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Original Research

Embracing opportunities and minimizing risks: leveraging decision models for project selection in Southeast Asian countries

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Abstract: In real estate investments in Southeast Asia, decisions worth billions of dollars are usually made without systematic analysis, leading to project failures. This paper presents a novel two-tier matrix method that combines the decision on country-project selection into a model. This model could assist real estate investors to select the right projects in Indonesia, Malaysia and Thailand, which is significantly under-reported. We used the Analytic Hierarchy Process (AHP) and the Weighted Sum Method (WSM) to create a matrix model to analyse investment projects. The results are encouraging and indicate that Malaysia is the best country for real estate investment, followed by Thailand and Indonesia respectively. This study also simulates the decision making of very experienced to inexperienced investors. It concluded that the two-tier decision model can safeguard investors from making intuitive decision mistakes and help them to make informed decisions when selecting investment projects in Southeast Asian countries.

Keywords: Southeast Asia, Real estate investment, MCDM, Emerging countries, Investment decision making, Project selection.

1. Introduction

ASEAN ranks as the fifth largest economy in the world with 679.7 million of people in 2023, representing 8.1% of the world's population [1] and a gross domestic product at current prices (GDP in US dollars) of USD 3,864 billion (USD 5,688 per capita GDP) in 2023. With a large population and economic growth, ASEAN will become an important growth engine and is already one of the most important markets for Hong Kong [2, 3]. The Global Competitiveness Report 2019 [4] shows that the infrastructure index of Malaysia is 78.8, followed by Thailand at 67.8 and Indonesia at 67.7, just below the median. The insufficient investment in infrastructure projects attracts a large amount of Foreign Direct Investment (FDI) from China, which flows into the ASEAN countries, especially in real estate investments [5]. The amount of real estate investment in ASEAN has shown a steady growth to USD 123.1 trillion in 2022 and a further increase to USD 126.2 trillion in 2023, representing a growth of 2.6% [6, 7]. Indonesia, Malaysia and Thailand have attracted a significant amount of investment in real estate due to their strong economic growth and favourable regulations [8]. The authors have been researching on decision making in the underrepresented countries namely Cambodia, Myanmar and Vietnam [9]. In a study covering the research performance in ASEAN countries for the period from

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2002 to 2021, the percentage of citations in Singapore is 58.2%, followed by Malaysia at 18.3%, Thailand at 7.8% and Indonesia at 6.0% [10]. These countries, with the exception of Singapore, have a less developed market, less available data and are under-reported. Real estate investment decisions are traditionally made by investors based on their experience and intuitive judgement rather than based on a systematic decision model [11]. Moreover, investment decisions often involve multiple criteria, varying priorities of these criteria, incomplete information and a lack of expert insight. This research focuses on the "less developed" Southeast Asian countries and aims to investigate the intuitive decisions made by investors that may lead to substantial loss, whilst smart investors can leverage on the novel two-tier matrix multi-criteria decision-making (MCDM) model to minimize the risks in the less developed and under-reported countries, namely Indonesia, Malaysia and Thailand. This study provides a systematic approach for an easily understood and practical analysis together with a decision model to assist investors in making informed investment decisions.

2. Literature review

2.1 Decision-making models

Real estate investment decisions are complicated and difficult as they often involve multiple criteria [12]. Some of these criteria often conflict with each other. In addition, investors traditionally rely on market intelligence and guanxi (a kind of personal network in Chinese culture) to make investment decisions [13-15], and they neither have sufficient information nor make a comprehensive decision making process [16, 17]. The situation is even worse in Southeast Asian countries, where good quality data cannot be easily found. MCDM models can often help to optimize conflicting investment criteria in business decisions [18, 19]. So we turn to a decision model to assist in making the right decision. Modeling and parameters are important factors that should be considered when selecting a suitable method [20]. The Weighted Sum method (WSM) is the most frequently used method. In WSM, the decision factors are first identified and then their relative weights are determined. Next, the goal is to evaluate alternatives based on these factors and make informed decisions [21]. The Analytic Hierarchy Process (AHP) method is used to help investors make rational decisions in their investment [22]. By combining WSM and AHP, a multi-objective model is formed and used to build an integrated decision support system [23]. The applied research methodology consists of involving experts of the real estate sector in the region combined with a novel two-tier matrix model for making investment decisions [9].

2.2 Influence factors

Economic, legal and political factors have been selected for real estate investment decisions in prior studies [8, 24, 26]. Within a particular country, factors such as city infrastructure, consumption levels, economy, government policies and market conditions were identified [26]. An extensive literature review was also carried out on the influence factors in the economic, financial and political fields [27]. Based on this research, we proposed to use economic, financial and political factors in our study. Among all the influence criteria, fifteen criteria were selected by a panel of industry experts. The economic factors include market transparency E01, supply and demand E03, currency control E04, exchange rates E05, land costs E08, material costs E09 and skilled labour E10. For the financial factor, this includes consumer price index (CPI) F01 and foreign direct investment (FDI) F03. While for the political factor, this includes protection of property rights P01, the organization of the legal system P02, business freedom P03, political risk P04, home ownership P05, financial freedom, investment freedom and monetary freedom P07. In total, fifteen factors were selected from the literature review. At project level, two frequently used criteria such as internal rate of return (IRR) and cash flow (CF) were selected.

3. Methodology

A mixture of quantitative data analysis and qualitative analysis was applied in this research. Data was collected through a survey of real estate investors in Southeast Asian countries. Secondary data was collected from internet sources published by academia, governments, institutions and investors. Case studies were conducted in the selected Southeast Asian countries to gain a deeper understanding of the investment decisions. The data collected was applied to the matrix MCDM model [9].

3.1 Concept framework

MCDM models normally use a one-step decision making process. For project selection in Southeast Asian countries, we need to make two decisions and therefore create a two-tier decision making process. The first tier is to determine which country to invest in and the second step is to determine which project in that country to be selected. This is a highly interrelated two steps decision making process. In step one, we created a decision matrix with the economic, financial and political factors and the associated fifteen criteria selected from literature reviews for country selection, as shown in Figure 1. In the second step, we created a project selection matrix using the two project criteria. In order for these two matrixes to interact and produce the correct decision, we proposed to multiply the two matrixes together to obtain the alternatives as illustrated in Figure 1.

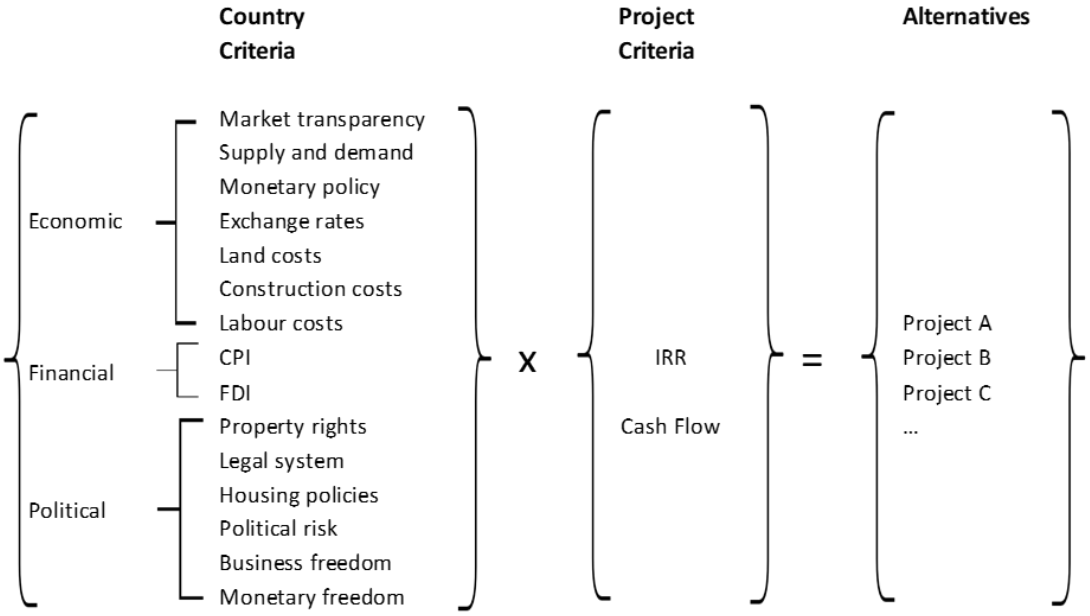

Figure 1. Country selection matrix and project selection matrix

Table 1. Methodology involving 3 countries and 6 projects

	Malaysia (C_1)			Thailand (C_2)	Indonesia (C_3)	
Project P_{ij}	P11	P12	P13	P36	P24	P25

3.2 WSM method

The WSM method calculates the weighted sum of the normalized performance ratings of all attributes for a particular alternative (i), as shown in the following:

$$V_i = \sum_{j=1}^{n} W_j R_{ij}, \quad i = 1,..., m \text{ alternatives}, \quad j = 1, \ldots, n \text{ attributes}$$

where:
V_i is the numeric value of Alternative A_i
W_j is the numeric weight of Attribute j
R_{ij} is the normalized performance ratings of attribute j for alternative A_i

3.3 Methodology illustration

In Table 1, the methodology for the three countries and six project scenarios was presented. For ease of reference, the decision matrix is inserted in Microsoft Excel (version: Professional Plus 2021) with the spreadsheet showing the formula in Appendix 1.

First, the input values for the country ranking are entered in row 5 *FRWj*, row 11 *RWj*, rows 15 to 17 performance ratings *Rij*; then the input values associated with project ranking are entered in row 31 *RWj*, rows 34 to 39 Normalized *IRR* and *CF* in the Excel file. Secondly, the calculations of the combined country-project ranking are conducted in five steps.

Step One: Determine the Country Rank RN_{ij} and insert the normalized performance ratings R_{ij} as illustrated in rows 3 to 17.

In rows 5 and 6, the relative weights of the country factors are determined by the experts, the sum of the *FRWj* is calculated, and then *FRWj* is divided by the sum to obtain *NFRWj*.

In row 11, the criteria relative weights *RWj* are determined by the experts, then normalized as shown in row 12 *NRWj*.

In row 13, the *NRWj* is multiplied by the respective NFRWj for the economic, financial and political criteria, then normalized as shown in row 14 *NFNRWj*

In rows 15 to 17, the respective country performance ratings *Rij* are obtained from renowned database and organizations such as the Asian Development Bank.

Step Two: Re-normalize the Country Rank as illustrated in rows 21 to 25

In row 22, for example, the Country Rank of Indonesia is obtained by multiplying the Performance Ratings *Rij* (row 15) with the Normalized Factored Market Criteria *NFNRWj* (row 14)

Step Three: Calculate the Project Criteria (PW_{ij} for P_{ij}) as illustrated in rows 28 to 39

The Normalized *IRR* and *CF* are calculated from the project *IRR* and cash flow, and entered in rows 34 to 39.

Step Four: Compile the country–project ranking as illustrated in rows 42 to 48

The *PWi,j* in rows 44 to 49 in columns D to E are calculated by multiplying the Normalized *IRR* and *CF* in row 32 with *NRWj* in rows 34 to 39.

Step Five: Calculate the final project rankings as illustrated in cells H44 to H49

Project P_{ij} = [$PW1_{ij}$ * RN_{ij}] + [$PW2ij$ * RN_{ij}]

The symbols used above and in the spreadsheet are defined as follows:

$CRIT_j$: the selected Criteria *j*

FRWj: Country factor relative weight *j*

NFRWj: normalized FRWj

RW_j: relative weight of Criteria *j*

NRWj: normalized RWj

$FNRW_j$: factored NRW_j

NFNRWj: normalized FNRWj;

R_{ij}: normalized performance ratings of Criteria *j* for Country *i*

RN_{ij}: re-normalized country rank

PW*ij*: project weight for Project *i* in Country *j*

P*ij*: final project rank for Project *i* in Country *j*

IRR: internal rate of return

CF: cash flow

IRR (PW1): Project weight criterion 1

CF (PW2): Project weight criterion 2

4. Data collection and surveys

We sought the advice from industry experts to obtain the relative weights of criterion *j* (RW_j). Next, we obtained criterion performance ratings (R_{ij}) from reputable organizations such as the Asian Development Bank and the Heritage Foundation. Data from 2018 to 2023 was used in order to maintain consistency.

4.1 Surveys and questionnaires

We conducted two surveys to collect the data. Survey 1 was a pilot study and Survey 2 was a detailed study. In Survey 1, we conducted pre-survey interviews with industry and country experts to generate and confirm the criteria listed in Figure 1. On the other hand, in Survey 2, we elicited the relative weights for the criteria (RWj) from senior real estate practitioners. For the performance ratings for the criteria (Rij), we obtained it from renowned organizations. For example, the performance ratings for "political risk P04" were obtained from Fitch Solutions Country Risk and Industry Research.

4.1.1 Survey 1 and data

In Survey 1, we asked industry experts with business in Southeast Asia to provide importance weights for the criteria (RWj) using Saaty's pairwise scale of 1 to 9 [28]. A copy of questionnaire 1 can be found in Appendix 2 for easy reference. The expert opinions were averaged by summing up each criterion across the experts and then dividing by the number of experts. The weighted criteria were then ranked from most to least important. We used the highest ranked 15 criteria to create the decision matrix as listed in Figure 1, because the marginal contribution of using additional criteria decreases as the number of criteria increases and the time and resources required by the experts must remain within a practical limit [29].

4.1.2 Survey 2 and data

We invited senior real estate practitioners in the Southeast Asia region to determine the weights for the criteria [30]. Ultimately, 92 senior real estate practitioners were invited to participate in the survey. We used the 15 criteria identified in Survey 1, which was in line with the sensitivity analysis study [29]. Similar to questionnaire 1, Saaty's pairwise scale of 1 to 9 was used [28]. In Survey 2, we identified the relative weights for the three country factors, 15 selection criteria, and two project selection criteria to build the decision matrix.

4.2 Data analysis

From the 92 senior real estate practitioners invited to participate in the survey, we received 86 questionnaires back, of which 81 were completed responses (response rate = 88%). The respondents had between 19 to 33 years of working experience. In addition, the respondents worked for companies such as property developers, construction companies, suppliers, service providers or consultants and investors.

The relative weights of the 15 selection criteria and the 2 project selection criteria obtained from the experts are listed in Table 2a and Table 2b in Appendix 3.

5. Case study

Indonesia, Malaysia and Thailand are among the most important members of ASEAN, with a population of 283.4 million, 35.8 million and 71.6 million, respectively [31]. The GDP of ASEAN was USD 3.8 trillion at current prices in 2023, with Indonesia having the largest share at 36.2%, followed by Thailand at 13.6% and Malaysia at 10.5%. In terms of FDI inflows, ASEAN had a record high at USD 211.7 billion in 2023. However, FDI inflows to Indonesia, Malaysia and Thailand showed sluggish movements at USD 22 billion, USD 2.2 billion and USD 8.1 billion, respectively [32]. Nevertheless, the large amount of FDI

inflow stimulated the real property sectors in the three countries [33, 34]. The amount of property investments also achieved a post-Covid level [35].

5.1 Decision matrix

As this study aims at building a decision making model to assist real estate investors, the matrix model is created using Microsoft Excel so that it can be used by investors who are not necessarily well familiar with statistics and formulas. In this case study, six projects ranging from high, medium to low investment returns were selected, with three projects from Malaysia, two projects from Indonesia and one project from Thailand. Details of the projects with project profiles, sales income and construction costs are illustrated in Figures 2a to Figure 2c as shown in Appendix 4. By multiplying the matrixes of country rankings with project rankings, we obtained the final country-project rankings. As shown in Table 3a, Malaysia was rated as the best country for investment, followed by Thailand and Indonesia. It also dispelled the myth that Thailand is the most popular country for investment. Thailand is undoubtedly a fantastic country for holiday and hence the intuitive perception is that it should be good for investments. This is a typical example of how our daily life experience would affect our intuitive decision makings [36]. However, the matrix model indicates a different result. The final ranking for the six projects was P11 > P36 > P24 > P12 > P13 > P25, as shown in Table 3b. The result indicates that Malaysia is the best choice and this finding is significant to investment decision making and project selection. It helps decision makers to identify the most suitable project for investment and to avoid project failure due to picking the wrong project in the wrong country.

5.2 Intuitive decisions vs matrix model decisions

Real estate investment decisions involve billions of dollars and are the most important decision for investors. Intuitive decisions based on experience and instinct are traditionally used for investment decisions, which might lead to failures [37]. Decision makers use market interpretation, experience and guanxi (personal networks and relationships) to support their judgment [13]. In fact, they often take an opportunistic approach [38]. Therefore, the multi-criteria expert decision system can make a significant contribution [11]. In this context, decision makers can benefit from the matrix model for investment decisions to achieve better results. In this section, we create three decision simulations to reflect the different experience levels of investors, from very experienced, to experienced and inexperienced investors. The three types of decision simulations and the criteria settings are shown in Table 4a.

Table 3a. Country rankings

Country	Country Rank = Sum (Normalized FNRW$_j$ × R$_{ij}$)
Indonesia	0.7490
Malaysia	0.8861
Thailand	0.7583

Table 3b. Final country-project rankings

Project (P$_{i,j}$)		PW$_{ij}$		Synthesized country-project rankings = PW$_{ij}$ * RN$_{ij}$		Final country-project ranking = Sum [PW$_{ij}$ * RN$_{ij}$]	Country-project Rankings
		PW$_{ij}$ = NRW$_j$ * Normalized IRR	PW$_{ij}$ = NRW$_j$ * Normalized CF	IRR	CF		
Malaysia	P11	0.4634	0.5366	0.4106	0.4755	0.8861	1*
Malaysia	P12	0.2518	0.4628	0.2231	0.4101	0.6332	4
Malaysia	P13	0.1741	0.3930	0.1543	0.3482	0.5025	5
Indonesia	P24	0.4634	0.4364	0.3471	0.3269	0.6739	3
Indonesia	P25	0.2518	0.3352	0.1886	0.2510	0.4396	6
Thailand	P36	0.4634	0.4850	0.3514	0.3677	0.7191	2

Note: PW$_{ij}$ = project weights; NRW$_j$ = normalized relative weights for the criteria; RN$_{ij}$ = re-normalized weights; IRR = internal rate of return; CF = cash flow.

Table 4a. Decision Simulations Type I, II and III

Type	Experience Level	Criteria Setting	Simulation
I	Very Experienced (10 years +)*	add the most important criterion in each of the sub-group Economic/Finance/ Political one by one to the model	Senior level, e.g. Director
II	Experienced (5 – 10 years)	add the least important criterion to the model, follow by the next important criterion till the most important criterion in each of the sub-group Economic/Finance/ Political is added	Middle level, e.g. Team head, Department head
III	Inexperienced (2 – 5 years)	add the least important criterion to the model, follow by the next important criterion until all 15 criteria are added	Junior level, e.g. manager

*Source: https://www.velvetjobs.com/job-descriptions/

Using the decision matrix results from the Type I, II and III tests, we demonstrated the investment decision mistakes and how the matrix model can provide an informed decision to avoid making such mistakes. We simulated the business decision making environment by testing three types of decision makers, that is, the very experienced with over 10 years of experience (Type I), the experienced with 5 to 10 years of experience (Type II) and the inexperienced with 2 to 5 years of experience (Type III). In the Type I test, we simulated the decision-maker as very experienced in real estate investment, for example, the director of the company. He can correctly select nine of the most important criteria in each sub-group and apply the criteria in the correct order. In this case, there is no reversal of the country ranking and the intuitive decision matching the model prediction, as shown in Table 4b. However, this is a huge task even for a very experienced decision maker without the assistance of the matrix model as a reference tool. He may overlook the important criteria or apply the criteria in the wrong order by using his experience and get an inaccurate result. In the Type II test, we simulated the decision-maker as an experienced investor, for example, a team head. He can apply the criteria correctly to each sub-group but unfortunately in a different order. In this case, the ranking of the countries only reserves when at least six criteria are applied to the model, as shown in Table 4c. In a business environment, smaller investment decisions are usually delegated to the experienced team head. Therefore, the two-tier model plays an important role as an informed decision making tool even for the “experienced” decision maker. To further demonstrate the usefulness of the model, we added a Type III test to stimulate the inexperienced decision-maker, for example, a junior manager. He applied the order of the criteria completely wrong. In this case, there is no reverse in country ranking until at least five criteria are used in the model, as shown in Table 4d. Therefore, the model plays a significant role as a safeguard tool for the "inexperienced" decision maker to avoid making mistakes. This is an important and significant finding as it demonstrates that matrix model is an important tool for decision makers. With the experience level decreasing, from very experienced to inexperienced, the importance of the model increases from a reference tool to a safeguard tool. The model protects the inexperienced decision makers from choosing the wrong country and the wrong project, which can lead to project failure. In summary, both experienced and inexperienced investors can make mistakes in the decision-making process, and the two-tier model can be a useful safeguard tool. The very experienced investors have made the same decision in line with the two-tier model. On one hand, this is due to the vast experience the senior investors gained from previous project successes or failures, and on the other hand, it also demonstrated the result that the decisions of two-tier model are at the same level and of similar quality as those of the very experienced investors. In brief, the matrix model can provide investors with a useful tool for making informed decisions and avoid costly mistakes of millions of dollars.

Table 4b. Decision Simulation Test I – Adding criteria one-by-one in the order from the most important to the least important criteria in each sub-group

Sensitivity case (base reference)	1 [3]	2 [6]	3 [9]	4 [12]	5 [14]	6 [15]
Indonesia (0.7490)	0.7829	0.7431	0.8182	0.8033	0.7961	0.7490
Malaysia (0.8861)	0.7596	0.7447	0.8296	0.8613	0.8790	0.8861
Thailand (0.7583)	0.6422	0.6696	0.7640	0.8211	0.8030	0.7583

Note: number of criteria is shown in [ ] e.g. case 1[3], case 2[6], case 3[9], case 4[12], case 5[14], case 6[15].

Table 4c. Decision Simulation Test II– Adding criteria one-by-one starting from the least important (case 1) to the most important in each sub-group (case 6), to the model.

Sensitivity case (base reference)	1 [3]	2 [6]	3 [10]	4 [12]	5 [14]	6 [15]
Indonesia (0.7490)	0.6668	0.7144	0.7611	0.7747	0.7296	0.7490
Malaysia (0.8861)	0.9009	0.9487	0.9593	0.9666	0.9322	0.8861
Thailand (0.7583)	0.4895	0.6167	0.7630	0.7676	0.7751	0.7583

Note: number of criteria is shown in [ ] e.g. case 1[3], case 2[6], case 3[10], case 4[12], case 5[14], case 6[15]

Table 4d. Decision Simulation Test III– Adding criteria one-by-one starting from the least important (case 1) to the most important (case 10), to the model.

Sensitivity case (base reference)	1 [1]	2 [3]	3 [4]	4 [5]	5 [7]	6 [8]	7 [10]
Indonesia (0.7490)	1.0000	0.6668	0.6955	0.6549	0.6505	0.6852	0.6833
Malaysia (0.8861)	0.7000	0.9009	0.9260	0.9413	0.9439	0.9514	0.9013
Thailand (0.7583)	0.4600	0.4895	0.5530	0.5275	0.6685	0.7114	0.7741
	8 [12]	**9 [14]**	**10 [15]**				
	0.7401	0.7628	0.7490				
	0.9186	0.8763	0.8861				
	0.8030	0.7668	0.7583				

Note: number of criteria is shown in [ ] e.g. case 1[1], case 2[3], case 3[4], case 4[5], case 5[7], case 6[8], case 7[10], case 8[12], case 9[14], case 10[15]

6. Conclusions

In this paper, we discussed the traditional intuitive decision-making approach versus the matrix decision-making approach. In brief, the matrix model can provide investors with a useful safeguard tool for making informed decisions and avoiding mistakes. With the growing economy and the large amount of investments coming to Southeast Asia, it is vitally important to make informed and correct investment decisions in the region. In this study, a two-tier matrix decision model has been developed based on a systematic decision-making methodology that includes key country criteria and project criteria. The matrix model helps investors to comprehend the intricacies involved and reduce the probabilities of project failure. Furthermore, due to the importance of economic contribution of real estate projects to Southeast Asian countries, this research can provide government officials with a decision-making

model to develop better and informed policies for real estate sector in Indonesia, Malaysia and Thailand.

Recommendation

Real estate investment is an important decision for any investor. With high interest rates returning to the region coupled with higher development costs, investors should make well- informed decisions when selecting suitable projects in Southeast Asia. We used a novel two-tier matrix decision model for project selection in three rapidly growing Southeast Asian countries, namely, Indonesia, Malaysia and Thailand. We recommend that investors of large real estate projects should consider using the two-tier model as a safeguard tool. Firstly, the model can help investors to select the best country and secondly, to select the suitable projects for investment in that country. Based on our matrix model, the results indicated that Malaysia was rated as the best investment country for real estate, followed by Thailand and with Indonesia trailing behind. These research findings are useful and highly relevant to real estate investment decisions.

Limitations and future research directions

Despite the fact that the two-tier model was extended to cover Indonesia, Malaysia and Thailand, the model has some limitations. In this research, the methodology is based on the AHP and SAW methods. Although these methods are less dependent on data [39], they are the simplest among the MCDM models [40]. Future research should consider other advanced MCDM models when reliable data become available in these countries. Next, in the project selection matrix, only the two most important project criteria, that is, IRR and CF, are used to evaluate the real estate investments. There are different types of real estate projects such as commercial, office and residential development just to name a few. Future research could refine the project criteria for different types of real estate projects to achieve better results.

Appendixes

Appendixes 1-4 are available at https://file.luminescience.cn/DMA-327%20Appendixes.pdf.

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Authors' contributions

Wilson Yeh contributed to the methodology, data collection and analysis, case study and writing of this research. Gang Hao provided advice and guidance on the methodology and decision model presented in this research.

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Conflict of interest

The authors declare no conflict of interest.

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