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The influencing factors of area-based infrastructure project sustainability in Thailand

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Abstract
The major problems of area-based infrastructure projects (ABIP) are caused by unsuitable plans, poor management, economic instability and administrative complication. These drives low productivity, poor project performance, unsustainability and inefficiency pattern. The objective of study is to analyze factors influencing ABIP for achieving sustainability model. Both qualitative and quantitative analyses were used when needed to follow the right procedure. In-depth information gathered by a reliable pilot case investigation in which the semi-structured interview had been illustrated earlier. The data collection using questionnaire was sent out to representative samples across Thailand. The results were classified into 4 groups: (1) implementation plan and area participation, (2) administration and tool management, (3) budget and public provision, and (4) connection network and research development. The total cumulative variance can be explained in 57.218%. An administration and tool management has the largest effect of all. As a result, an overall ABIP sustainability model was developed. With this model, the proposed ABIP can be evaluated and ranked according to their expected sustainability outcomes. The decision-makers can successfully plan for the sustainable development of the infrastructure projects within certain specified boundaries and restrictions.

Keywords Infrastructure management · Infrastructure sustainability · Infrastructure development · Area-based infrastructure · Sustainable development · Sustainability

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1 Introduction

The perspectives of infrastructure are widely applied for accomplishing a goal of greater quality of live, achieving the economic development and contributing to sustainable development (Zeng et al., 2015; Wong et al., 2008; United Nation, 2007). The ultimate objective of infrastructure investment aims to achieve Sustainable Development Goals (United Nations, 2018). Infrastructure sustainability is a significant effect on area-based project implementation to achieve community sustainable development (Shen et al., 2011). In Thailand, the main objectives of infrastructure development focus on supporting the sustainability of local careers, enhancing living standard, achieving basic needs, balancing socio-economic development, decreasing risk of economic impacts, and protecting environment degradation (RIDF, 2020; RDPB, 2020).

The infrastructure development usually complicates and requires appropriate reaction from both public and private sectors for managing projects (Aksorn & Charoenngam, 2015 and 2016; Leungbootnak & Charoenngam, 2007). The effective infrastructure management is the significant key to support the successful process in action and critical point to accomplish actual objectives on ABIP (RIDF, 2020; Williams, 2016). The efficient management is the operation through stages of project that should be applied to the aspects of environmental, economic, social, and political issues (Hubbard & Hubbard, 2019; Xia et al., 2018; Aarseth et al., 2017; Kokkaew & Rudjanakanoknad, 2017; Guo et al., 2011; Shen et al., 2011; Zeng et al., 2015).

The critical problems of ABIP are exacerbated by unsuitable plans, inappropriate management, a community participation barrier, local economic instability and administrative complication (Ansar et al., 2016; Aksorn & Charoenngam, 2015; Flyvbjerg et al., 2009; Barthorpe, 2010; Leungbootnak & Charoenngam, 2007). Moreover, the ABIP management of many stakeholders, various characteristics and topographic conditions and constraints are difficult to efficiently manage and control (Krajangsri & Pongpeng, 2019). Also, the significant problems lead to low productivity, poor project performance, and lack of safety, sustainability, and efficiency (Barthorpe, 2010). From these problems, the objective of the study is to explore the influencing factors of ABIP and analyze the relationship between these factors to accomplish infrastructure sustainability. The critical success factors can be used as a checklist to prepare and implement ABIP sustainability in Thailand. Furthermore, it will also provide information on general concepts involved in the preparations of international infrastructure projects.

2 Literature review

2.1 Area-based infrastructure project

Area-based infrastructure refers to the basic physical systems for serving community or region such as transportation services, electricity, water and sanitation, and telecommunications sectors (African Development Bank, 2019). The execution is more successful when started as a cooperation action through the stages (Park & Kwon, 2011). In addition, the appropriate plans should meet both area-based constraints and policy-based implementation (RDPB, 2020). However, the regional administrations should not be obstructed by the administration of the locals as long as they are able to take action and successfully control certain matters (Sjöstrand et al., 2018). Also, both informal relations and enough

experience for sharing resources, commitments, and goals can be gained through the community collaboration and cooperation (Carlson & Cohen, 2018). The participation should develop a partnership among the community members, government agencies, and organizations (Krajangsri & Pongpeng, 2019). This is the basis for why ABIP involves socio-economic, environment and culture-sensitive designing.

From reviews, the ABIP in Thailand concerned water supply, water resource, port and waterway, village craft and industry, road, market building, sanitation, waste management, and occupation promotion (Leungbootnak & Charoenngam, 2007). The important area-based infrastructure categories relate to agricultural infrastructure, local commerce infrastructure support, and production chain (RDPB, 2020). Most of the agricultural infrastructure projects focus on water supply and water resource projects (MFLF, 2020; RID, 2020; RPF, 2020; Aksorn & Charoenngam, 2016). This supports and facilitates the local to increase agricultural production, contributing and promoting to enhance economic development (RIDF, 2020; RDPB, 2020). Based on evidence, regional governments need budget support from the central government to allocate sufficiency in area-based water resource development (RDPB, 2020). However, local governments usually having a limited budget cannot preserve and maintain newly established water resource prevailing in ABIP (Frow et al., 2010).

2.2 Comparative study with different countries

Infrastructure project development is an integral part of area-based, regional and national development. Infrastructure projects provide benefits to communities and nations at the social, economic and environmental levels (Shen et al., 2011; Zeng et al., 2015). Area-based infrastructure development also provides the foundation for social and industrial upgrades and transformation (Han et al., 2021). Moreover, the investigation of the relationship between economic and environmental sustainability (ES) for 42 Asian countries showed a growing trend of ecological deficit in Asia and advocated rapid policy development for environment-friendly economic development (Ahmed et al., 2022). The study in New Zealand and Australia found that the small and medium-sized projects sustainability can fulfil the ethical and economic aspects of social responsibility (Bevan & Yung, 2015; Lim & Loosemore, 2017). In recent years, culture is also identified as an essential pillar in achieving sustainable development (Froner, 2017; Lazar & Chithra, 2021; Soini & Birkeland, 2014). For example, New Zealand depicted the interdependent relationship between economy, society, environment, and culture for sustainable development (New Zealand Ministry for Culture & Heritage, 2006). In China, megaproject social responsibility (MSR) is a key to the successful delivery of megaprojects and sustainability (He et al., 2019; Ma et al., 2019). In India, they developed a new instrument to measure environmental sustainability innovations measures in the Indian context. These results can be useful for the government, managers, developers and innovators (Tiwari & Thakur, 2020). For a developed country like Italy, the study focused on environmental and economic sustainability in public. This context relied on waste management, carbon emissions and operating costs of infrastructure projects (Coller et al., 2021). Developing countries are facing many problems regarding area-based development due to a lack of performance capabilities, financial resource, infrastructure investment, and proper infrastructure management to achieve sustainability (Dahiya & Das, 2019; Li et al., 2017; Smoke, 2019). This study integrated all perspectives; economic, environment, society, social responsibility, socioeconomic, and culture that are more than previous researches.

2.3 Influencing factors of sustainability

Mancini and Marek (2004) presented the model to shape the sustainability pattern of community-based projects. The objective was to investigate the influential and sustainable factors of community-based projects in achieving sustainable development. The model was used to test the reliability and validity of a sustainability evaluation tool. This resulting model consisted of seven major elements defined as the capacity to supply "constant benefit" regardless of formally delivering particular undertaking. The second component deals with middle-range project results and middle points along the pathway leading to the end of sustainability and shows a list of viability for satisfying needs of clients, effectively planning for sustainability, and having confidence in project survival. Besides, other intermediate results are related to sustainability; for example, it is the matter of the precise degree required that the organization perceives projects as constant and that the number of years affects the project funding support. The more important key to sustainability is whether the benefits to communities and clients are preserved, rather than the program activities.

According to Aksorn and Charoenngam (2015 and 2016), the sustainability factors are found to be influential in regional infrastructure development. The factors including the holistic management for community water resource projects in the important realms of environment, culture concerns and socioeconomics were fully and properly investigated. Coping with the particular domain, the perspectives of natural resources and environment, policy and plan, knowledge and information, budget and finance, facility and infrastructure, and management and administration has taken active parts in the process respectively. The management and information dimensions were found to be the highly significant factors in local infrastructure of sustainable development. The benefits of management were to motivate mutual trust among the community and keep a good relation among stakeholders as well. Besides, the trust relationship could make possible and safeguard the aim of sustainability development (RIDF, 2020).

2.4 Research methodology

To accomplish the objective, the research design is to proceed steadily following a methodological process. First, management factors influencing ABIP sustainability, theoretical and practical, were collected through related literature review, semi-structured interview, and focused group discussion thoroughly. Second, the pilot project of area-based Royal Development Project (RDP) in Udon Thani Province, Thailand, was selected. This project is one of successful RDP, established by his Late Majesty King Bhumibol Adulyadej of Thailand to support area-based activities and agricultural careers of local people (RDPB, 2020). The project implementation focused on water resource infrastructure and water supply improvement to get enough water for agricultural activities. The ultimate goal of this project is to improve the well-being of the community to achieve sustainable development. The data were accumulated from the whole area of content and confirmed the practical use by project managers, developers, and practitioners. Third, the content validity, all of the gathered data were identified to be suitable, precise items for a pilot questionnaire through close teamwork between five cooperative experts in the related ABIP fields. Before trialing the questionnaire test, a sample of candidates was obviously adequate for the degree of precision required and as the representative of the target population as was perfectly feasible. Opinions regarding

content accuracy from test takers to be, lay advisers, and professionals were also elicited. Additionally, any necessary amendments for the questionnaire items were made in the light of this scrutiny.

Then, after the trial of the pilot questionnaire, analysis at the item and task level was carried out to ensure that they were working satisfactorily. After that, the questionnaire test was revised in the light of the quantitative and qualitative data generated concerning its efficiency and validity. The questionnaires with precise items as required together with a 5-point Likert Scale format ranging in importance from "1 = not important to 5 = very important" were ready to go further with the next category.

Due to the expertise in use, the five cooperative experts were well-qualified, able to meet the criteria required for accomplishing the tasks as follows: (1) working as project manager/developer, (2) having at least 15 years of experience, (3) willingly participating in carrying out research.

To sum up, the research process followed the right procedure. First, the selected raw information of ABIP from reliable sources namely Royal Development Project in Thailand was collected. Second, the gathered data were developed to become precise items of a representative sample through a close teamwork of project managers, developers, staff members, and five cooperative experts to validate the content. Third, the identifying required items with necessary amendments were scrutinized; some items had to be rejected, others reworked—to be maintained or improved. Fourth, the analysis of the item was carried out to ensure that items were working satisfactorily concerning its reliability, validity, and efficiency. Fifth, the improved questionnaires were distributed to target population around Thailand. Finally, data collection and analysis were performed.

The following is the list of influencing factors as presented in Table 1.

3 Data collection

From literature, there are three main organizations taking on responsibility for area-based water resource infrastructure projects implementation and community sustainable development in Thailand (MFLF, 2020; RID, 2020; RPF, 2020; RDPB, 2020; RIDF, 2020; Aksorn & Charoenngam, 2016). The data was collected from these organizations. (1) Royal Irrigation Department (RID), the duties and responsibilities are related to increase area-based water resources and to develop irrigated areas in accordance with natural balance and their potential. They have 17 offices in regional areas to manage water resources for sustainable development around Thailand (RID, 2020). (2) Royal Project Foundation (RPF), a non-profit organization located in north of Thailand, was established by King Bhumibol Adulyadej and regarded as an association institution for his humanitarian inventiveness and research. The main objective of the projects is to enhance the standard of living. The Royal Project Foundation has 38 development centers spread in the northern area of Thailand (RPF, 2020). (3) The Mae Fah Luang Foundation (MFLF), is an organization that manages numerous area-based projects. The Foundation's operation concentrated on improving economic and social development, supporting the environment, and preserving culture and local art. The Doi Tung Development Project (DTDP), one of the flagship projects of the Mae Fah Luang Foundation, is located in Chiang Rai. The project focused on developing self-sufficient communities that would become well equipped to adapt to the changing environment and independent of external support (MFLF, 2020).

Table 1 List of influencing factors

Influencing factors	Coding
Development of area-based infrastructure project (Aksorn & Charoenngam, 2016)	FA01/No
Response to the sources of problem or area-based requirement (Aksorn & Charoenngam, 2015; Brillo & Simondac-Peria, 2021)	FA02
Combination of top-down and bottom-up approach (Lin et al., 2010; Price et al., 2011)	FA03
SWOT analysis (Terrados et al., 2007)	FA04
Natural compatibility service, product, and process (Klevas et al., 2009)	FA05/No
Professional management or organization support (Hosny et al., 2021; Othman, 2009; Peterson et al., 2010)	FA06
Research and development for practical application (Joseph et al., 2008; Lee et al., 2009)	FA07
Development of networking and collaboration (Campo et al., 2009)	FA08
Community strength and weakness (Nasuchon & Chareles, 2010)	FA09
Community participation and involvement (Fleeger & Becker, 2008)	FA10
Government agency support (McFadden & Barnes, 2009)	FA11
Integration perspective of socio-economic, environment, and culture concern (Bevan & Yung, 2015; Doloi, 2012; Lazar & Chithra, 2021; Lim & Loosemore, 2017; Xia et al., 2018)	FA12/No
Environment conservation concern (Coller et al., 2021; Tiwari & Thakur, 2020; Kock & Gemunde, 2019)	FA13/No
Facility and infrastructure investment policy (Fedderke, 2006)	FA14
Public involvement (Yung & Chan, 2012)	FA15
Physical infrastructures support (Lee & Chan, 2009)	FA16
Public-community participation (Lei & Herder, 2011)	FA17
Financial source (Kamara, 2008)	FA18
Budget allocation (Wen, 2005)	FA19
Community financial institution development (George & Prabhu, 2003)	FA20
Budget provision and support (Eedlenbruch et al., 2009)	FA21/No
Ownership perception (Davis, 2019; Sperry & Jetter, 2019)	FA22
Continuity budget in operational matter (Frow, 2010)	FA23
Adequacy information service (Razali & Juanil, 2011)	FA24
Local knowledge application (Raymond and Fazey, 2010)	FA25/No
Information and knowledge center (Ferguson et al., 2010)	FA26/No
Study center for productivity improvement (Peskircioglu, 2008)	FA27/No
Local leader competence for cooperation (RDPB, 2020)	FA28/No
Trust in agency (Hong et al., 2012)	FA29
Project management tool support (PMI, 2021; Park & Kwon, 2011)	FA30
Maintenance the relationship among all stakeholders (Perez, 2009)	FA31
Community policing agencies (Lilley & Hinduja, 2006)	FA32
Training program for expertise development (Collins, 2008)	FA33
Understanding social environment and area conditions (Ghomashchi, 2012)	FA34
The agricultural production (RDPB, 2020; RIDF, 2020)	FA35
The income from agricultural production (RIDF, 2020)	FA36
The forest and water resource conservation (Koch-Ørva, 2019)	FA37/No
The development of organic farming (RDPB, 2020; RIDF, 2020)	FA38
Water resource fund foundation (George & Prabhu, 2003; RIDF, 2020)	FA39
The establishment of community enterprise and cooperative (Fleeger & Becker, 2008; RIDF, 2020)	FA40

Table 1 (continued)

Influencing factors	Coding
The network creation of public, private and academic institution (Barrutia, et al., 2007; RIDF, 2020)	FA41
The local development plan (Busscher et al., 2015)	FA42
The involvement of decision-making process (Varol et al., 2011)	FA43
The public financial provision and support (Vries & Peterson, 2009)	FA44
The sufficient support of physical infrastructure (Santos et al., 2010)	FA45
Active community committee (Lilley & Hinduja, 2006; RDPB, 2020)	FA46
The occupation training and help each other prog ram (Rehan et al., 2014)	FA47
Cooperation and collaboration between community and public agencies (Fleeger & Becker, 2008)	FA48
Information and knowledge available and guideline (Brent & Labuschagne, 2007)	FA49
Academic research on community-based and partnership creation (Bodorkos & Pataki, 2009)	FA50
Benefit in areas of professional development, community cohesion, and humanitarian concerns (Ayub et al., 2019)	FA51
The traditional knowledge application (Raymond et al., 2010)	FA52
The initiative from bottom (Lin et al., 2010; RDPB, 2020)	No
The support from private (RDPB, 2020; Alexander et al., 2019)	No
Land use pattern and land use change policy (Reidsma et al., 2011)	No
The effectiveness technology transfer (Martinsions et al., 1996)	No
The promotion of tourism (Connell et al., 2009)	No
The legal regulation support (Geng & Doberstein, 2008; RDPB, 2020)	No
The owner of land use (Boonyanam, 2020; RDPB, 2020)	No
The international organization support (Othman, 2009; RDPB, 2020)	No
The international specialist support (RDPB, 2020)	No
The information available of worldwide (Razali & Juanil, 2011; RDPB, 2020)	No
The international organization network (RDPB, 2020; RIDF, 2020)	No

FA = validated factor, No = not validated factor

3.1 Data analysis and result

The adjusted versions of the questionnaire were sent to 4,000 target respondents: project managers, developers, staff members, project representatives, and participants to respond to all requests. From 830 returned with complete responses (20.75%) were used for analysis. To obtain reliable results from this analysis, five major steps are followed (Comrey & Lee, 1992):

(1) identify the variables;
(2) compute a correlation matrix for the variables;
(3) extract the unrotated factors to see whether the chosen model fits the data;
(4) rotate the factors to make them more interpretable; and
(5) interpret and label the rotated factors.
(6) develop the regression model and relationship

The result showed that 4.94% of the respondents are managers, 9.28% specialists, 9.88% researchers, 57.71% technicians, and 18.19% participants, respectively. Most of them 72.53% are male, bachelor degree of education 56.63%, the average years of age is 40.42 years old, and the average years of working experience 14.84 years, respectively. All details are shown in Table 2 and Fig. 1.

Bartlett's test of sphericity and the Kaiser–Meyer–Olkin (KMO) test were used. The Kaiser–Meyer–Olkin evaluation of sampling adequacy was measured whether the partial correlations among variables are 0.968 larger than 0.70. Bartlett's test of sphericity was tested whether the correlation matrix is an identity matrix which indicates that the significant level of 0.000 less than 0.05 is acceptable (Pett et al., 2003).

Cronbach's alpha was calculated to measure the reliability of the questionnaire. The calculated coefficients above 0.70 demonstrate that the questionnaire is reliable (Nunnally & Berstein, 1994). Moreover, item analysis was calculated to eliminate items with total-item correlation less than 0.30. The analysis shows that only three items FA20, FA35 and FA36 were eliminated. According to Pett et al. (2003), the approach determining the numbers of initial factors selects only those factors for which the eigenvalues are greater than 1.00 as shown in Table 3. An eigenvalue indicates how much of the total variance of all variables is covered by the factors; these factors would account for more than their share of the total variance in the items. The results show four dimensions that form the construct. Also, the graphical figure is presented in scree plot as shown in Fig. 2.

Table 4 presents the factor loading and variance of management factors. For the variance, a total of four groups at about 57.218% is explained. The maximum group (21.132%) comes from "implementation plan and area participation", while the second group (16.309%) "administration and tool management". The third group (12.757%) is "budget and public provision", and the last one (7.020%) is "connection network and research development". The practical framework of area-based infrastructure projects on sustainability is shown in Fig. 3.

Table 2 Profile of the respondents (n = 830)

Respondents' profile	Number	Percentage
Position		
Manager	41	4.94
Specialist	77	9.28
Researcher	82	9.88
Technician	479	57.71
Participant	151	18.19
Education		
Master' degree or higher	126	15.18
Bachelor	470	56.63
Lower than Bachelor	234	28.19
Gender		
Male	602	72.53
Female	228	27.47
Work's experience (years)	mean = 14.84,	std = 11.263
Age (years)	mean = 40.42,	std = 10.995

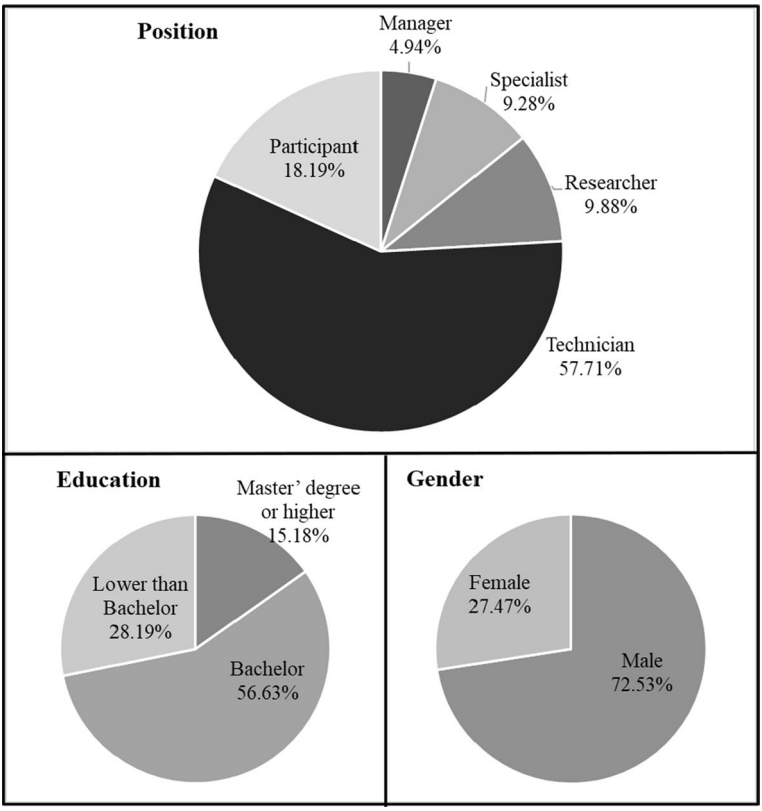

Fig. 1 Percent of the respondents

3.2 Effects of factors on area-based infrastructure projects sustainability

Figure 1 could be regarded as evidence to support the significant, influential factors on area-based infrastructure projects in the area of sustainability. Dot lines represent the correlation between modes of influencing factors. The finding shown that the sustainability of infrastructure projects is influenced by four modes of factors: (1) administration and tool management (ATM) ($\beta = 0.392$, $t = 10.734$, and $p \leq 0.01$), (2) connection network and research development (CNR) ($\beta = 0.326$, $t = 9.768$, and $p \leq 0.01$), and (3) implementation plan and area participation (IPA) ($\beta = 0.155$, $t = 4.729$, respectively. Besides, there is a very high correlation (0.728) between the administration and tool management mode and the budget and public provision mode (BPP). These four modes could imply the sustainability of infrastructure projects ($R^2 = 0.572$, $F = 280.256$, and $p < 0.05$). In addition, "administration and tool management" has the largest effect of all. However, in practice, the budget and public provision could proceed under the permission of central and/or regional administrations.

Table 3 The eigenvalue and total variance

Item	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.994	41.010	41.010	8.241	21.132	21.132
2	3.331	8.542	49.551	6.361	16.309	37.441
3	1.605	4.116	53.667	4.975	12.757	50.198
4	1.385	3.551	57.218	2.738	7.020	57.218
5	.892	2.288	59.506			
6	.871	2.234	61.740			
7	.821	2.105	63.845			
8	.783	2.008	65.854			
9	.724	1.856	67.709			
10	.698	1.790	69.500			
11	.664	1.702	71.201			
12	.636	1.630	72.831			
13	.591	1.515	74.346			
14	.584	1.497	75.843			
15	.545	1.397	77.240			
16	.526	1.350	78.590			
17	.510	1.307	79.897			
18	.485	1.243	81.140			
19	.477	1.222	82.362			
20	.467	1.198	83.560			
21	.450	1.153	84.713			
22	.441	1.130	85.843			
23	.423	1.085	86.927			
24	.417	1.070	87.997			
25	.404	1.036	89.033			
26	.385	.987	90.020			
27	.371	.952	90.973			
28	.354	.907	91.880			
29	.345	.885	92.764			
30	.336	.862	93.626			
31	.317	.814	94.440			
32	.312	.801	95.241			
33	.308	.789	96.030			
34	.294	.754	96.784			
35	.277	.711	97.495			
36	.271	.695	98.190			
37	.255	.653	98.844			
38	.238	.610	99.454			
39	.213	.546	100.000			

Extraction Method: Principal Component Analysis

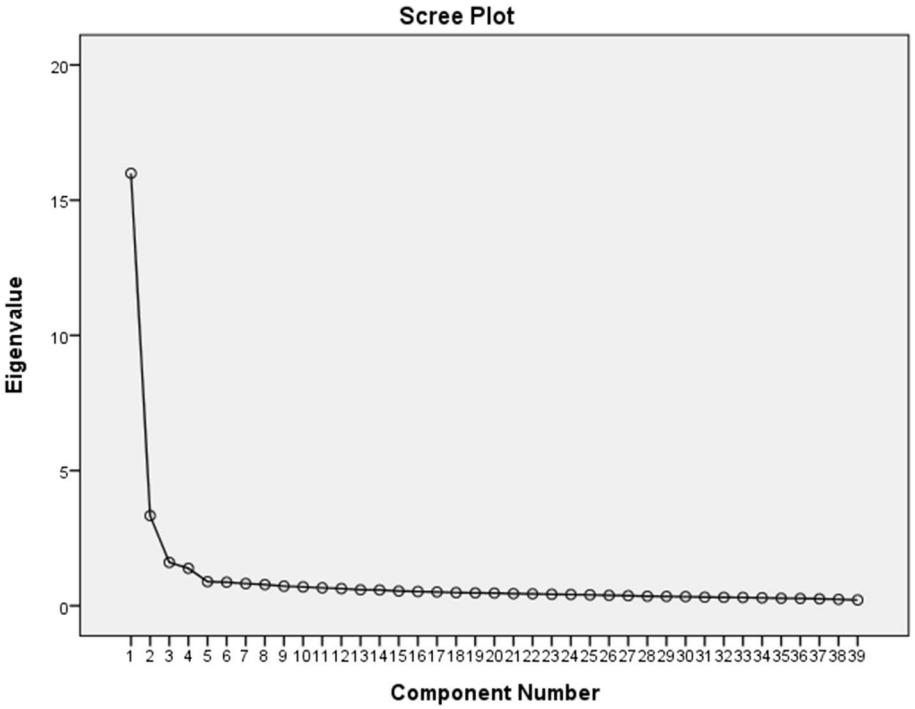

Fig. 2 Scree plot

4 Findings and discussion

4.1 Implementation plan and area participation (IPA)

This factor concerning the role of group 1 "implementation plan and area participation" has fifteen items. Among this group, the "academic research on community-based and partnership creation" item, gets the highest loading factor (0.767) while the others coped with area-based participation, local development plan, cooperation and collaboration between local people and public agencies, occupation training and help each other development, academic research on area-based, and traditional knowledge application. Dealing with the major role of this factor, to form a new partnership between local people and project manager/participants is needed to implement the plan. A great attainment of gain understanding and participating with local people relies heavily on the conservation of good relationship and trust among the members of the community. Consequently, a large crowd of people spontaneously joined hands in the project without delay. Trust between project participants and project manager could display the benefits of a trusting relationship (Jabareen & Carmon, 2010). Also, the several sources of appropriated information could be applied, scientific rigour, lead to consistence, and fairness for the environmental impact reports (Barish & Knoblock, 2008; RPF, 2020). The knowledge and information center can aid the agricultural productivity improvement of ABIP (RDPB, 2020). Moreover, the study center has to be the place of collection of the study results, experiment, and demonstration of the project success.

Table 4 Factor loading and variance

Item	Factor loading	% of variance explained	% Cum. of variance
Group1 Implementation plan and area participation: IPA (15 items)			
FA50	0.764	21.132	21.132
FA39	0.744		
FA40	0.732		
FA51	0.732		
FA47	0.699		
FA42	0.695		
FA41	0.686		
FA44	0.670		
FA52	0.654		
FA38	0.652		
FA46	0.628		
FA45	0.599		
FA48	0.569		
FA49	0.563		
FA33	0.546		
Group 2 Administration and tool management: ATM (10 items)			
FA31	0.710	16.309	37.441
FA29	0.684		
FA02	0.675		
FA22	0.659		
FA30	0.644		
FA32	0.636		
FA43	0.594		
FA10	0.579		
FA34	0.565		
FA03	0.560		
Group 3 Budget and public provision: BPP (9 items)			
FA15	0.713	12.757	50.198
FA16	0.671		
FA17	0.654		
FA19	0.636		
FA14	0.621		
FA18	0.580		
FA11	0.555		
FA23	0.543		
FA24	0.519		
Group 4 Connection network and research development: CNR (5 items)			
FA06	0.676	7.020	57.218
FA07	0.635		
FA09	0.583		
FA04	0.514		
FA08	0.507		

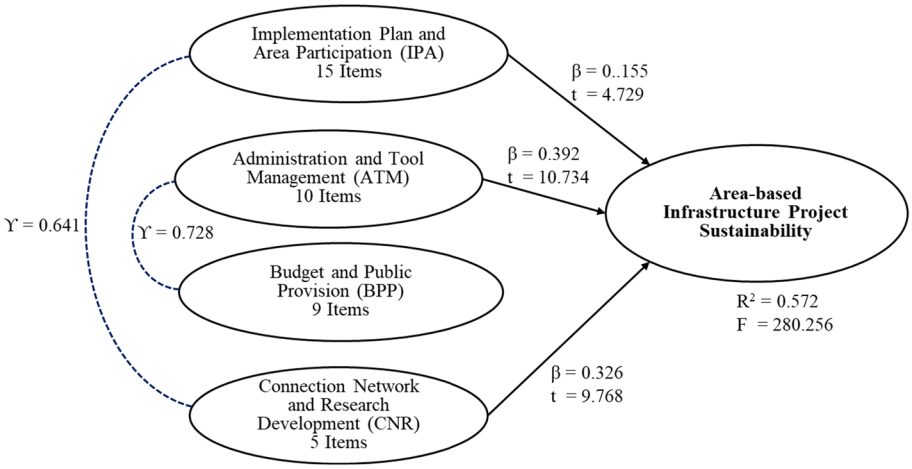

Fig. 3 Regression result

However, inadequate central commitment and lack of support can lead to unsatisfactory results (RDPB, 2020).

4.2 Administration and tool management (ATM)

Group 2 "administration and tool management" is composed of ten items. "Maintenance the relationship among all stakeholders" item takes the highest factor loading (0.710). The other areas of concern are project management and tool application, area-based involvement in decision-making process, combination of bottom-up and top-down process, and relationship maintenance among all stakeholders. Project management and tool application is an essential instrument in monitoring via implementation that drives the team members and the managers successfully manage, and execute all tasks of projects (Kumar & Markeset, 2006). All of the appropriate strategies, suitable policies, and effective plans are applied to solve or protect the unsustainable figures (Park & Kwon, 2011). The management tool with integration of holistic perspective also needs inspection of environment, socio-economic, and area-based culture issues (Nasuchon & Chareles, 2010). In addition, the success of project contingent on performance of managers to control and manage throughout the project life span. Bringing practical resolution by using management tools to proceed project with success and sustainability requires integration of strategic planning, holistic management, and multidisciplinary knowledge (Carlson & Cohen, 2018). Properly projected development can provide sufficient budget and support in unexpected occurrences to attain sustainable development (Eedlenbruch et al., 2009).

4.3 Budget and public provision (BPP)

Group 3 "budget and public provision" comprises nine items. Among all "public involvement" carries the highest factor loading 0.713. The scope of them is to cover budget allocation, physical infrastructures support, public involvement, and adequacy information service. Budget support and provision for project implementation tend to be more effective

if the local representatives provide participating and information in the selection stage (Eedlenbruch et al., 2009). The insufficient budget obstructs the development of local functions as well as limits the projects and programs implementation (RDPB, 2020). The systematic reconstruction and inspection-based treatment can be provided an efficient tool for sustainability management (Sheils et al., 2010). Although the local administration can create their revenue from loans, taxes, enterprises, and properties, they still require the budget support and provision from the central government subsidies for infrastructure development projects (RIDF, 2020). Moreover, the local information had duplicated with the method to provide community persons with comprehension of their area-based conditions and present scientific knowledge. This was made possible by giving essential, useful, and fresh information to the community. Various sources of information could be unity, compliance, and reasonability for describing problems and impact (Barish & Knoblock, 2008; Boutin et al., 2009).

4.4 Connection network and research development (CNR)

Group 4 "connection network and research development" is made up of five variables. The highest factor loading 0.676 "professional management or organization support" item is emphasized. Besides, this group is connected to community weakness/strength, development of networking collaboration, and research and practical application development. The early stage of project implementation was to promote community strengths and then improve the weaknesses to increase experience and skill. Moreover, the development programs and research are required to be promoted for enhancing effective practical application (RDPB, 2020). Also, the interchange of experience between academics and villagers lead to integrated practicality with technical theories suitable for area-based projects and significantly to an increase in productivity of crops and livestock. Collaborative and networking approaches can support local administration, share knowledge, and save resources and the best practices (Barrutia, 2007). The encouraging of research and development concern, networking development, knowledge transfer, and continuation of improvement are important factors to gain the success of area-based project development (RIDF, 2020).

5 Conclusions

To sum up, with the highly motivated aim of the research to analyze the influential factors of ABIP sustainability, usable inputs well equipped with important elements could proceed steadily. Each category of all activities could be worked out well by corporative attempts of individual persons, a group of project managers/developers, staff, a team of invited experts in related fields when needed along a basic research procedure. At the final stage, the accomplished results, the expected outcome, could satisfy the objective of this study identified as four factors—(1) implementation plan and area participation (15 items); (2) administration and tool management (10 items); (3) budget and public provision (9 items); and (4) connection network and research development (5 items).

The major limitation of this research which should be recognized as of the data in use from the limited boundary, only in Thailand. Obviously, a comparative study with other countries will be very useful in the field of doing research on sustainability of ABIP.

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