 2017); and (3) immunity in the social body, which is: preparation for the various effects and changes that occur by taking into account the possibility of situations that are expected to occur in the future (Samukkhethum, 2018). This can be developed based on the concept of sustainable development which has an aim towards a balance in the three pillars of environment, society, and economy (Meister and Jap, 1998; Lozano, 2008; Purvis et al., 2019; Emas, 2015) as shown in Figure 1. However, in promoting sustainable development in the local economy that is based on the SEP, there are important checklists to keep in mind, including: participation, thinking collectively, realizing common ownership, a robust community-management system, the creation of a network of cooperation, and the ethics of the people in the community.

2.2. The importance of the local economy

Components of the local economy that describe its importance to sustainable development are as follows:—(1) the collaboration of people in the community that encourages community and stakeholder cooperation, and allows everyone to work together for the benefit of negotiating with internal and external factors efficiently; (2) a fund to effectively manage the financial reserve of people within that community; (3) a system of community cost-management, which includes social, human,
resource, cultural, wisdom, identity, and history-based domains; (4) information management systems, which are used to share information inside and outside the community for planning, analysis, and evaluation of items within that community; (5) a standardized community production system, which enhances the value-add of products within that community to a proper standard and which can be linked to external economies; (6) facilitation of cooperation between parties, which establishes collaborative networks in and among groups in communities, sub-districts, districts, or provinces to exchange information and facilitate mutual aid; (7) the normativity of rules, such that rules of the community support its way-of-life and are respected; (8) morality and ethics, which are relevant to business activities’ operation and subsistence, and which makes development decisions predictable, fair, and cost-effective; (9) common ownership in the community, which includes joint ventures and development activities, and the formulation of a sense of co-ownership; and (10) mutually-beneficial private-public venture to develop social, economic, and environmental dimensions of the community (Rypkema, 2008; CODI, 2016) as shown in Figure 2.

2.3. Guidelines to enhance the local economy

Guidelines that are used to enhance the goals of sustainable development of the local economy are as follows: (1) determine the sub-district of target areas by setting standards, strategies, tools, measurements, principles of development, and establishing a management system; (2) enable human resources to further and direct leadership activities at the community, sub-district, district, and province levels with cooperation and joint planning by the government and with support by the business sector; (3) establish mechanisms to drive development at the national, provincial, sub-district, and community levels with the goal of securing economic development in the community; (4) develop the economic approach in order to establish a knowledge-information system to use in the management of appropriate resources in each community; and (5) generate network community management to document sustainable development of the local economy, capital management systems, relationships between people, and economies in the short and long term (CODI, 2016) as shown in Figure 3.

Figure 2. Important components of the local economy.
Denoncourt, 2020); SDG 10, the reduction of inequality such as to obtain impartiality in economic decision-making (MacNaughton, 2017); SDG 11, the provision of sustainable cities and communities, which aims at having safe and sustainable residences (Zoomers et al., 2017). The environmental dimension consists of five goals: SDG 6, the sustainable management of clean water and sanitation (Han et al., 2016); SDG 12, responsible consumption and production patterns (Bengtsson et al., 2018); SDG 13, action to combat climate change and its effects (Campbell et al., 2018); SDG 14, the preservation of underwater life and the utilization of ocean, sea, and marine resources sustainably and responsibly (Mugagga and Nabaasa, 2016); SDG 15, the protection and restoration of land ecosystems and the encouragement of their sustainable use (Andrew, 2017). SDG 16 contains the peace dimension: justice builds strong institutions that promote a harmonious society and achieves fair outcomes (Hope Sr, 2020). Finally, the partnership dimension is reflected in SDG 17: partnerships are used to achieve goals for creating a global collaboration predicated on sustainable development (Kumar et al., 2016). The categories of SDGs are as shown in Figure 6.

2.6. SEP for SDGs partnership

The aims of SEP and SDGs are to develop and balance the social, economic, and environmental dimensions of national growth by relying on the rules of law or moral conditions under the SEP (e.g., Dharma, rule of law, living in coexistence with Nature without encroachment) and by building partnerships that exist in both SEP and SDGs (e.g., New Theory Agriculture that leads to self-sufficiency in the family, exchanging knowledge within and between communities, provinces, or countries). The SEP can be used to guide and promote the achievement of key SDGs;
for example, less wasteful consumption and production, controlling the use of fossil fuels, sustainable management of marine and terrestrial ecosystems, dealing with climate change, promoting equality and justice, developing clean energy sources, and reducing pollution. Nonetheless, any action must be self-sufficient and have no negative effects on the society and the environment. All action plans should be considered in every aspect, and the causes, results, and effects of each option of action should be considered as well. Resources should be used effectively in order to achieve the desired goals without unnecessarily wasting any. Furthermore, available resources should be used in a modest and reasonable way. Lastly, immunity should be built. In other words, there should be a systematic assessment of the risks that may arise, and the decision-maker should be prepared to accommodate any changes that may occur (i.e. assessing the security of health, food, water, and energy).

The SEP is therefore as a guideline fundamental to the success of the 17 Sustainable Development Goals (Ministry of Foreign Affairs, 2016; CMU, 2020).

King Rama IX conducted the RDPs under the SEP from 1952 to June 2019. Thailand International Cooperation Agency (TICA) has advocated for the SEP to be integrated into Thailand’s development corporation since 2003. The committee of TICA has studied, analyzed, and determined the relationship characteristics of the RDPs under the SEP that is implemented in accordance to a factor of the SDGs (i.e. the SEP for SDGs Partnership) in all 17 goals, which can be then divided into eight characteristics (Memavit, 2017; Chaiyasan, 2017; TICA, 2018) that consist of: (1) the agricultural sector, which is predicated on holistic farm management in relation to SDG 1, 2, 12, 13, and 15; (2) healthy communities, which focuses on the promotion of the well-being of people, environment, society, and culture in relation to SDG 1, 3, 4, and 11; (3) human capacities and capabilities, which focuses on the promotion good business operations and good governance in relation to SDG 4, 5, 8, 9, and 12; (4) water resources, which focuses on quality improvement and the rehabilitation of water and related ecosystems in relation to SDG 6, 7, 11, 12, and 13; (5) climate change, which focuses on the promotion of green technology and the preservation of ecosystems in relation to SDG 11, 13, 14, and 15; (6) Economic stability, which focuses on the management of risk and uncertainty in relation to SDG 8, 9, 10, and 12; (7) strong government institutions, which focuses on facilitating leadership, and inspiring loyalty to the king as the head and heart of state in relation to SDG 3, 16, and 17; (8) partnerships towards sustainable development, which serves as a guide for international cooperation in relation to SDG 17 as shown in Figure 7.

3. Research methodology

3.1. The sample

The sample used in this research consists of: (1) responses from five experts with relevant knowledge and understanding or at least five years of work experience related to the SEP and SDGs that are selected by purposive sampling as show in Table 1, and (2) number of development projects based on the application of the SEP from two categories: (2.1) 1,667 royal initiative projects that were compared to the Taró Yamame table at a 95% confidence level had a deviation (e) of 0.02 which was selected by stratified sampling according to regions and provinces as show in Tables 2 and 3, and (2.2) Ten partnership projects for development which were based on the application of the SEP under the framework of South-South cooperation and the Triangular cooperation with ten countries which are Lao PDR, Tonga, Fiji, Cambodia, Timor-Leste, Sri Lanka, Mozambique, Chile, and Mongolia, that were selected by purposive sampling as shown in Table 4.

The study has been approved by Mahidol University Central Instructional Review Board (MU-CIRB), Certificate of Approval COA No. MU-CIRB 2019/180.3010, date of approval 30 October 2019. Informed consent was obtained from all individual participants included in the study.

3.2. Research tools

The research tools utilized in this study are based on expert opinion questionnaires about consistency and the weighted consistency score of the royal initiative projects according to the SEP with SDGs had an accuracy value of 0.88.

3.3. The data collection

The data analysis was done using Multiple Linear Regression Analysis, Decision Matrix analysis, K-Means, percentage, and average.

3.3.1. Multiple Linear Regression Analysis

\[ y_i = \beta_0 + \beta_1 x_{i1} + \epsilon_i, \ i = 1, \ldots, n. \]

\[ y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \epsilon_i, \ i = 1, \ldots, n. \]  

\[ \hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_i, \ i = 1, \ldots, n. \]  

3.3.2. Decision matrix analysis

| Criterion 1 | Alternative 1 | Alternative 2 | ... | Alternative M |
|-------------|---------------|---------------|-----|---------------|
| x_{11}      | x_{12}        | ...           | ... | x_{1M}        |
| x_{21}      | x_{22}        | ...           | ... | x_{2M}        |
| ...         | ...           | ...           | ... | ...           |
| x_{N1}      | x_{N2}        | ...           | ... | x_{NM}        |

\[ \text{Rank} = \begin{cases} 
0 & \text{No} \\
1 & \text{Yes} 
\end{cases} \]

3.3.3. K-means

\[ S_i = \left\{ x_p : x_p - m_i^m^2 \leq x_p - m_i^j^2, \forall j, 1 \leq j \leq k \right\} \]

3.3.4. Percentage

\[ \text{pct} = \frac{X}{n} \times 100 \]

3.3.5. Average

\[ \bar{x} = \frac{1}{n} \left( \sum_{i=1}^{n} x_i \right) \]

4. Results

4.1. Multiple Linear Regression Analysis

The description of the relationship between the SEP with the 17 Goals of SDGs was generated using a Stepwise Method of Multiple Linear Regression Analysis. The SEP was divided into five independent variables consisting of Modesty (MOD), Reasonableness (RON), Immunity (IMU),
Knowledge (KOD), and Morality (MOR). The dependent variable of the SDGs included SDG1 - SDG17.

The hypothesis was tested at the significance level of 0.05, as follows:

\[ H_0 : \beta_i = 0 \]

\[ H_1 : \beta_i \neq 0 \]

When

\( H_0 \) is the independent variable; \( i \) does not affect the dependent variable.

\( H_1 \) is the independent variable; \( i \) affects the dependent variable.

The conceptual framework for Regression analysis is shown in Figure 8.

The results of the data analysis indicate that the SEP independent variables (MOD, RON, IMU, KOD, and MOR) are significantly related to the 17 goals-dependent variable of the SDGs. The acceptance of \( H_1 \) was significant at the level of 0.05 (p value <0.001).

The overall results indicated an average of five SEP independent variables (MOD, RON, IMU, KOD, and MOR) of Multiple Linear Regression Analysis being related to the 17 goals-dependent variable of SDGs at a significance level of 0.05 (p value <0.001) with the adjusted R square (R2) of 0.896 that accounts for 89.60% of instances when the independent variables that influenced the dependent variable are observed in descending order as KOD (Beta = -1.181), IMU (Beta = -0.924), RON (Beta = -0.877), MOD (Beta = -0.400), and MOR (Beta = -0.087), which is described in Table 5.

The results of the independent variable effect on the dependent variable were as follows:

SDG 1 with the adjusted R square (R2) of 0.878 accounted for 87.80%, and the independent variable that influenced the dependent variable the most was KOD (Beta = -1.457, p value <0.001) as shown in Table 6.

SDG 2 with the adjusted R square (R2) of 0.926 accounted for 92.60%, and the independent variable that influenced the dependent variable the most was KOD (Beta = -1.580, p value <0.001) as shown in Table 7.

SDG 3 with the adjusted R square (R2) of 1.000 accounted for 100.00%, and the independent variable that influenced the dependent variable the most was IMU (Beta = -1.270, p value <0.001) as shown in Table 8.

SDG 4 with the adjusted R square (R2) of 0.995 accounted for 99.50%, and the independent variable that influenced the dependent variable the most was IMU (Beta = -0.901, p value <0.001) as shown in Table 9.

SDG 5 with the adjusted R square (R2) of 0.966 accounted for 96.60%, and the independent variable that influenced the dependent variable the most was MOD (Beta = -1.353, p value <0.001) as shown in Table 10.

SDG 6 with the adjusted R square (R2) of 0.959 accounted for 95.90%, and the independent variable that influenced the dependent variable the most was KOD (Beta = -2.259, p value <0.001) as shown in Table 11.

SDG 7 with the adjusted R square (R2) of 0.921 accounted for 92.10%, and the independent variable that influenced the dependent variable the most was MOD (Beta = -1.565, p value <0.001) as shown in Table 12.

SDG 8 with the adjusted R square (R2) of 0.921 accounted for 92.10%, and the independent variable that influenced the dependent variable the most is MOD (Beta = -1.565, p value <0.001) as shown in Table 13.

SDG 9 with the adjusted R square (R2) of 0.337 accounted for 33.70%, and the independent variable that influenced the dependent variable the most was IMU (Beta = 1.038, p value <0.001) as shown in Table 14.

SDG 10 with the adjusted R square (R2) of 0.943 accounted for 94.60%, and the independent variable that influenced the dependent variable the most was MOD (Beta = -2.245, p value <0.001) as shown in Table 15.

SDG 11 with the adjusted R square (R2) of 0.964 accounted for 96.40%, and the independent variable that influenced the dependent variable the most was KOD (Beta = -2.720, p value <0.001) as shown in Table 16.

SDG 12 with the adjusted R square (R2) of 0.993 accounted for 99.30%, and the independent variable that influenced the dependent variable the most was IMU (Beta = 1.695, p value <0.001) as shown in Table 17.

SDG 13 with the adjusted R square (R2) of 0.970 accounted for 97.00%, and the independent variable that influenced the dependent variable the most was IMU (Beta = 1.895, p value <0.001) as shown in Table 18.
### Table 3. Sample of the Royal Development Project divided by province.

| Provinces | The Royal Development Projects | 1. Development of Water Sources | 2. Agriculture | 3. Environment | 4. Occupational Promotion | 5. Public Health | 6. Transportation/Communications | 7. Public Welfare | 8. Other Projects | Summary |
|-----------|-------------------------------|---------------------------------|----------------|----------------|--------------------------|----------------|-----------------------------|----------------|-----------------|---------|
|          | Population | Sample | Population | Sample | Population | Sample | Population | Sample | Population | Sample | Population | Sample | Population | Sample | Population | Sample | Population | Sample | Population | Sample | Population | Sample |
| Kamphaeng Phet | 30 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | 1 | 36 | 12 |
| Chiang Rai | 132 | 46 | 6 | 2 | 8 | 3 | 4 | 1 | 1 | 0 | 0 | 4 | 1 | 42 | 15 | 9 | 3 | 206 | 71 |
| Chiang Mai | 451 | 156 | 9 | 3 | 22 | 8 | 33 | 11 | 1 | 0 | 13 | 5 | 59 | 20 | 38 | 13 | 626 | 216 |
| Tak | 54 | 19 | 0 | 0 | 7 | 2 | 2 | 1 | 2 | 1 | 1 | 0 | 27 | 9 | 7 | 2 | 100 | 34 |
| Nan | 109 | 38 | 4 | 1 | 5 | 2 | 13 | 5 | 8 | 3 | 1 | 0 | 19 | 7 | 12 | 4 | 171 | 59 |
| Nakhon Sawan | 8 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 2 | 1 | 14 | 5 |
| Phayao | 52 | 18 | 3 | 1 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 5 | 2 | 65 | 22 |
| Phrae | 49 | 17 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 53 | 18 |
| Phetchabun | 27 | 9 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 1 | 1 | 0 | 37 | 12 |
| Phichit | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 |
| Phitsanulok | 25 | 9 | 5 | 2 | 2 | 1 | 3 | 1 | 0 | 1 | 0 | 7 | 2 | 4 | 1 | 47 | 16 |
| Mae Hong Son | 102 | 35 | 3 | 1 | 9 | 3 | 24 | 8 | 0 | 0 | 2 | 1 | 24 | 8 | 9 | 3 | 173 | 59 |
| Lampang | 119 | 41 | 0 | 0 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 125 | 44 |
| Lampang | 66 | 23 | 5 | 2 | 2 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 2 | 80 | 29 |
| Sukhothai | 29 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 30 | 10 |
| Uttaradit | 27 | 9 | 0 | 0 | 4 | 1 | 9 | 3 | 2 | 1 | 0 | 0 | 10 | 3 | 10 | 3 | 62 | 20 |
| Uthai Thani | 7 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 10 | 3 |
| Bangkok | 13 | 5 | 1 | 0 | 2 | 1 | 0 | 0 | 10 | 3 | 12 | 4 | 15 | 6 | 1 | 0 | 54 | 19 |
| Kanchanaburi | 41 | 14 | 1 | 0 | 2 | 1 | 2 | 1 | 1 | 0 | 0 | 14 | 5 | 3 | 1 | 64 | 22 |
| Chanthaburi | 22 | 8 | 1 | 0 | 3 | 1 | 1 | 0 | 2 | 1 | 0 | 7 | 3 | 3 | 1 | 39 | 14 |
| Chaochengsoa | 23 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 1 | 1 | 0 | 29 | 10 |
| Chonburi | 21 | 8 | 1 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 3 |
| Chai Nat | 1 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 1 |
| Trat | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 9 | 3 |
| Nakhon Nayok | 22 | 8 | 5 | 2 | 3 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 5 | 2 | 38 | 14 |
| Nakhon Pathom | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 7 | 2 | 2 | 1 | 11 | 3 |
| Nonthaburi | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Pathum Thani | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 1 |
| Prachuap Khiri Khan | 61 | 22 | 1 | 0 | 8 | 3 | 6 | 2 | 0 | 0 | 3 | 1 | 10 | 3 | 2 | 1 | 91 | 32 |
| Prachinburi | 13 | 6 | 2 | 1 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 1 | 24 | 9 |
| Phra Nakhon Si Ayutthaya | 11 | 5 | 3 | 1 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 3 | 1 | 3 | 1 | 24 | 9 |
| Phetchaburi | 77 | 28 | 6 | 2 | 9 | 3 | 5 | 2 | 0 | 0 | 0 | 0 | 2 | 1 | 3 | 1 | 102 | 37 |
| Ratchaburi | 40 | 15 | 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 4 | 1 | 52 | 19 |
| Rayong | 10 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 4 |
| Lopburi | 26 | 9 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 30 | 10 |
| Samut Prakan | 6 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 2 | 1 | 2 | 1 | 0 | 0 | 13 | 5 |
| Samut Songkram | 3 | 1 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 2 | 1 | 8 | 3 |
| Samut Sakhon | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2 |
| Saraburi | 15 | 6 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 20 | 8 |
| Sa Kaeo | 82 | 28 | 2 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 10 | 3 | 6 | 2 | 104 | 35 |

(continued on next page)
| Provinces | 1. Development of Water Sources | 2. Agriculture | 3. Environment | 4. Occupational Promotion | 5. Public Health | 6. Transportation/Communications | 7. Public Welfare | 8. Other Projects | Summary |
|-----------|-------------------------------|----------------|---------------|--------------------------|----------------|-------------------------------|----------------|----------------|---------|
| Sing Buri | 2 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 3 | 1 | | | | | | | |
| Suphan Buri | 11 4 0 0 1 0 0 0 0 0 0 0 0 0 0 0 12 | 4 | | | | | | | |
| Ang Thong | 3 1 1 0 0 0 3 1 0 0 0 0 0 0 0 1 8 | 2 | | | | | | | |
| Kalasin | 32 11 0 0 1 0 5 2 0 0 0 0 0 0 0 2 40 | 14 | | | | | | | |
| Khon Kaen | 58 20 6 2 2 1 8 3 0 0 0 0 0 0 0 0 74 | 26 | | | | | | | |
| Chaiyaphum | 30 10 1 0 2 1 1 0 0 0 0 0 0 0 0 2 36 | 12 | | | | | | | |
| Nakhon Phanom | 79 27 2 1 0 0 18 7 7 2 1 0 1 0 8 3 116 | 40 | | | | | | | |
| Nakhon Ratarchives | 41 14 3 1 3 1 2 1 0 0 1 0 0 0 1 0 51 | 17 | | | | | | | |
| Bueng Kan | 18 6 1 0 0 0 2 1 0 0 0 0 4 1 0 0 25 | 8 | | | | | | | |
| Buriram | 75 26 8 3 1 0 11 4 0 0 0 0 10 3 7 2 112 | 38 | | | | | | | |
| Maha Sarakham | 13 5 0 0 0 0 5 2 0 0 0 0 0 0 0 0 18 | 7 | | | | | | | |
| Mukdahan | 53 18 1 0 5 2 8 3 0 0 0 0 1 0 1 0 69 | 23 | | | | | | | |
| Yasothon | 11 4 1 0 0 0 3 2 0 0 0 0 1 0 1 0 17 | 6 | | | | | | | |
| Roj Et | 17 6 0 0 2 1 4 1 0 0 0 0 0 0 0 0 23 | 8 | | | | | | | |
| Loei | 20 7 0 0 1 0 9 3 0 0 1 0 7 2 1 0 39 | 12 | | | | | | | |
| Sisaket | 37 13 0 0 2 1 8 3 0 0 0 0 2 1 5 2 54 | 20 | | | | | | | |
| Sakon Nakhon | 241 85 0 0 12 4 27 9 0 0 9 3 3 1 9 3 301 | 105 | | | | | | | |
| Surin | 34 12 1 0 4 1 3 1 0 0 1 0 6 2 6 2 55 | 18 | | | | | | | |
| Nong Khai | 6 2 0 0 2 1 0 0 0 0 0 0 1 0 2 1 11 | 4 | | | | | | | |
| Nong Bua Lamphu | 23 8 0 0 0 0 1 0 0 0 0 0 0 0 0 0 24 | 8 | | | | | | | |
| Amnat Charoen | 8 3 0 0 0 0 2 1 0 0 0 0 1 0 0 0 11 | 4 | | | | | | | |
| Udorn Thani | 44 15 4 1 3 1 5 2 0 0 0 0 8 3 1 0 65 | 22 | | | | | | | |
| Ubon Ratchathani | 37 14 0 0 0 0 9 3 0 0 3 1 12 4 4 1 65 | 23 | | | | | | | |
| Krabi | 7 2 0 0 3 1 1 0 0 0 0 0 0 0 0 5 2 16 | 5 | | | | | | | |
| Chumphon | 44 16 0 0 2 1 0 0 0 0 1 0 7 2 3 1 57 | 20 | | | | | | | |
| Trang | 23 9 1 0 0 0 1 0 0 0 0 1 0 6 2 0 0 32 | 11 | | | | | | | |
| Nakhon Si Thammarat | 55 20 0 0 5 2 1 0 0 0 0 4 1 4 1 69 | 24 | | | | | | | |
| Narathiwat | 284 99 15 5 10 3 48 18 2 1 7 2 13 5 10 3 389 | 136 | | | | | | | |
| Pattani | 52 18 2 1 1 0 26 10 1 0 4 1 4 1 6 2 96 | 33 | | | | | | | |
| Phang Nga | 10 3 3 1 6 2 0 0 0 1 0 0 0 0 0 0 20 | 6 | | | | | | | |
| Phatthalung | 29 11 1 0 0 0 4 1 0 0 0 0 1 0 2 1 37 | 13 | | | | | | | |
| Phuket | 1 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 | | | | | | | | |
| Yala | 65 24 2 1 2 1 5 2 1 0 4 1 6 2 1 0 86 | 31 | | | | | | | |
| Ranong | 10 3 2 1 0 0 0 0 0 0 3 1 0 1 0 0 0 16 | 5 | | | | | | | |
| Songkhla | 42 16 2 1 3 1 4 1 0 0 1 0 12 5 3 1 67 | 25 | | | | | | | |
| Satun | 12 4 0 0 2 1 1 0 0 0 0 0 5 2 0 0 20 | 7 | | | | | | | |
| Surat Thani | 20 8 0 0 1 0 3 1 0 0 3 1 4 1 1 0 32 | 11 | | | | | | | |
| No specified area | 1 0 0 0 1 0 1 0 11 4 0 0 0 4 1 10 | 4 28 | 9 | | | | | | |
| Summary | 3,336 1,172 139 46 188 67 346 122 58 19 84 23 402 134 257 84 4,810 | 1,667 | | | | | | | |
SDG 14 with the adjusted R square ($R^2$) of 0.836 accounted for 83.60%, and the independent variable that influenced the dependent variable the most was KOD ($\beta = -1.580$, p value < 0.001) as shown in Table 19.

SDG 15 with the adjusted R square ($R^2$) of 0.926 accounted for 92.60%, and the independent variable that influenced the dependent variable the most was KOD ($\beta = -1.439$, p value < 0.001) as shown in Table 20.

SDG 16 with the adjusted R square ($R^2$) of 0.978 accounted for 97.80%, and the independent variable that influenced the dependent variable the most was MOD ($\beta = -1.499$, p value < 0.001) as shown in Table 21.

SDG 17 with the adjusted R square ($R^2$) of 0.723 accounted for 72.30%, and the independent variable that influenced the dependent variable the most was RON ($\beta = 2.304$, p value < 0.001) as shown in Table 22.

### 4.2. Decision matrix analysis

Royal Development Projects (RDPs) are defined as development projects that are based on the application of the SEP for SDGs Partnership (ORDP, 2020a, b; Memanvit, 2017; Chaiyasan, 2017). This variable type was referred to as Class. The data were analyzed using decision matrix analysis and the opinions of experts is shown in Table 23.

### 4.3. The created model from a sample

The data were defined for the created model from a sample used in this research that was taken from development projects based on the application of the SEP with a total of 1,677 projects as shown in Table 24.

### 4.4. Clustering by K-Means

The default random number of six groups (k = 6) was determined, then the data were analyzed by k-Means using Weka software. The results are shown in Table 25.

The results of the cluster model after analysis by k-Means displayed six clusters that are ordered by percentage as follows: cluster 0 was WAT (70%, $\chi = 4.51$), cluster 5 was HUM (10%, $\chi = 4.35$), cluster 1 was ECO (7%, $\chi = 4.56$), cluster 3 was HEA (5%, $\chi = 4.58$), cluster 2 was CLI (4%, $\chi = 4.44$), and cluster 4 was AGR (3%, $\chi = 4.62$). These were used to develop the IAEM that is explained in detail in the next section.

### 4.5. Information analysis and evaluation model (IAEM)

The results of the cluster after an analysis model by k-Means are displayed on Table 25. These results were used to develop the IAEM for analysis and evaluation of the economy of Thailand, which was calculated from the equation.

$$IAEM = \frac{SPWAT + SPHUM + SPECO + SPHEA + SPCLI + SPAGR}{6}$$  \hspace{1cm} (6)

The RDPs’ relationship with the SEP for SDGs Partnership was significantly-positive in six classes out of eight classes which consisted of the development of water sources WAT (water resources), agriculture AGR (agricultural sector), environment CLI (climate change), occupational promotion ECO (economic stability), public health HEA (healthy communities), transportation/communications HEA (healthy communities), public welfare HUM (human capacities and capabilities), and other projects HEA (healthy communities).

### Table 4. SEP projects in partner countries.

| SEP Projects in Partner Countries | Countries | Year |
|----------------------------------|-----------|------|
| Sustainable Community Development Model | 1. Sri Lanka | 2016 |
| | 2. Cambodia | 2006 |
| | 3. Timor-Leste | 2010 |
| | 4. Chile | 2014 |
| Sustainable Agricultural Development | 5. Lao PDR | 2016 |
| | 6. Tonga | 2016 |
| | 7. Fiji | 2016 |
| | 8. Lesotho | 2006 |
| | 9. Mozambique | 2016 |
| | 10. Mongolia | 2016 |

### Table 5. Overall results in the SEP with the 17 goals of SDGs.

| Dependent Variable (SDGs) | Independent Variable (SEP) | b | S.E | Beta | p value | R | $R^2$ | F |
|--------------------------|-----------------------------|---|-----|------|---------|---|-------|---|
| SDG 1 – SDG 17           | MOD                         | .234 | .023 | .400 | < 0.001 | .942 | .896 | 70767.829* |
|                          | RON                         | .869 | .022 | .877 | < 0.001 |       |       |   |
|                          | IMU                         | .985 | .041 | .924 | < 0.001 |       |       |   |
|                          | KOD                         | -1.284 | .026 | -1.181 | < 0.001 |       |       |   |
|                          | MOR                         | .015 | .018 | .087 | < 0.001 |       |       |   |

*The significance level at 0.05.
Table 6. Results of the relationship between the SEP and the SDG 1.

| Dependent Variable (SDGs) | Independent Variable (SEP) | b    | S.E  | Beta  | p value | R    | R²    | F       |
|---------------------------|-----------------------------|------|------|-------|---------|------|-------|---------|
| SDG 1 MOD                 | .729                        | .028 | 1.210| <.001 | .937    | .878 | 2405.396* |
| RON                       | .273                        | .024 | .308 | <.001 |         |      |       |         |
| IMU                       | -.102                       | .029 | -.109| <.001 |         |      |       |         |
| KOD                       | -.142                       | .029 | -.145| <.001 |         |      |       |         |
| MOR                       | .848                        | .020 | 1.127| <.001 |         |      |       |         |

*The significance level at 0.05.

Table 7. Results of the relationship between the SEP and the SDG 2.

| Dependent Variable (SDGs) | Independent Variable (SEP) | b    | S.E  | Beta  | p value | R    | R²    | F       |
|---------------------------|-----------------------------|------|------|-------|---------|------|-------|---------|
| SDG 2 MOD                 | .095                        | .045 | .077 | <.001 | .962    | .926 | 4171.624* |
| RON                       | 1.756                       | .039 | .960 | <.001 |         |      |       |         |
| IMU                       | 3.003                       | .046 | 1.560| <.001 |         |      |       |         |
| KOD                       | -3.182                      | .047 | -1.580| <.001 |         |      |       |         |
| MOR                       | -.338                       | .032 | -.218| <.001 |         |      |       |         |

*The significance level at 0.05.

Table 8. Results of the relationship between the SEP and the SDG 3.

| Dependent Variable (SDGs) | Independent Variable (SEP) | b    | S.E  | Beta  | p value | R    | R²    | F       |
|---------------------------|-----------------------------|------|------|-------|---------|------|-------|---------|
| SDG 3 MOD                 | 1.190                       | .003 | .942 | <.001 | 1.000   | 1.000| 1017524.304*  |
| RON                       | -.842                       | .003 | -.452| <.001 |         |      |       |         |
| IMU                       | -.491                       | .003 | -.270| <.001 |         |      |       |         |
| KOD                       | .338                        | .003 | .165 | <.001 |         |      |       |         |
| MOR                       | 1.772                       | .002 | 1.123| <.001 |         |      |       |         |

*The significance level at 0.05.

Table 9. Results of the relationship between the SEP and the SDG 4.

| Dependent Variable (SDGs) | Independent Variable (SEP) | b    | S.E  | Beta  | p value | R    | R²    | F       |
|---------------------------|-----------------------------|------|------|-------|---------|------|-------|---------|
| SDG 4 MOD                 | -.041                       | .011 | -.035| <.001 | .997    | .995 | 61393.420* |
| RON                       | .045                        | .010 | .026 | <.001 |         |      |       |         |
| IMU                       | -.163                       | .012 | -.901| <.001 |         |      |       |         |
| KOD                       | .550                        | .012 | .290 | <.001 |         |      |       |         |
| MOR                       | 1.058                       | .008 | .724 | <.001 |         |      |       |         |

*The significance level at 0.05.

Table 10. Results of the relationship between the SEP and the SDG 5.

| Dependent Variable (SDGs) | Independent Variable (SEP) | b    | S.E  | Beta  | p value | R    | R²    | F       |
|---------------------------|-----------------------------|------|------|-------|---------|------|-------|---------|
| SDG 5 MOD                 | -2.014                      | .037 | -1.353| <.001 | .983    | .966 | 9423.827* |
| RON                       | 1.168                       | .032 | .532 | <.001 |         |      |       |         |
| IMU                       | -.913                       | .038 | -.395| <.001 |         |      |       |         |
| KOD                       | 1.567                       | .038 | .648 | <.001 |         |      |       |         |
| MOR                       | .269                        | .026 | .145 | <.001 |         |      |       |         |

*The significance level at 0.05.
| Table 11. Results of the relationship between the SEP and the SDG 6. |
|----------------------------------|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|-----------------|
| Dependent Variable (SDGs)       | Independent Variable (SEP) | b    | S.E  | Beta | p value | R    | R²   | F               |
| SDG 6                            | MOD                   | -.162 | .023 | -.186 | <.001   | .979 | .959 | 7789.168*       |
|                                  | RON                   | 1.191 | .020 | -.931 | <.001   |      |      |                 |
|                                  | IMU                   | 3.044 | .024 | 2.262 | <.001   |      |      |                 |
|                                  | KOD                   | -3.180| .024 | -2.259| <.001   |      |      |                 |
|                                  | MOR                   | -.650 | .017 | -1.600| <.001   |      |      |                 |

*The significance level at 0.05.

| Table 12. Results of the relationship between the SEP and the SDG 7. |
|----------------------------------|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|-----------------|
| Dependent Variable (SDGs)       | Independent Variable (SEP) | b    | S.E  | Beta | p value | R    | R²   | F               |
| SDG 7                            | MOD                   | -1.828| .020 | -1.565| <.001   | .960 | .921 | 3915.582*       |
|                                  | RON                   | 1.076 | .017 | 1.380 | <.001   |      |      |                 |
|                                  | IMU                   | .361  | .020 | .440  | <.001   |      |      |                 |
|                                  | KOD                   | -.340 | .020 | -3.96 | <.001   |      |      |                 |
|                                  | MOR                   | -.035 | .014 | .053  | <.001   |      |      |                 |

*The significance level at 0.05.

| Table 13. Results of the relationship between the SEP and the SDG 8. |
|----------------------------------|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|-----------------|
| Dependent Variable (SDGs)       | Independent Variable (SEP) | b    | S.E  | Beta | p value | R    | R²   | F               |
| SDG 8                            | MOD                   | -1.828| .020 | -1.565| <.001   | .960 | .921 | 3915.582*       |
|                                  | RON                   | 1.076 | .017 | 1.380 | <.001   |      |      |                 |
|                                  | IMU                   | .361  | .020 | .440  | <.001   |      |      |                 |
|                                  | KOD                   | -.340 | .020 | -3.96 | <.001   |      |      |                 |
|                                  | MOR                   | -.035 | .014 | .053  | <.001   |      |      |                 |

*The significance level at 0.05.

| Table 14. Results of the relationship between the SEP and the SDG 9. |
|----------------------------------|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|-----------------|
| Dependent Variable (SDGs)       | Independent Variable (SEP) | b    | S.E  | Beta | p value | R    | R²   | F               |
| SDG 9                            | MOD                   | -1.490| .085 | -1.625| <.001   | .580 | .337 | 169.687*       |
|                                  | RON                   | .971  | .074 | .839  | <.001   |      |      |                 |
|                                  | IMU                   | 1.263 | .087 | 1.038 | <.001   |      |      |                 |
|                                  | KOD                   | -1.882| .088 | -1.692| <.001   |      |      |                 |
|                                  | MOR                   | -.302 | .060 | -.308 | <.001   |      |      |                 |

*The significance level at 0.05.

| Table 15. Results of the relationship between the SEP and the SDG 10. |
|----------------------------------|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|-----------------|
| Dependent Variable (SDGs)       | Independent Variable (SEP) | b    | S.E  | Beta | p value | R    | R²   | F               |
| SDG 10                           | MOD                   | .129  | .009 | 1.229 | <.001   | .971 | .943 | 5479.255*       |
|                                  | RON                   | .207  | .007 | 1.523 | <.001   |      |      |                 |
|                                  | IMU                   | .393  | .009 | .946  | <.001   |      |      |                 |
|                                  | KOD                   | -1.183| .009 | -2.720| <.001   |      |      |                 |
|                                  | MOR                   | .243  | .006 | .727  | <.001   |      |      |                 |

*The significance level at 0.05.
| Table 16. Results of the relationship between the SEP and the SDG 11. |
|---------------------------------------------------------------|
| **Dependent Variable** (SDGs) | **Independent Variable** (SEP) | b    | S.E  | Beta  | p value | R    | R²   | F    |
|--------------------------------|---------------------------------|------|------|-------|---------|------|------|------|
| SDG 11                       | MOD                             | -.052| .023 | -.058 | <.001   | .982 | .964 | 9073.155* |
|                              | RON                             | 1.222| .019 | .925  | <.001   |      |      |      |
|                              | IMU                             | 3.036| .023 | 2.184 | <.001   |      |      |      |
|                              | KOD                             | -3.265| .023 | -2.245| <.001   |      |      |      |
|                              | MOR                             | -.554| .016 | -.495 | <.001   |      |      |      |

*The significance level at 0.05.

| Table 17. Results of the relationship between the SEP and the SDG 12. |
|---------------------------------------------------------------|
| **Dependent Variable** (SDGs) | **Independent Variable** (SEP) | b    | S.E  | Beta  | p value | R    | R²   | F    |
|--------------------------------|---------------------------------|------|------|-------|---------|------|------|------|
| SDG 12                       | MOD                             | -.031| .007 | -.047 | <.001   | .996 | .993 | 45460.990* |
|                              | RON                             | .869 | .021 | .916  | <.001   |      |      |      |
|                              | IMU                             | 1.693| .008 | 1.695 | <.001   |      |      |      |
|                              | KOD                             | -1.634| .008 | -1.564| <.001   |      |      |      |
|                              | MOR                             | -.331| .005 | -.411 | <.001   |      |      |      |

*The significance level at 0.05.

| Table 18. Results of the relationship between the SEP and the SDG 13. |
|---------------------------------------------------------------|
| **Dependent Variable** (SDGs) | **Independent Variable** (SEP) | b    | S.E  | Beta  | p value | R    | R²   | F    |
|--------------------------------|---------------------------------|------|------|-------|---------|------|------|------|
| SDG 13                       | MOD                             | -.343| .024 | -.333 | <.001   | .985 | .970 | 10689.705* |
|                              | RON                             | 1.631| .021 | 1.073 | <.001   |      |      |      |
|                              | IMU                             | 3.032| .025 | 1.895 | <.001   |      |      |      |
|                              | KOD                             | -2.844| .025 | -1.699| <.001   |      |      |      |
|                              | MOR                             | -.722| .017 | -.560 | <.001   |      |      |      |

*The significance level at 0.05.

| Table 19. Results of the relationship between the SEP and the SDG 14. |
|---------------------------------------------------------------|
| **Dependent Variable** (SDGs) | **Independent Variable** (SEP) | b    | S.E  | Beta  | p value | R    | R²   | F    |
|--------------------------------|---------------------------------|------|------|-------|---------|------|------|------|
| SDG 14                       | MOD                             | -.714| .031 | -1.236| <.001   | .914 | .836 | 1705.476* |
|                              | RON                             | 1.469| .027 | 1.727 | <.001   |      |      |      |
|                              | IMU                             | 2.004| .032 | 2.237 | <.001   |      |      |      |
|                              | KOD                             | -2.110| .032 | -2.251| <.001   |      |      |      |
|                              | MOR                             | -.907| .022 | -1.258| <.001   |      |      |      |

*The significance level at 0.05.

| Table 20. Results of the relationship between the SEP and the SDG 15. |
|---------------------------------------------------------------|
| **Dependent Variable** (SDGs) | **Independent Variable** (SEP) | b    | S.E  | Beta  | p value | R    | R²   | F    |
|--------------------------------|---------------------------------|------|------|-------|---------|------|------|------|
| SDG 15                       | MOD                             | .095 | .045 | .077  | <.001   | .962 | .926 | 4171.624* |
|                              | RON                             | 1.756| .039 | .960  | <.001   |      |      |      |
|                              | IMU                             | 3.003| .046 | 1.560 | <.001   |      |      |      |
|                              | KOD                             | -3.182| .047 | -1.580| <.001   |      |      |      |
|                              | MOR                             | -.338| .032 | -.218 | <.001   |      |      |      |

*The significance level at 0.05.
### Table 21. Results of the relationship between the SEP and the SDG 16.

| Dependent Variable (SDGs) | Independent Variable (SEP) | b     | S.E  | Beta  | p value | R    | R²   | F      |
|---------------------------|-----------------------------|-------|------|-------|---------|------|------|--------|
| SDG 16                    | MOD                         | -0.631| 0.009| -1.439| <0.001  | 0.989| 0.978| 14893.025*|
|                           | RON                         | 0.378 | 0.007| 0.585 | <0.001  |      |      |        |
|                           | IMU                         | 0.274 | 0.009| 0.403 | <0.001  |      |      |        |
|                           | KOD                         | -0.211| 0.009| -0.296| <0.001  |      |      |        |
|                           | MOR                         | -0.023| 0.006| -0.041| <0.001  |      |      |        |

*The significance level at 0.05.

### Table 22. Results of the relationship between the SEP and the SDG 17.

| Dependent Variable (SDGs) | Independent Variable (SEP) | b     | S.E  | Beta  | p value | R    | R²   | F      |
|---------------------------|-----------------------------|-------|------|-------|---------|------|------|--------|
| SDG 17                    | MOD                         | -0.290| 0.011| -1.888| <0.001  | 0.850| 0.723| 871.278*|
|                           | RON                         | 0.522 | 0.009| 2.304 | <0.001  |      |      |        |
|                           | IMU                         | 0.411 | 0.011| 1.725 | <0.001  |      |      |        |
|                           | KOD                         | -0.508| 0.011| -2.037| <0.001  |      |      |        |
|                           | MOR                         | -0.212| 0.008| -1.106| <0.001  |      |      |        |

*The significance level at 0.05.

### Table 23. Relation to the RDPs type with the SEP for SDGs Partnership.

| Royal Development Projects Type | CLASS | AGR | HEA | HUM | WAT | CLI | ECO | STR | PAR |
|---------------------------------|-------|-----|-----|-----|-----|-----|-----|-----|-----|
| Development of Water Sources    | ✓     |     |     |     |     |     |     |     |     |
| Agriculture                     | ✓     |     |     |     |     |     |     |     |     |
| Environment                     |       | ✓   |     |     |     |     |     |     |     |
| Occupational Promotion          |       |     | ✓   |     |     |     |     |     |     |
| Public Health                   |       |     |     | ✓   |     |     |     |     |     |
| Transportation/Communications   |       |     |     |     | ✓   |     |     |     |     |
| Public Welfare                  |       |     |     |     |     | ✓   |     |     |     |
| Other Projects                  |       |     |     |     |     |     | ✓   |     |     |

Note: AGR is Agricultural sector, HEA is Healthy communities, HUM is Human capacities and capabilities, T is Water resources, CLI is Climate change, ECO is Economic stability, STR is Strong government institutions, PAR is Partnerships towards sustainable development.

### Table 24. Determining the class model by k-Means (before).

| No. | Class | Before Cluster model by K-Means (Projects) | Percent |
|-----|-------|--------------------------------------------|---------|
| 1   | WAT   | 1,173.00                                   | 70%     |
| 2   | AGR   | 49.00                                      | 3%      |
| 3   | CLI   | 66.00                                      | 4%      |
| 4   | ECO   | 124.00                                     | 7%      |
| 5   | HUM   | 136.00                                     | 8%      |
| 6   | HEA   | 129.00                                     | 8%      |
| Total|       | 1,677.00                                   | 100.00% |

### Table 25. Comparison before and after analysis cluster model by k-Means.

| No. | Class | Before Cluster model by K-Means (Projects) | Percent | After Cluster model by K-Means (Projects) | Percent | Average(%) | Cluster |
|-----|-------|--------------------------------------------|---------|------------------------------------------|---------|------------|---------|
| 1   | WAT   | 1,173.00                                   | 70%     | 1,173.00                                 | 70%     | 4.51       | 0       |
| 2   | AGR   | 49.00                                      | 3%      | 49.00                                    | 3%      | 4.62       | 4       |
| 3   | CLI   | 66.00                                      | 4%      | 66.00                                    | 4%      | 4.44       | 2       |
| 4   | ECO   | 124.00                                     | 7%      | 124.00                                   | 7%      | 4.56       | 1       |
| 5   | HUM   | 136.00                                     | 8%      | 175.00                                   | 10%     | 4.35       | 5       |
| 6   | HEA   | 129.00                                     | 8%      | 90.00                                    | 5%      | 4.58       | 3       |
| Total|       | 1,677.00                                   | 100.00% | 1,677.00                                 | 100.00% | 4.51       | 6       |
wherein \( \text{AvPWAT} \) is an average of each water resources project, \( \text{AvPHUM} \) is an average of each of the human capacities and capabilities projects, \( \text{AvPECO} \) is an average of each of the economic stability projects, \( \text{AvPHEA} \) is an average of each of the healthy community projects, \( \text{AvPCLI} \) is an average of each of the climate change projects, \( \text{AvPAGR} \) is an average of each of the agricultural sector projects, and \( n \) is a number of projects in each sector. The next section shows the criteria score in detail of the IAEM and the class WAT, AGR, CLI, ECO, HUM, and HEA.

### 4.6. Criteria score for information analysis and evaluation

The criteria scores for analysis and evaluation of the IAEM and the class WAT, AGR, CLI, ECO, HUM, and HEA are shown in Table 26. The full score to be used as criteria was calculated from the average score of 5.00 for each project.

#### Table 26. Criteria score for analysis and evaluation of the IAEM and for six classes.

| Description       | Criteria score |
|-------------------|----------------|
| Model             | 22.55          |
| Class             |                |
| WAT               | 22.55          |
| AGR               | 23.10          |
| CLI               | 22.20          |
| ECO               | 22.80          |
| HUM               | 21.75          |
| HEA               | 22.90          |

#### Table 27. Rating scales for analysis and evaluation of the IAEM and for six classes.

| Rating Scales | Criteria       |
|---------------|----------------|
| 4.50-5.00     | Very good      |
| 3.50-4.49     | Good           |
| 2.50-3.49     | Medium         |
| 1.50-2.49     | Few            |
| 1.00-1.49     | Least          |
| 0.00-0.99     | Improve        |

#### Table 28. Sample data for the test of IAEM consisting of communities A, B, C, D, and E.

| Community   | Projects | WAT (AvPWAT) | HUM (AvPHUM) | ECO (AvPECO) | HEA (AvPHEA) | CLI (AvPCLI) | AGR (AvPAGR) |
|-------------|----------|--------------|--------------|--------------|--------------|--------------|--------------|
| Community A |          | 2.50         | 2.19         | 3.51         | 3.00         | 2.80         | 3.50         |
|             |          | 2.25         | 3.21         | 2.98         | 2.50         | 2.95         | 3.60         |
| n of project (n) | 2        | 2            | 1            | 2            | 2            | 2            |
| Community B |          | 3.50         | 2.19         | 2.75         | 2.50         | 2.95         | 3.60         |
|             |          | 3.45         | 2.19         | 2.75         | 2.50         | 2.95         | 3.60         |
|             |          | 3.5          | 2.19         | 2.75         | 2.50         | 2.95         | 3.60         |
| n of project (n) | 3        | 1            | 2            | 3            | 2            |
| Community C |          | 2.50         | 2.19         | 3.51         | 3.00         | 2.78         | 3.50         |
|             |          | 2.50         | 2.19         | 3.51         | 3.00         | 2.78         | 3.50         |
|             |          | 2.50         | 2.19         | 3.51         | 3.00         | 2.78         | 3.50         |
| n of project (n) | 4        | 2            | 1            | 3            | 3            |
| Community D |          | 3.00         | 2.78         | 3.51         | 3.00         | 2.78         | 3.50         |
|             |          | 2.98         | 2.78         | 3.51         | 3.00         | 2.78         | 3.50         |
|             |          | 2.98         | 2.78         | 3.51         | 3.00         | 2.78         | 3.50         |
| n of project (n) | 5        | 3            | 2            | 3            | 2            | 0            | 1            |
| Community E |          | 3.21         | 2.78         | 3.51         | 3.05         | 2.87         | 2.98         |
| n of project (n) | 1        | 1            | 1            | 1            | 1            | 1            | 1            |
4.7. Rating scales for analysis and evaluation

The rating scales for evaluation of the IAEM and for each class are as shown in Table 27.

4.8. The experiment of the local situation regarding the IAEM

4.8.1. The sample of data for the test—i.e. the data simulation to test the IAEM—are shown in Table 28

4.7.2 Considering the results of the IAEM of each community, the community with the highest level of sustainability was community E which scored at 13.84, 61.39% at the medium level, followed by community C with a score at 13.48, 59.78% at the medium level, community A with a score of 12.97, 57.51% at the medium level, community B with score at 11.01, 48.81% in the low level, and communities D with score at 10.95, 48.54% in the low level, respectively. These data are as shown in Figures 9, 10, 11, 12, 13, 14, and 15.

5. Discussion

The SEP (MOD, RON, IMU, KOD, and MOR) is related to the SDGs (SDG 1 – SDG 17) which accounts for 89.60% ($R^2 = 0.896$) at the
significance level of 0.05 (p value <0.001). The independent variables that influence the dependent variable in descending order are: KOD (Beta = -1.181), IMU (Beta = 0.924), RON (Beta = 0.877), MOD (Beta = -0.400), and MOR (Beta = -0.087) as shown in Figures 16 and 17. This finding suggests that a local economy planning its sustainable development based on the SEP is benefited by disseminating academic knowledge to interested people in all aspects such as by using the “Kok Nong Na Model,” which is an original model for a new agricultural theory.

Figure 12. Results of the analysis and evaluation of community D.

Figure 13. Results of the analysis and evaluation of community E.

Figure 14. Analysis and evaluation comparing all communities.
according to the SEP. The focus of this model is to provide information on water management and land management that is integrated with local wisdom. For instance, the land has been segregated into the proportion of 30:30:30:10. Water accounts for 30 percent of the land in the form of ponds or water reservoirs. Another 30 percent of land is for farming or rice fields, while another 30 percent is for the planting of trees for utilization, consumption, and commercial purposes. The last ten percent is for accommodation and animal farming such as in chicken, fish, cow, and buffalo (Yimkaew and Kultawanich, 2019). This agricultural model demonstrates stability in agriculture, animal farming, drought solution, soil fertilization, and ensuring the cycle of life of plants and animals.

Such models can be used in planning and implementing various methods for the development and strengthening of the community economy in order to sustainably allow the application of knowledge to
help individuals build a career, create immunity in themselves and their families, obtain critical thinking skills, be self-sufficient, and live with virtue. This approach results in the country of Thailand being able to move towards the 17 goals of the SDGs that are confirmed by the results of the analysis of the relationship between SEP and SDGs [Table 5–22]. This finding is consistent with an analysis of RDPs—which are divided into eight categories consisting of the development of water sources, agriculture, environment, occupational promotion, public health, transportation and communications, public welfare—and other projects with a purpose to help all people to obtain “well-being and happiness.”

The work of these authors can be used as a guideline for developing projects of the local economy for sustainable development that are oriented towards SDGs, as well as to provide food security within the family, ensure food is adequate for consumption, build immunity in the community, and cope with the crisis that has arisen from COVID-19. Our methodology can be applied at all levels, all branches, and all sectors of the economy by focusing on modernization and immunization for the community.

SEP serves SDGs with the common purpose of the development and balance of social, economic, and environmental dimensions including the ultimate purpose of sustainable development which is the “Happiness” and “Wellness” of society (Bunnag and Kamolnorat, 2021). The principles of SEP as it relates to SDG are emphasized in this research as the following: (1) the importance of relevant knowledge and sound morality for implementation of policies considering the negative effects towards economy, society, and environment (principle of condition on knowledge (Beta = -1.181) and morality (Beta = -0.087)); (2) the consideration of possible options, reasons, outcomes, and effects of each option of action (principle of reason (Beta = 0.877)); (3) the efficient use of resources to fit the purpose of use and to prevent waste (principle of modesty (Beta = -0.400)); (4) preparation to cope with risk and changes (principle of immunization (Beta = 0.924)); and (5) the use of local wisdom and dimension of culture to link people with sustainable development.

However, the problem of development and strengthening the community-oriented economy includes the bio-diversity of each area such as diversity in economy, society, people, community, culture, environment, and natural resources. In addition, there is still a lack of tools for data analysis and evaluation of the community-oriented economy that can be applied to all situations regardless of changes in external conditions. Because of this importance, these authors have developed an information analysis and evaluation model of the local economy [IAEM] based on the application of SEP (as shown in Figure 18) that can be used in the analysis and evaluation of the community-oriented economy to allow for the assessment of problems in the community in each area for development, and for the strengthening of the community based on the SEP and SDGs. We used Decision Matrix Analysis to determine the relationship between the RDPs with development projects and the application of the SEP for SDGs Partnership. The RDP types are shown to be related with the SEP for SDGs Partnership in six classes out of eight classes. The cluster model analysis was done by k-Means. The results showed six clusters in descending order of percentage as follows: cluster 0 was WAT (70%, x = 4.51), cluster 5 was HUM (10%, x = 4.35), cluster 1 was ECO (7%, x = 4.56), cluster 3 was HEA (5%, x = 4.58), cluster 2 was CLI (4%, x = 4.44), and cluster 4 was AGR (3%, x = 4.62). These results can be used to develop the IAEM for analysis and evaluation of the Thai economy.

The IAEM model is shown in Eq. (6) and can be calculated for each cluster in the equation—Eq. (7) for WAT, Eq. (8) for HUM, Eq. (9) for ECO, Eq. (10) for HEA, Eq. (11) for CLI, and Eq. (12) for AGR—in which each community must prepare all six clusters of the projects, or at least one project on each side. The IAEM can be used in analysis and evaluation of the sustainability of a local economy by covering all three dimensions of development: society, economy, and environment. If one side is missing, the results of sustainable development will be out of balance and will not follow the right path. The simulation to test the IAEM is as shown in Figures 9, 10, 11, 12, 13, 14, and 15. The results suggest that an essential feature of community development, which is the monitoring and managing of water resources, should be better acknowledged. A project can enhance knowledge and improve capabilities of communities to define their own capacities and strengths in the context of their community (Press et al., 2010; Bunclark et al., 2011; Simmons et al., 2011). This is a community-oriented economic development approach based on the part of the individual to build a career and earn enough to encourage sustainable living (Markusen, 2004; Garne-lo-Gomez et al., 2019); this approach includes education on how to prepare for integrated farming that does not impact the ecosystem and climate change, while promoting well-being and health for the population based on the SEP (Labonte and Laverack, 2001; McCreanor and Watson, 2004; Elasha et al., 2005; Janmaimool and Denpaiboon, 2016).

However, sustainable, community-oriented economic development that is predicated on the SEP requires that everyone in the community is participating, thinking collectively, realizing common ownership, developing a community management system, creating a network of cooperation, and practicing sound ethics.

6. Conclusions

The IEAM is an analysis and evaluation of the local economy that is based on the application of the SEP with SDGs Partnerships. The model
analysis and evaluation are divided into six clusters: water resources (WAT), human capacities and capabilities (HUM), economic stability (ECO), healthy communities (HEA), climate change (CLI), and the agricultural sector (AGR). The results can be used in policies and projects related to sustainable development at each level of the Thai economy based on the SEP with SDGs Partnerships that cover three pillars: society, economy, and environment. The criteria and method for analysis and evaluation of the project, which is established in six clusters (WAT, HUM, ECO, HEA, CLI, and AGR), should be developed in order to be standardized and reliable before using the average score to represent the value in IEAM.

Declarations

Author contribution statement

S. Kiattisin and T. Wongkumchai: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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