

BUILDING A STRATEGIC PERFORMANCE MANAGEMENT MODEL FOR ENTERPRISES INVESTING TO COASTAL URBAN PROJECTS TOWARD SUSTAINABILITY

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Received 14 May 2020; accepted 02 October 2020

Abstract. In addition to the sustainable development of coastal areas, the success of local corporations investing in coastal urban projects is significantly affected by severe sea level rises and extreme disasters. Investment companies should plan which objectives need to target to reduce uncertainty in the early project stages, track project execution, and assess project output as projects complete the construction phase and start operational activities. To assist enterprises in planning, evaluating, and monitoring project performance aligning with vision and strategy, this study contributes a strategic management tool developed by integrating the Balanced Scorecard (BSC), Analytic Network Process (ANP), and Decision Making Trial and Evaluation Laboratory (DEMATEL) methods. A case study of a well-known investment corporation in Vietnam illustrates the research approach. This research appreciated stakeholder's satisfaction as the main consequence and human resource as the most prominent cause of coastal urban projects. Furthermore, the proposed model for Vietnam in this study could be referred by other developing countries to facilitate companies to plan, measure, evaluate, and control the organizational performances for the coastal urban project success.

Keywords: strategic management, performance management, project success, coastal urban project, sustainable development.

Introduction

The crowded population factor indeed creates many opportunities for economic development, but it also puts much pressure on sustainable socio-economic development in these vulnerable areas. The need for balanced and harmonious development between socio-economic and environmental conditions is, therefore, urgently needed for coastal economies. The coastal cities have greater population density than noncoastal areas, and coastal migration has been still growing (Neumann et al., 2015). But climate change has various impacts worldwide, such as increased sea-levels and beach erosion, high winds and storm surge, rising air and water temperatures, changes in rainfall patterns and amounts, extreme weather events (e.g., tropical cyclones), and changes in the environment (e.g., ocean acidification) (IPCC, 2014). Therefore, it well recognizes that the coastal and marine environment is highly vulnerable and likely to be threatened by climate change (IPCC, 2007, 2014).

Along with the sustainable development of coastal areas, the success of local corporations investing in coastal urban projects (CUPs) is highly influenced by extreme coastal disasters and severe sea level rise. In hence, strategic management is critical to sustaining the long-term success of these organizations (Wheelen & Hunger, 2012; Cantasano et al., 2017). Strategic planning and monitoring become essential as the environment becomes fragile (Brews & Purohit, 2007; Correia et al., 2020). In addition, the creation and maintenance of a dedicated and centered strategy can help distinguish successful enterprises (Joyce, 2005). The well-planned strategy could facilitate investment enterprise planning objectives that need focus on reducing vagueness in the early project stages, monitoring progress during the project implementation, and evaluating the project performance as the projects complete the construction phase. Thus, the development of strategic performance management tools to enhance these projects' success chance is necessary.

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In the field of strategic project management, performance management is critical because its role in strategy control (Morris & Jamieson, 2004; Todorović et al., 2015; Wheelen & Hunger, 2012). The well-developed performance management frameworks provide steps to measure and monitor efficiently throughout the project stages (Todorović et al., 2015). Because project success is defined variously by different stakeholders, a performance management model is useful and effective if it considers the stakeholders' satisfaction in addition to project characteristic factors, project environment factors, or experience of participants (Chan & Chan, 2004).

Because of the "easily vulnerable" properties of coastal areas, incorporating to objectives of sustainable development is recommended for CUPs. Some works of literature tried to integrate sustainability dimensions (social – economic – environmental) to the coastal project targets. However, most of the existing relevant studies have not yet shown the connection of sustainability measures to project success criteria in the field of standardized project management (et cetera Project Management Body of Knowledge standard). Therefore, this study is motivated to fill this gap by suggesting a performance management framework combining sustainable development objectives to project management criteria for CUPs.

This study contributes a strategic management tool supporting investment enterprises in planning, evaluating, and monitoring performances of CUPs toward sustainable development. This tool integrated quantitative approaches to develop the strategic performance management framework with considering sustainability development dimensions. The combination exploited the Balanced Scorecard (BSC), the Analytic Network Process (ANP), and the Decision Making Trial and Evaluation Laboratory (DEMATEL). Firstly, a comprehensive literature review of performance criteria and strategic objectives serves to identify the leading ones. After that, the ANP method helps to measure the direct relations of objectives (project success criteria). The BSC method assists in group strategic objectives in performance perspectives according to the point of view of the BSC method. DEMATEL helps to explore the total (indirect and direct) relationships among them and then produce the impact-relationship map (IRM). This IRM is highlighted as the strategy map to help companies to measure, evaluate, and control the organizational performances for the project success in a risky climate change context.

The remainder of this paper is as follows. Section 1 reviews on sustainable performance management of CUPs, the strategic performance management frameworks for project success, the application of quantitative methods in constructing the performance management frameworks, and the combination of the BSC, ANP, and DEMATEL for strategic performance management. Section 2 details the methodology of the study into steps of the research procedure integrating BSC – ANP – DEMATEL. Section 3 presents the application of the proposed framework through

a case study and an explanation about the results. As well, further discussion of the model discloses in sections 4. The last section offers a conclusion and recommendations for future research.

1. Literature review

1.1. Sustainable performance management of coastal urban projects

A coastal urban project is an urban development project in coastal zones. Therefore, this kind of project comprises of complicated characteristics of urban development projects and coastal construction projects. Urban development projects themselves have complicated attributes that come from infrastructure systems, architecture demand, and public spaces. Artificial coastal structures, such as dams, jetties, pillages, quay walls and diaphragms, may protect urban projects in coastal areas from climate hazards (Bulleri & Chapman, 2010). Due to the unique location in coastal zones that are sensitive to climate change, CUPs should consider objectives as well as recommendations of the ICZM program of the country. Regarding the first definition of Thia-Eng (1993) that "ICZM is a resource management system following an integrative, holistic approach and an interactive planning process in addressing the complex management issues in the coastal area." There are several essential objectives of ICZM, including protecting community and assets, increasing sustainability and ecosystem services, developing economic conditions, enhancing the community's awareness, improving governance (Dronkers, 2019).

To reduce the impact of climate change on CUPs, it should integrate sustainable development objectives into strategic planning, performance measuring, and evaluation toward project success. Project success can be recognized from itself or from what the project intended or expected to achieve. Each project has multiple stakeholders with different objectives and expectations about the project (Bannerman, 2008). Typically, time, quality, cost, and safety are the most popular project success measures. De Wit (1988) developed into general technology metrics and criteria related to companies and project stakeholders' satisfactions. In recent decades, multi-dimensional measures are more popular in evaluating project performances (Fortune & White, 2006). Sustainable development related criteria have been more and more highlighted (Labuschagne et al., 2005; Singh et al., 2012; Gianni et al., 2017; Nawaz & Koç, 2018; Cantele & Zardini, 2018; Vieira de Castro et al., 2020). Although the various researchers have considered sustainability dimensions to the project targets for several recent years, the incorporation of sustainability measures and standardized project management criteria in CUPs' strategic planning and monitoring has still been limited. Therefore, this study is motivated to fill this gap by suggesting a performance management framework combining sustainable development objectives to project management criteria for the CUPs' success.

1.2. The strategic performance management frameworks for project success

This section analyzes the role of the performance management frameworks to successful project chance through relevant literature review in the past. It noted that these frameworks had been recognized tools transferring strategic measures into project management practice through a range of recommended policies or actions.

Recently, the construction industry has seen the critical attention of scientific researchers in terms of performance management tools, which could categorize into process-based and criteria-based models. Key performance indicators are the key parts of the performance management frameworks (Lin et al., 2011). Whereas, performance measurement matrix (Keegan et al., 1989; Fitzgerald et al., 1991), balanced scorecard (BSC) (Kaplan & Norton, 1992), performance pyramid (Lynch & Cross, 1991; Kennerley & Neely, 2002); European Foundation for Quality Management excellence model (EFQM, 2009) and importance performance diagram (Chou & Pramudawardhani, 2015) are typical representatives of process-based frameworks. Table 1 concisely summarizes performance management models applied in the construction industry.

Although there have been some potential investments to accommodate climate change, the formulation of science and policy for coastal urbanization needs more attention. Science and policies must be incorporated together

to support a stable, inclusive, and efficient policy system. Such cooperation could lead to better management of economic resources based on the interaction between government, society, and local organizations (Duraiappah et al., 2015). Because of management challenges of coastal projects, engineers, scientists, and decision-makers need to understand the legal requirements and socio-economic factors affecting the projects, and to transmit the technical information to the project stakeholders (Kamphuis, 2011). In comparison to other methods described in Table 1, the BSC method shows its definite advantages. The Balanced Scorecard is a system that transforms the vision and strategy of the organization into specific goals and metrics through the establishment of a performance measurement system. In addition to instructing the business operations according to the organizational vision and strategy, and monitoring the business performances compared to the target, the BSC system also helps to improve the efficiency of internal and external communication through the strategy map. Figure 1 presents in detail the application and adaptation of the BSC in this research.

In the original version of the BSC, Kaplan and Norton (1992) explained financial performance measures and performance effects. The dynamic (nonfinancial) measures were grouped into three aspects: customer satisfaction, internal business processes, and innovation and learning. Then, in the 1996 BSC version, the internal business aspect was renamed the internal innovation processes, and

Table 1. Summary of performance management frameworks applied in the construction industry

Category	Definition/brief description	References
<i>Criteria – based framework</i>		
– Success criteria	Success criteria can be defined as the set of principles or standards by which favorable outcomes can be completed within a set of specifications	Ashley et al. (1987)
– Key performance indicators	Regarding Oxford's Dictionary definition of KPI: a quantifiable measure used to evaluate the success of an organization, employee, etc. in meeting objectives for performance. KPI is to enable measurement of the project and organizational performance throughout the construction industry	KPI Working Group (2000)
<i>Process-based framework</i>		
– Performance measurement matrix (PMM)	In PMM, performance is measured by a four dimensioned matrix, splitting into four cells: external/cost, external/non-cost, internal/cost, and internal/non-cost	Keegan et al. (1989)
– Balanced scorecard (BSC)	BSC is used to explain the organization's financial performance measures and performance effects. In the original study, the dynamic (nonfinancial) measures were grouped into three aspects: customer satisfaction, internal business processes, and innovation and learning	Kaplan and Norton (1992)
– Performance pyramid (PP)	PP is a hierarchy model of financial and non-financial performance measures, indicating actions to assist in the achievement of corporate vision through several levels	Lynch and Cross (1991)
– European Foundation for Quality Management's Business Excellence Model (EFQM-BEM)	EFQM-BEM consists of two distinct subsets of performance factors, broadly classified as enablers and results	EFQM (2009)
– Two-dimension analysis diagram	Two-dimensional importance diagram is a model derived from Importance – performance analysis, which is typically used to measure service operations, the importance indices of customer satisfaction, and performance rating	Chou and Pramudawardhani (2015)

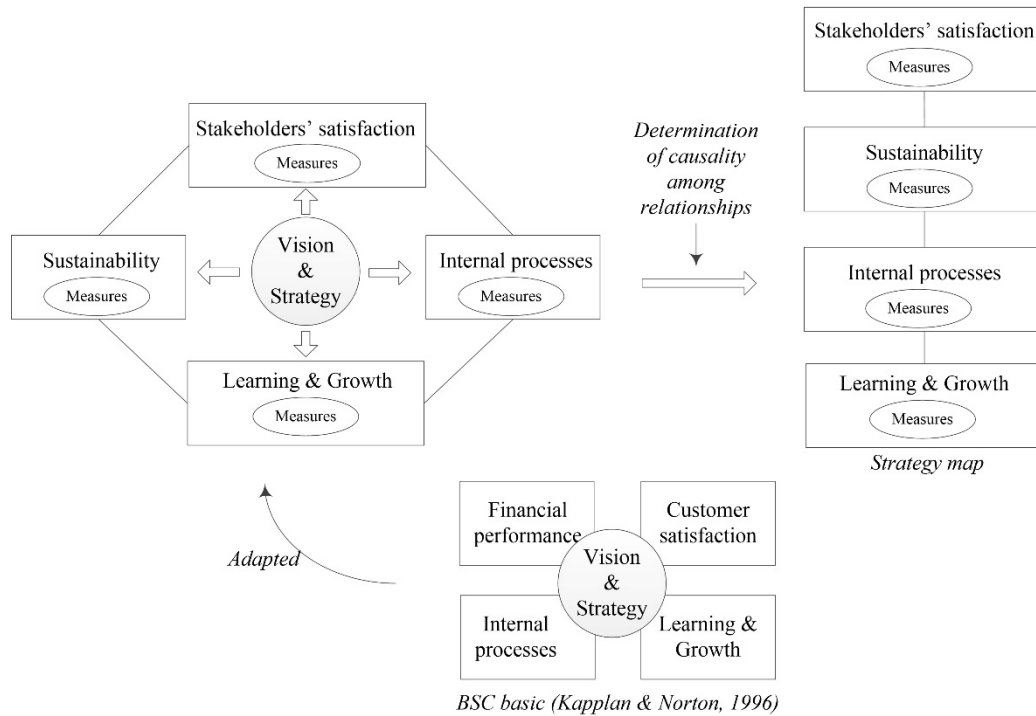


Figure 1. The adaptation of BSC method

the learning and innovation aspect renamed the learning and growth aspect (Kaplan & Norton, 1996). According to the BSC method, strategic measures are distributed to each strategic perspective, and they need to be consistent with the organizational mission. Strategic mapping is the most important task in building a BSC system (Kaplan & Norton, 2004). As shown by Kaplan and Norton (2004), a strategy map indicates visual representations of the important company goals and the significant relationships of organizational performance measures. While developing logical relationships among strategic objectives in the strategy map, the decision-makers need to discuss and analyze constructively based on each members' knowledge and experience. However, the determination of causal relationships among BSC measures in practice has been rather qualitative. The quantitative construction of the BSC framework still needs more attention, especially for CUPs.

DEMATEL is a multi-criteria analysis method for analyzing the structure of complicated causal relationships or many possible alternatives. It can explain the link between vital goals in strategy maps by collecting knowledge base to identify causal relations (Acuña-Carvajal et al., 2019). However, the essence of the DEMATEL method is that through matrix computation to build causal relationships, so the application of DEMATEL will be more complicated due to overload calculation volume. Therefore, this study proposes to apply the ANP method to generate weighted matrix results, which will then become an input matrix (direct impact relational matrix) of the DEMATEL method. This approach helps reduce the computational load and save more time. The ANP has expanded from the Analytical Hierarchy Process (AHP), both of which were de-

veloped by Professor Saaty (2000). In comparison to other MCDM methods, the ANP has remarkable strengths as it allows interdependence of elements; correlations within and between groups of elements; and multiple criteria for decision-making (Asgari & Darestani, 2017).

The linkage of the AHP/ ANP and DEMATEL for strategic planning has attracted substantial research attention. Lee et al. (2011) provided the first combination of the ANP and DEMATEL to explore the interactive relationships between factors. Büyüközkan and Gülerüz (2016) applied this combination to select the optimal renewable energy resource in Turkey, which is a globally emerging energy generation alternative. The causal relations in the strategy map among strategic objectives have been tried by Quezada et al. (2018) using a similar approach for a manufacturing enterprise. Balsara et al. (2019) exploited the advantages of this combination to assess the climate change mitigation strategies of the cement industry, known as the largest pollution emitting industry.

In general, the coordination and interaction between the BSC, ANP/AHP, and DEMATEL have commonly focused on a range of different sectors over recent years. These combinations have only been done at the company level. And they have not yet been addressed at the project level. The transition of the strategic visions and objectives from the enterprises into lower scales, such as business units or projects, has not yet been supported by tools or models using innovative quantitative methods. Also, there is no focus on the integration of BSC, ANP, and DEMATEL in developing strategic planning tools for CUPs. Consequently, the detected research gaps strongly motivated this research.

1.3. Application of quantitative methods in constructing the performance management frameworks

This study conducted a comprehensive review of the literature regarding the application of BSC, ANP, and DEMATEL to strategic performance management, using well-known searching engines such as Scopus, Google Scholar, ASCE library with specific keywords (balanced

scorecard, analytic network process, decision making trial and evaluation laboratory) from the year 2011 to 2020. Consequently, there was a range of studies on combining these methods for strategic performance management in many different fields. Table 2 presents a summary of noticeable researches.

Poveda-Bautista et al. (2012) built a company competitiveness index based on BSC and ANP. An application

Table 2. Quantitative methods for strategic performance management in prior studies

Studies	Brief descriptions	Applied approaches	Subjects
Hsu et al. (2011)	The study proposed a sustainability framework to measure the sustainable strategic performance of Taiwanese semiconductor companies to enhance their competitiveness	BSC-fuzzy Delphi-ANP	Semiconductor companies
Huang et al. (2011)	The study integrated KPIs with the BSC perspectives and AHP for the strategic planning of a pharmaceutical firm in an emerging market	KPI-BSC-AHP	Pharmaceutical firm
Lee et al. (2011)	This paper combined the ANP and DEMATEL to explore the interactive relationships between factors of stock investment decision making	ANP-DEMATEL	Stock investment
Bentes et al. (2012)	The authors proposed the decision-making tool to measure and rank strategic alternatives for a Brazilian telecom company	BSC-AHP	Telecom company
Poveda-Bautista et al. (2012)	The research built a company competitiveness index and the usefulness for strategic management was illustrated through a case study of the Venezuelan plastic industry	BSC-ANP	Plastic industry
Wu (2012)	The authors determined the causal connections between the KPIs of a strategy map that was developed using the BSC method for banking institutions	KPI-BSC-DEMATEL	Banking institutions
Boj-Viudez et al. (2014)	This study proposed a framework to analyze the relevance of intangible assets in the achievement of an organization's strategic objectives in a university research center	BSC-ANP	Education
Shafiee et al. (2014)	combined the BSC with data envelopment analysis and the DEMATEL to create a model to help managers evaluate the supply chain performance of the Iranian food industry	BSC-DEMATEL	Food industry
Shaik and Abdul-Kader (2014)	The study provided a causal model supporting the reverse logistics decision-making process that improved enterprise performance	BSC-DEMATEL	Reverse logistics
Tjader et al. (2014)	The study combined BSC and ANP to develop a decision model for company level IT outsourcing strategy	BSC-ANP	IT
Büyüközkan and Güleriyüz (2016)	The paper integrated political and social, economic, technical attributes to build an evaluation model of the optimal renewable energy resource in Turkey	DEMATEL-ANP	Energy
Carlisle et al. (2016)	The research proposed a strategic prediction method for coastal projects. The authors revealed that the systematic approach combined with complex relationship management and other methodologies is useful for exploring negative externalities and effective strategic decisions for urban tourism development	System dynamics + scenario modeling	Coastal urban tourism projects
Michailidou et al. (2016)	The study presented an MCDA-based management framework that was formed through the case study of 18 mitigation and 16 adaptation strategies in a coastal tourism area	ELECTRE III/IV	Coastal tourism
Rahimnia (2016)	The proposed model helps to translate a university's vision into objectives and define the cause-and-effect relationships between them	BSC-DEMATEL	Education
Lane et al. (2017)	The study results provide the driving forces for improved community strategic planning in the context of a changing coastal environment due to global warming	System dynamics	Coastal communities
Modak et al. (2019)	The proposed approach in the study was to select the best outsourcing operational strategy for coal mining organizations in India	BSC-ANP	Coal mining
Quezada et al. (2018)	The study proposed a strategy map for a metalworking manufacturing enterprise	BSC-ANP-DEMATEL	Metalworking manufacturing
Balsara et al. (2019)	The paper exploited the advantages of this combination to assess the climate change mitigation strategies of the Indian cement industry	AHP-DEMATEL	Cement industry

to a case study of the Venezuelan plastic industry illustrated the usefulness of strategic management. Applying BSC and ANP to strategic planning helped to improve the organizational decision-making processes in several industries such as IT, mining, and education (Boj-Viudez et al., 2014; Modak et al., 2019; Tjader et al., 2014). In recent years, there are many studies consider combining BSC and DEMATEL methods. For example, the implications of the BSC-DEMATEL combination for educational administration strategies was demonstrated by (Rahimnia, 2016). The proposed model helps to translate a university's vision into objectives and define the cause-and-effect relationships between them. The linkage of AHP/ ANP and DEMATEL for strategic planning has attracted substantial research attention. Lee et al. (2011) provided the first combination of the ANP and DEMATEL to explore the interactive relationships between factors. Balsara et al. (2019) exploited the advantages of this combination to assess the climate change mitigation strategies of the cement industry, known as the largest pollution emitting industry.

Furthermore, the integrated approach using quantitative methods and scenario modeling has also received considerable interest (Gössling & Scott, 2012; Carlisle et al., 2016; Torres et al., 2017; Yuan et al., 2019). For instance, Carlisle et al. (2016) applied system dynamics and scenario modeling to propose a strategic prediction method for coastal projects. The authors revealed that the systematic approach combined with complex relationship management and other methodologies is useful for exploring negative externalities and effective strategic decisions for urban development. Michailidou et al. (2016) present an MCDA-based management framework formed through the case study of 18 mitigation and 16 adaptation strategies in a coastal tourism area. The ELECTRE III/IV-based software was applied to rank the optimal mitigation alternatives of the management strategies. Lane et al. (2017) use a system dynamics model for the strategic assessment of adaptation strategies for coastal communities.

After the literature review, we realize that the research on the strategic tools or approaches supporting enterprises investing in property projects in coastal zones is limited. The existing studies for coastal projects mainly focus on generic strategic management frameworks at the national or regional macro scales and have not been connected to the company and project level. Furthermore, the transition

of the strategic visions and objectives from the enterprises into lower units, such as business units or projects, has not yet been supported by tools or models using innovative quantitative methods. Therefore, the detected research gaps strongly motivated this study.

2. Methodology

This study combines ANP and DEMATEL to identify the causal connections of the strategy maps. In particular, the ANP helps to build a matrix of relationships that directly impacts the strategic goals and helps to evaluate the consistency of the opinions of interview participants, which the DEMATEL cannot do. On the other hand, the DEMATEL is used to create the total relationship matrix (indirect and direct relations) and the Impact Relationship Map (IRM). Figure 2 describes the proposed integrated framework in this study that support to strategic performance management of CUPs.

2.1. Setting the BSC framework with selected criteria

This research proposes a BSC-based performance management framework for CUPs using a strategy map with four perspectives: stakeholders' satisfaction, sustainability, internal processes, and learning and growth. Specifically, the strategic purpose of learning and growth identifies the organizational infrastructure for sustainable development. Whereas, it is necessary to focus on the internal processes within an organization to determine critical processes for the organization. With the sustainability perspective, the social and environmental impact assessment could disclose how to link the goals of the organization to its social and environmental missions. Whereas, the measures related to financial performance could explain how is the achievement of business performance. Finally, meeting the satisfaction of stakeholders may help the organization understand how happy the stakeholders are with project performances.

After defining the BSC aspects, strategic performance measures belonging to each BSC perspective need to identify. As a result of the literature review, this study selected a list of 13 proper success criteria for CUPs presented in Table 3.

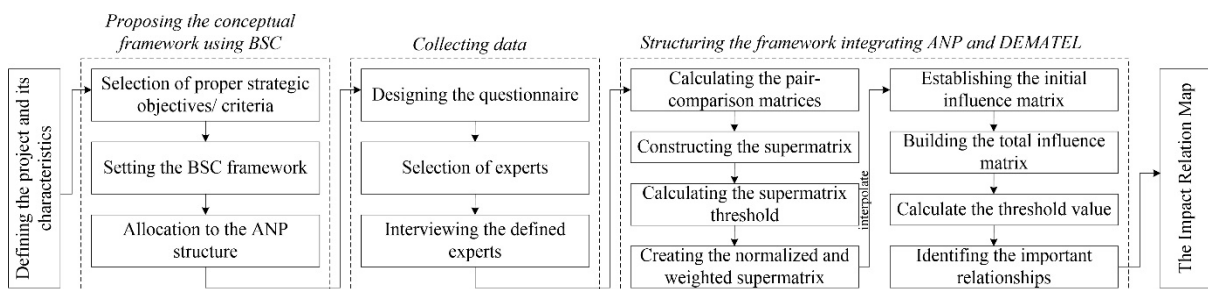


Figure 2. The proposed framework

Table 3. Performance criteria adopted in this study

Criteria	Brief descriptions	Explanations	References
1. Human (H)	Improvement level of human resources	Measuring the improvement level on staffing, training, professions, and skills until the project finished	Yu et al. (2007), Zhai et al. (2014)
2. Culture (C)	Cooperation and communication level	Measuring teamwork spirit, organizational culture, and association within the project	Yu et al. (2007), Zhai et al. (2014)
3. System (S)	Application IT level	Measuring the application level of information technology and automation in the project	Yu et al. (2007)
4. Time (T)	Predictability level on project time	$\frac{(\text{Actual time} - \text{Planned time})}{\text{Planned time}} \times 100\%$	KPI Working Group (2000), Tang et al. (2019), Yan et al. (2019)
5. Quality (Q)	Project quality	Meeting technical specifications	KPI Working Group (2000), Tang et al. (2019), Yan et al. (2019)
6. Technology (TE)	The development level of professional skills and applied technologies	The development level of professional skills of all project participants	Chan and Chan (2004), Toor and Ogunlana (2010), Chou et al. (2013), Davis (2017)
7. Legislation (L)	Legal performance	Meeting level of contract terms; consistency level of applied policies; the legal practice of project participants	Hui et al. (2008), Chou et al. (2013), Carvalho et al. (2015)
8. Resources (R)	Optimization level of using the project's resources	Optimization of available local resources in consumption of all resources for project completion and operation	Chou et al. (2013), Davis (2017), Yan et al. (2019)
9. Predictability (P)	Predictability of project	Meeting to future needs and potentials	Chou et al. (2013), Carvalho et al. (2015)
10. Health and safety (HS)	Meeting level to society's health and safety conditions	Project's satisfaction to environment, health and safety conditions of users, project neighborhood and society	KPI Working Group (2000), Chan and Chan (2004), Tang et al. (2019), Yan et al. (2019)
11. Environment (E)	Meeting level to strategic environmental objectives	Evaluated by the public council on all potential environmental impacts toward nature and community	KPI Working Group (2000), Chan and Chan (2004), Tang et al. (2019), Yan et al. (2019)
12. Financial performance (F)	Predictability level on project costs	$\frac{(\text{Actual cost} - \text{Planned cost})}{\text{Planned cost}} \times 100\%$	KPI Working Group (2000), Tang et al. (2019), Yan et al. (2019)
13. Stakeholders' satisfaction (SS)	Satisfaction level of stakeholders	Degree of overall satisfaction of main stakeholders and end-users	KPI Working Group (2000), Tang et al. (2019), Yan et al. (2019)

The learning and growth perspective can be considered to be the foundation of the home organization and should focus on building and continuous improvement through each project. Human, system, and culture are the three main contents that an organization should focus on in terms of learning and growth. Human represents project employees and managers whereby they need to improve their professional capacities and personal and communication skills that could help to enhance their performance and organizational performance as well. Besides, system content includes information resources, software/tools and databases that are intangible resources that the project should utilize and use to improve efficiency and achieve goals. Culture content tells about teamwork spirit, organizational culture, and association within the project. This content becomes significant in today's modern businesses.

For internal processes perspective, time, technology, quality, legislation, and project resources are five essential strategic measures to the measurement of internal process effectiveness. These strategic measures are typical performance measurement criteria through literature review (i.e. Davis, 2017; Yan et al., 2019; Tang et al., 2019). Time presents predictability level on project time, while quality indicates the project quality performance that is measured by the meeting of a technical specification or by the number of quality issues during construction and operational phases. The technology measures the degree of conformance to project functionality by meeting all technical specifications. The project resources evaluate the optimization level of using project resources. The consumption of resources for completing and operating the project needs to be optimized and preferred to available local resources. Besides,

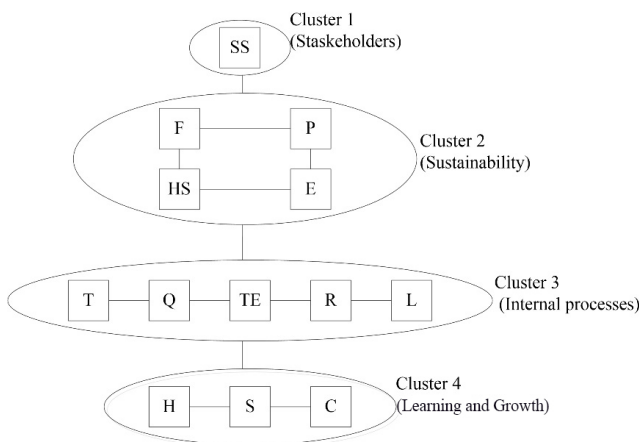
legislation assesses the meeting level of contract terms, the consistency level of policies applied for the project, and the legal practice of the project participants.

Strategic measures of the sustainability aspect are health and safety, environment, financial performance, and predictability. Such performance metrics have received the attention of many previous studies on integrating sustainable development dimensions into project performance measurement criteria (i.e. Chou et al., 2013; Tang et al., 2019; Yan et al., 2019). The indicator of health and safety evaluates the projects' meeting level to health and safety requirements, while the environment criterion measures the meeting level to environmental management targets of project locations. Therefore, these projects need to be assessed by the public council on projects' environment impacts and health and safety conditions to the community.

The stakeholders' satisfaction perspective is at the top level of the BSC framework. The most important index of CUPs is to measure the satisfaction of the related stakeholders. Accordingly, the degree of overall satisfaction of main stakeholders who participated during the project phases included end-users should be quantified.

2.2. Designing the ANP structure

Figure 3 depicts the structure of the ANP model for the strategic framework of CUPs. The model is a network in which nodes represent strategic objectives/success criteria. These objectives are grouped into BSC perspectives, expressed as clusters in the ANP structure. Accordingly, the ANP model has 4 cluster levels that are arranged following the hierarchical results from the top to the bottom of the strategy map, as done by Kaplan and Norton (2004). In particular, cluster level 4 is the group of the strategic objectives of the learning and growth aspect, and the third-floor cluster is the internal processes aspect. Cluster level 3 indicates the sustainability perspective, and the top one is about the stakeholders' satisfaction. Specifically, cluster



Notes: SS – Stakeholders Satisfaction; F – Financial performance; P – Predictability; HS – Health and Safety; E – Environment; T – Time; Q – Quality; TE – Technology; R – Resources; L – Legislation; H – Human; S – System; C – Culture.

Figure 3. The ANP structure of the strategic objectives

level 3 is sustainability cluster, since it includes the strategic objectives of sustainable development. The top represents the most crucial goal of CUPs, which is to achieve satisfaction for all stakeholders throughout the project life cycle.

2.3. Questionnaire survey

The purpose of investigating the opinions of decision-makers is to compare the importance of the criteria with one another. The weight matrix, which is the input matrix of the DEMATEL method, can be calculated. Although the data collection mode is direct interviews with experts, carefully designing a clear survey is necessary. The questionnaire has four essential parts, including the introduction to the research purpose, author, and the information of the surveyed person; an introduction to the conceptual strategy map (strategic objectives and strategic perspectives); an introduction to the scale; and an example of the understanding and answering questions.

For the interview questions, the questionnaire comprises ten questions related to the importance of the criteria to one another to support their achievement of the BSC perspectives, and three questions to survey the influences between criteria within the same cluster. The first ten questions use the scale of ANP, and the remaining questions apply the DEMATEL scale. Similar to the AHP method, the ANP method also uses a 9-point scale (1=equal importance, 2=weak, 3=moderate importance, 4=moderate plus, 5=strong importance, 6=strong plus, 7=very strong or demonstrated importance, 8=very very strong, and 9=extreme importance) (Saaty & Vargas, 2006). The DEMATEL scale is a range of 0 to 4 (0 = no influence, 1 = low influence, 2 = medium influence, 3 = high influence, and 4 = very high influence) (Si et al., 2018).

An example question to survey the importance of strategic criteria is as follows: Do you think that the achievement of human development, automation/database/systems development, and organizational culture development has an impact on achieving the optimal objective of time? If yes, please compare the importance of achieving these objectives in influencing the achievement of the goal of time.

2.4. Combination of ANP and DEMATEL to structure the strategy map

As shown in Figure 2, after the problem definition, the strategic criteria, and the ANP model structure are established, the following steps need to be taken.

Step 1: Calculate the pair comparison matrices between the nodes in each cluster. This work helps to determine the priority weights of the criteria. This step also helps to evaluate the consistency of the respondent's response data. The construction of the paired comparison matrices is performed using Equation (1), and the consistency evaluation of the data is performed using Equation (2).

$$A = \lambda_{\max} \cdot w, \quad (1)$$

where: A is a comparison matrix; λ_{\max} is the maximum eigenvalue of the matrix A ; w is the weighting vector.

$$CR = \frac{\lambda_{\max} - n}{RI \cdot (n - 1)}, \tag{2}$$

where: n is the size of the comparison matrix A ; RI is a random index that depends on the matrix's size.

Step 2: Develop an unweighted supermatrix. The resulting vectors in step 1 are introduced to construct the supermatrix based on the supermatrix structure shown in Figure 4. It is supposed that the analytic network has N clusters (cluster N is denoted as C_N), and the cluster N has n nodes (the number of nodes in the cluster N is denoted as $n(N)$ and node n of the cluster N is denoted as e_{Nn}).

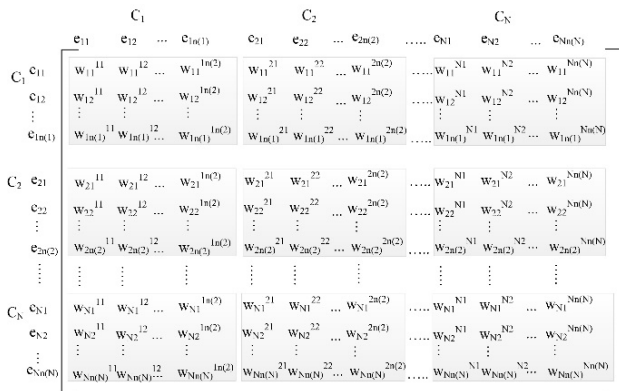


Figure 4. Structure of the supermatrix in the ANP

Step 3: Calculate the limit value of the supermatrix. The supermatrix is limited to obtaining the weights of the nodes in each cluster. The calculation of the limit value of the supermatrix is performed using the Superdecisions software.

Step 4: Calculate the weighted supermatrix (weighted supermatrix).

Let w_{ki}^{lj} denotes the priority of node i in the cluster k in comparison to the node j in cluster l where $\forall i, j, k, l$, and w_{ni}^{mj} is the element of the supermatrix; q_k^{lj} denotes the number of nodes of the cluster k that are related to the node j in the cluster l , where $\forall j, k, l$; d_j^l denotes the weight of node j in the cluster l , and this weight was calculated in step 3. Accordingly, the supermatrix includes the weights that are calculated by the following equation:

$$c_{ki}^{lj} = w_{ki}^{lj} \cdot d_j^l \cdot q_k^{lj}. \tag{3}$$

Step 5: Before converting the data into the matrix of the initial effects of the DEMATEL method, the supermatrix with the weights in step 4 should also be normalized by multiplying by the s factor calculated using Equation (4).

$$s = \text{Min} \left[\frac{1}{\text{Max}_{1 \leq i \leq n} \sum_{j=1}^n a_{ij}}, \frac{1}{\text{Max}_{1 \leq j \leq n} \sum_{i=1}^n a_{ij}} \right], \tag{4}$$

where: a_{ij} represents the direct relationship of the factor i on the factor j ($\forall i, j$); n represents the factor number.

Step 6: Develop the initial matrix of the influence. The data entered into the initial influence matrix of the DEMATEL method has a scale from 0–4 (0 = no influence, 1 = low influence, 2 = medium influence, 3 = high influence, and 4 = very high influence). To exploit the weighted supermatrix (scale 0–1) and to standardize it using the ANP to build the initial influence matrix, the transition from a scale from 0–1 to a scale from 0–4 should be implemented. The interpolation method is adopted from the study of Quezada et al. (2018) to change a 0–1 scale to a 0–4 scale as in Equation (5).

Let a_{ki}^{lj} denotes the importance (regarding the scale from 0 to 4 of the DEMATEL method) of the node i in cluster k compared to the node j in the cluster l , where $\forall i, j, k, l$.

$$a_{ki}^{lj} = \begin{cases} 0 & \text{if } c_{ki}^{lj} = 0 \\ 3 \cdot \frac{c_{ki}^{lj} - v}{V - v} + 1 & \text{otherwise} \end{cases}; \forall i, j, k, l, \tag{5}$$

where: $V = \max_{kij} \{c_{ki}^{lj}\}$ and $v = \min_{kij} \{c_{ki}^{lj} > 0\}$.

Step 7: Develop an overall influence matrix using Equations (6) and (7).

$$T = [t_{ij}]_{j=1, \dots, n}^{i=1, \dots, n}; \tag{6}$$

$$T = \frac{X}{(I - X)}. \tag{7}$$

Step 8: Calculate the values in Equations (8) and (9) to determine which strategic goal is the cause (influence) and what is the result (affected).

$$r_i = \sum_{j=1}^n t_{ij} : \text{sum of the row } i \forall i, \text{ and} \tag{8}$$

$$c_j = \sum_{i=1}^n t_{ij} : \text{sum of the column } j \forall j. \tag{9}$$

Step 9: Determine the threshold value that classifies which relationships are important and which are not. The unimportant relationships do not need to show in the impact relationship map (IRM). The threshold value is the average value of all elements in the overall influence matrix. Whereby, those relationships with influence values that are greater than or equal to the threshold values are retained, and values that are less than the threshold values do not need to express in the IRM.

3. Case study

3.1. Introduction to the studied case

This study was motivated by one of the most famous investment corporations in real estate, especially luxury hospitality projects in Vietnam. For the sake of confidentiality, this paper calls it SG Corporation. SG is an investment enterprise founded in 1998. Since establishment, SG has been developing dramatically and has become one of the most

Table 4. Profiles of interviewed experts

Expert	Designation in organization	Role of organization	Year of experience
1	Deputy-chief executive officer	The corporation X	+13
2	Head	Project management office	+13
3	Director	Contractor	+15
4	Head	Engineering and consultancy office	+13
5	Director	Department of construction (government management unit)	+20
6	Director	Department of resources and environment (government management unit)	+20
7	Vice president	District authority (government management unit)	+15

well-known companies in hospitality property investment in Vietnam. SG has 51 member-companies, 4631 staff, 113 projects with a total investment capital of US\$6.85 billion in 4 main business fields, including leisure travel, reaction and entertainment, real estate, and infrastructure investment. Among SG's products, some projects received famous international awards in the tourism industry.

Data used in this study was collected from direct interviews with seven experts from top managers of SG company and organizations that have had many years of experience in cooperation with SG in CUPs. Table 4 briefly describes the profiles of these experts. In addition to managers of SG, this study also invited the leader of a contractor that has had more than 15 years of working experience with SG and the representative leaders of government management units (GMUs). Because the CUP is quite complex due to the diverse and sensitive built environment characteristics, research data should consider the opinions of different stakeholders. Therefore, the appearance of experts from GMUs is valid for this study. An expert surveying is a valuable tool in situations where a regular implementation of assessment is not easy. And it enables researchers to investigate subjects that could otherwise be hard to study systematically. Besides, expert surveys may often be carried out quicker

and more cost-effectively than broad public opinion surveys. The efficiency gains are highest when expert pools of less than ten raters are supplemented (Maestas, 2016).

3.2. Results

3.2.1. Calculating the weighted supermatrix using the ANP method

Following the process of applying the ANP method described above, the matrix comparing the pairs of strategic objectives/success criteria in each cluster is calculated based on the opinions of each expert. Following the ANP network structure proposed in Figure 3 and the results of the pair-weighted vectors, a supermatrix (Table 5) is constructed to show the priority of the nodes on the map. Because there are 13 strategic objectives, the supermatrix matrix is a 13×13 square matrix.

After establishing the supermatrix matrix, the next step is to calculate the threshold for this matrix and, thereby, determine the weight of each strategic criterion in each cluster. This study used Superdecisions software version 3.2 (2019) to calculate the threshold for the supermatrix and determine the weight values of the 13 strategic criteria in each perspective, as shown in Table 6. Because there is only one node in cluster 1 (stakeholder

Table 5. Unweighted supermatrix

	SS	F	HS	E	P	T	Q	TE	R	L	H	S	C
SS	0	0	0	0	0	0	0	0	0	0	0	0	0
F	0.195	0	0	0	0	0	0	0	0	0	0	0	0
HS	0.287	0	0	0	0	0	0	0	0	0	0	0	0
E	0.248	0	0	0	0	0	0	0	0	0	0	0	0
P	0.270	0	0	0	0	0	0	0	0	0	0	0	0
T	0	0.195	0.047	0.043	0.041	0	0	0	0	0	0	0	0
Q	0	0.231	0.226	0.151	0.287	0	0	0	0	0	0	0	0
TE	0	0.113	0.279	0.212	0.194	0	0	0	0	0	0	0	0
R	0	0.178	0.279	0.465	0.285	0	0	0	0	0	0	0	0
L	0	0.282	0.168	0.128	0.192	0	0	0	0	0	0	0	0
H	0	0	0	0	0	0.284	0.121	0.438	0.299	0.606	0	0	0
S	0	0	0	0	0	0.202	0.351	0.426	0.421	0.088	0	0	0
C	0	0	0	0	0	0.514	0.528	0.136	0.280	0.306	0	0	0

Table 6. The weights of the strategic objectives

Perspectives	Measures	Weight
Sustainability	F	0.195
	HS	0.287
	E	0.248
	P	0.270
Internal processes	T	0.073
	Q	0.225
	TE	0.207
	R	0.307
	L	0.187
Learning and growth	H	0.328
	S	0.328
	C	0.344

satisfaction), there will be no weight for this objective in table. And it is considered that the weight value of the stakeholder satisfaction objective is equal to 1.

The supermatrix is weighted according to Equation (3) and then normalized to the whole matrix according to Equations (4) and (5). Table 7 shows the weighted and standardized supermatrix.

3.2.2. Identification of the causal relations by the DEMATEL method

To build the original DEMATEL influence matrix, the elements in the supermatrix, that are weighted and normalized, are converted to a scale of (0–4) using the interpolation Equation (5). The influences of the objectives within the same perspective are calculated using the mean ratings of the decision-makers. Table 8 shows the initial impact matrix.

Table 7. Normalized and weighted supermatrix

	SS	F	HS	E	P	T	Q	TE	R	L	H	S	C
SS	0	0	0	0	0	0	0	0	0	0	0	0	0
F	0.195	0	0	0	0	0	0	0	0	0	0	0	0
HS	0.287	0	0	0	0	0	0	0	0	0	0	0	0
E	0.248	0	0	0	0	0	0	0	0	0	0	0	0
P	0.270	0	0	0	0	0	0	0	0	0	0	0	0
T	0	0.047	0.017	0.013	0.014	0	0	0	0	0	0	0	0
Q	0	0.056	0.081	0.047	0.097	0	0	0	0	0	0	0	0
TE	0	0.028	0.100	0.066	0.066	0	0	0	0	0	0	0	0
R	0	0.043	0.100	0.144	0.096	0	0	0	0	0	0	0	0
L	0	0.069	0.060	0.040	0.065	0	0	0	0	0	0	0	0
H	0	0	0	0	0	0.016	0.020	0.068	0.069	0.085	0	0	0
S	0	0	0	0	0	0.011	0.059	0.066	0.097	0.012	0	0	0
C	0	0	0	0	0	0.028	0.090	0.021	0.065	0.043	0	0	0

Table 8. Initial influence matrix

	SS	F	HS	E	P	T	Q	TE	R	L	H	S	C
SS	0	0	0	0	0	0	0	0	0	0	0	0	0
F	2.995	0	0.286	0.000	0.571	0	0	0	0	0	0	0	0
HS	4.000	2.857	0	0	2.000	0	0	0	0	0	0	0	0
E	3.570	3.429	3.143	0	0.571	0	0	0	0	0	0	0	0
P	3.814	2.857	0.000	2.286	0	0	0	0	0	0	0	0	0
T	0	1.394	1.065	1.025	1.031	0	2.143	0.000	0.000	0.000	0	0	0
Q	0	1.491	1.763	1.388	1.933	0	0	0.286	0.429	2.000	0	0	0
TE	0	1.179	1.969	1.591	1.592	1.571	2.857	0	0.714	0.714	0	0	0
R	0	1.351	1.969	2.445	1.926	0.286	0.571	1.143	0	0.714	0	0	0
L	0	1.627	1.533	1.311	1.583	1.429	0.286	0.000	0.000	0	0	0	0
H	0	0	0	0	0	1.049	1.101	1.619	1.628	1.802	0	2.000	0.714
S	0	0	0	0	0	1.000	1.523	1.599	1.934	1.014	0	0	0
C	0	0	0	0	0	1.187	1.849	1.109	1.581	1.344	0	0	0

DEMATEL total influence matrix is a matrix that shows both the direct relationships and also the indirect relationships (if any). Before establishing the total influence matrix, the initial influence matrix needs to be normalized. Table 9 shows the matrix of the initial influence after normalization.

The influence matrix is built based on Equation (7). Table 10 shows the total influence matrix of the research project. This table shows the values of r (determined by the Equation (8)) and c (determined by the Equation (9)).

Table 11 presents the results of identifying the “cause” and “effect” criteria of the studied project. After determining the r and c values of each strategic objective, the value ($r - c$) of the 13 strategic criteria shows that the criteria belonging to “learning and growth” and “internal processes” are causes, and the measures in the “sustainable development” and “stakeholder satisfaction” clusters are consequential. The value ($r + c$) represents the magnitude of each strategic objective’s influence. Accordingly, “quality”, “resources”, and “technology” are highlighted as the most prominent causes in the strategy map.

Table 9. The normalized initial matrix of the direct relations

	SS	F	HS	E	P	T	Q	TE	R	L	H	S	C
SS	0	0	0	0	0	0	0	0	0	0	0	0	0
F	0.185	0	0.018	0	0.035	0	0	0	0	0	0	0	0
HS	0.247	0.177	0	0	0.124	0	0	0	0	0	0	0	0
E	0.221	0.212	0.194	0	0.035	0	0	0	0	0	0	0	0
P	0.236	0.177	0	0.141	0	0	0	0	0	0	0	0	0
T	0	0.086	0.066	0.063	0.064	0	0.132	0	0	0	0	0	0
Q	0	0.092	0.109	0.086	0.119	0	0	0.018	0.026	0.124	0	0	0
TE	0	0.073	0.122	0.098	0.098	0.097	0.177	0	0.044	0.044	0	0	0
R	0	0.083	0.122	0.151	0.119	0.018	0.035	0.071	0	0.044	0	0	0
L	0	0.100	0.095	0.081	0.098	0.088	0.018	0	0	0	0	0	0
H	0	0	0	0	0	0.065	0.068	0.100	0.101	0.111	0	0.124	0.044
S	0	0	0	0	0	0.062	0.094	0.099	0.119	0.063	0	0	0
C	0	0	0	0	0	0.073	0.114	0.068	0.098	0.083	0	0	0

Table 10. Total influence matrix

	SS	F	HS	E	P	T	Q	TE	R	L	H	S	C	r
SS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F	0.202	0	0.019	0.005	0.038	0	0	0	0	0	0	0	0	0.265
HS	0.322	0.205	0	0.019	0.132	0	0	0	0	0	0	0	0	0.678
E	0.337	0.262	0.201	0	0.070	0	0	0	0	0	0	0	0	0.869
P	0.319	0.215	0.032	0.144	0	0	0	0	0	0	0	0	0	0.710
T	0.099	0.157	0.103	0.092	0.104	0	0.134	0.003	0.004	0.017	0	0	0	0.711
Q	0.143	0.195	0.157	0.128	0.170	0.014	0	0.020	0.028	0.127	0	0	0	0.980
TE	0.166	0.212	0.198	0.161	0.179	0.105	0.195	0	0.050	0.071	0	0	0	1.337
R	0.169	0.207	0.185	0.195	0.177	0.029	0.053	0.072	0	0.054	0	0	0	1.141
L	0.121	0.181	0.129	0.109	0.134	0.089	0.029	0.001	0.001	0	0	0	0	0.792
H	0.074	0.100	0.082	0.073	0.081	0.103	0.128	0.127	0.129	0.150	0	0.124	0.044	1.213
S	0.064	0.085	0.071	0.064	0.070	0.083	0.131	0.110	0.128	0.089	0.000	0	0.000	0.893
C	0.061	0.084	0.068	0.060	0.068	0.092	0.146	0.078	0.105	0.109	0.000	0.000	0	0.872
c	2.077	1.903	1.244	1.048	1.222	0.515	0.815	0.410	0.443	0.616	0.000	0.124	0.044	

Table 11. Determination of the cause-and-effect relationships

Perspectives	Measures	$r + c$	Rank	$r - c$	
Stakeholders	SS	2.077	2	-2.077	Effects
Sustainability	F	2.167	1	-1.638	
	HS	1.923	4	-0.566	
	E	1.917	5	-0.179	
Internal processes	P	1.931	3	-0.512	Causes
	T	1.226	5	0.196	
	Q	1.795	1	0.165	
	TE	1.747	2	0.927	
	R	1.584	3	0.698	
Learning & growth	L	1.408	4	0.175	Causes
	H	1.213	6	1.213	
	S	1.017	7	0.770	
	C	0.916	8	0.828	

3.2.3. Building the impact-relation map (IRM)

The IRM is a visualized product of the application of the proposed framework to deliver strategic suggestions for the success of CUPs. Accordingly, a network-based strategy map has resulted in which the strategic performance measures in the BSC perspectives are identified regarding causal-effect relationships.

The IRM is designed using data of Table 10 in which all influences, including direct and indirect relationships, are quantified. Two questions, needed to answer to develop the IRM, are (1) How are the dimensions of the arrows related to the strategic objectives? (2) What relationships are important enough to be shown in the IRM? With the second question, the threshold value needs to calculate to determine whether the relationship is important enough. In many previous related studies, a threshold value has been the average value of all the elements in the total influence matrix. For this case study, the threshold value is 0.109, calculated following this approach. Accordingly, the relationships which have a value higher than 0.109 are significant and shown in the IRM (Figure 5).

Finally, the IRM in Figure 5 is drawn by plotting the related values of 13 criteria in Table 10 on a scatter plot with a horizontal axis ($r + c$) and a vertical axis ($r - c$). The horizontal axis describes prominence, which means that the farther to the right side, the more prominent than the others the criteria recognized. On the vertical axis, values above zero indicate causes, whereas negative values specify effects. In the IRM, the lines with arrows indicate the direction of influences between criteria having the values higher than the threshold value (0.109). The regular arrows, which represent the cause-effect relationships determined by the threshold, are the stronger ones. The dotted arrows indicate the significant influences among causes or effects.

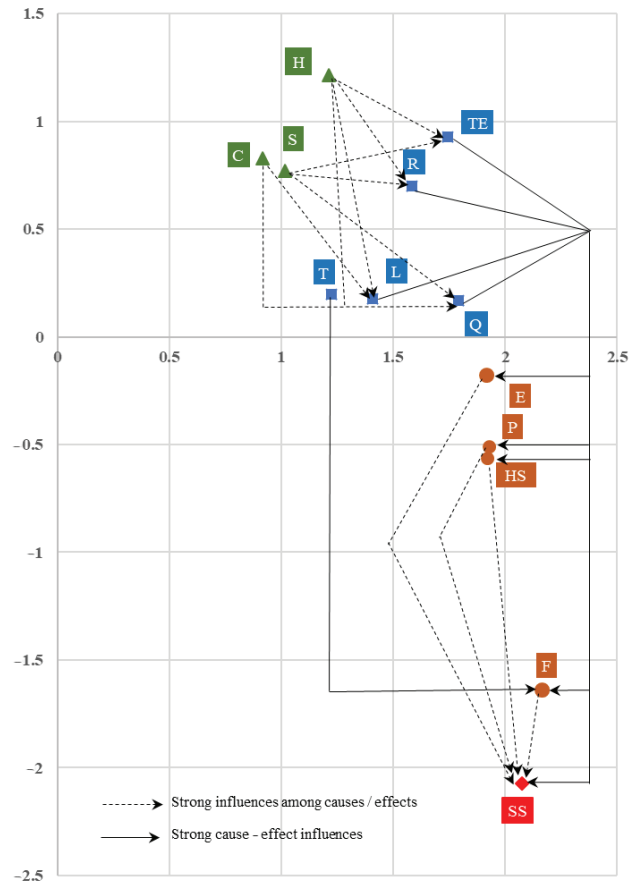


Figure 5. The impact-relation map

4. Discussion

4.1. Discussion on case study’s results

In overview, Figure 5 shows that the fulfillment of 8 criteria of “learning and growth” and “internal processes” perspectives may significantly affect the four sustainability criteria of “sustainability” perspectives, and so that impact on the “stakeholders’ satisfaction” goal. On the other hand, the IRM indicates influences among these 8 “cause” objectives as well as among 5 “effect” goals.

In general, five causes belonging to “internal processes” aspect including T (time), Q (quality), TE (technology), R (resources), and L (legislation), are affected by three causes of “learning and growth” perspective comprising of H (human), C (culture), and S (system). In particular, the dotted arrows from three causes, namely H (human), C (culture), and S (system) to Q (quality), indicate that they may strongly affect the achievement of the project quality’s objective. The remaining dotted arrows in the upper part of Figure 5 present that H (human) and S (system) have substantial influences to TE (technology) and R (resources), whereas L (legislation) is strongly affected by the two causes, namely H (human) and C (culture). From these observations, there are several insights discovered. Accordingly, to improve the performance of the meeting

level to legislation, the coastal project should focus on the fulfillment of human and culture related criteria (i.e. staffing, training, building, and monitoring organizational culture...). Alternatively, to enhance the performance of technology and resource-consuming in the project, the role of the human resource and IT system/automation level should be highly appreciated.

The IRM also shows the relationships among 5 “effect” criteria. The dotted arrows in the lower part of Figure 5 reveal that the achievement of 4 “sustainability” criteria including F (financial performance), HS (health and safety), E (environment), and P (predictability) of the project may play an important role to be able to help the project could achieve the satisfaction of all stakeholders.

In addition to the above observations about the direction of criteria, the IRM also indicates the relationship’s prominence (using X-axis values) within causes and effects, presented in the part (a) and (b) of Figure 6 respectively. Among effects, SS (stakeholders’ satisfaction) and F (financial performance) are the most prominent. SS, affected by the most other criteria, expresses that the satisfaction of stakeholders can appreciate as the most important consequence. Among the causes, the five causes related to “internal processes” are more prominent than the three from “learning and growth.” In detail, Q (quality) is considered as the most leading cause in a CUP, while the followings are TE (technology), R (resources), L (legislation), and T (time), all from the internal processes.

To more broadly analyze, the relationships within each BSC perspective are also visualized in detail in Figure 7. The parts (a), (b), (c) of Figure 7 describes a more detail view on the interactions among criteria in “learning and growth”, “internal processes”, and “sustainability” aspects sequentially. This study also discloses the significant impact of H (human) on criteria S (system) through the arrow from H to S, as shown in part (a) of Figure 7. Besides, criteria H (human), which has the largest value on the X-axis among the three causes of “learning and growth”, is appreciated as the most prominent or the root cause for the growth of the CUP. On the other hand, the arrows, presented in part (b) of Figure 7, indicate the interesting interactions among “internal processes” criteria. For instance, although Q (quality), which has the highest X-axis value, is the most prominent cause, it also is affected strongly by the achievement of T (time) and TE (technology). Besides, once crite-

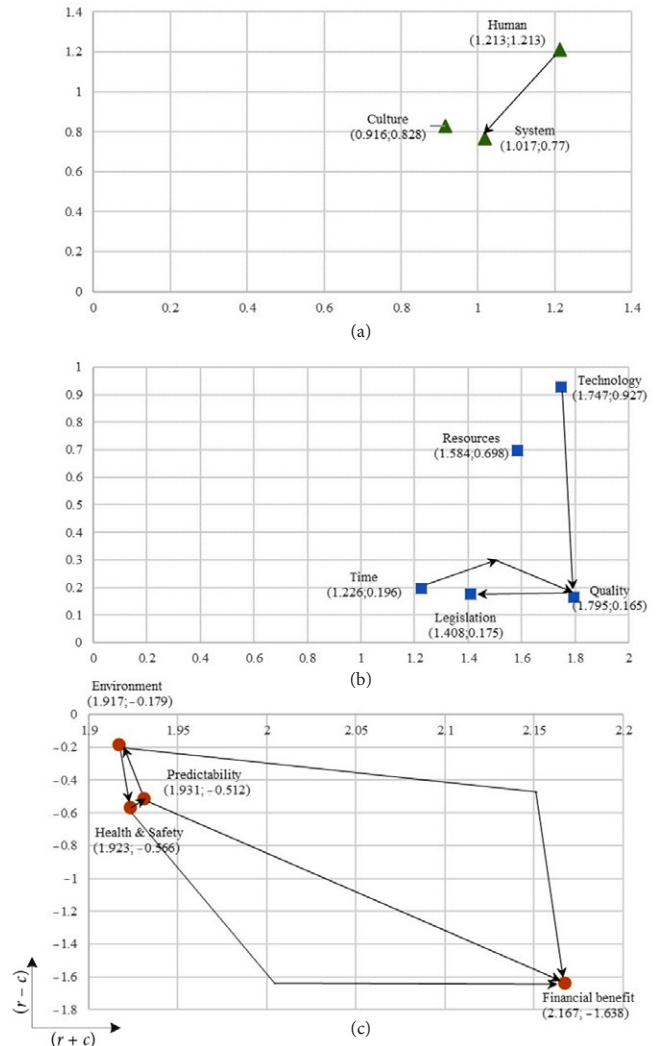


Figure 7. The relationships within each perspective: (a) Learning and growth perspective; (b) Internal processes perspective; (c) Sustainability perspective

ria Q (quality) is obtained, it could support usefully to the project meeting level to legislation. Finally, the part (c) of Figure 7 draws the connections among the 4 “effect” criteria of sustainability dimensions. For the sustainable development of the CUPs, F (financial performance), which has the highest X-axis value, is still considered as the most important objective. However, the direction of arrows express that the financial performance of CUPs could only be achieved as the criteria of E (environment), HS (health and safety), and P (predictability) fulfilled. On the other hand, the arrows from P (predictability) to E (environment) and F (financial performance) emphasize the position of planning and forecasting activities to the performance of sustainable development dimensions for CUPs.

It should note that the abovementioned discussions are for the studied case based on the company leaders as well as related organizations’ leaders. To generalize for the type of CUPs, this is beyond the scope of this study. Future work may conduct multiple-case studies with large-scale surveys (semi-structured questionnaires or direct interviews) to senior managers to ensure the strategy is trustworthy.

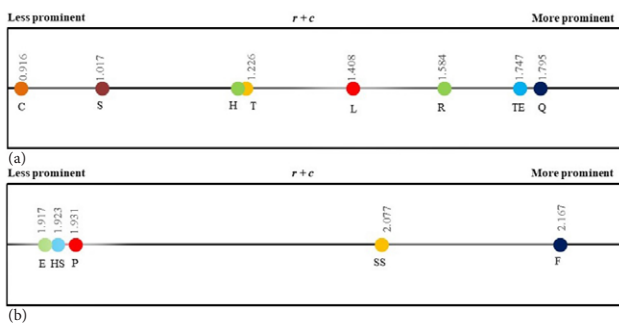


Figure 6. The prominence of criteria

4.2. Discussion on model development

This study proposed a strategic performance management model delivered a strategy map that would facilitate companies investing in CUPs under the increasing impact of climate change. Representative project management measures and sustainable development dimensions integrated into the strategy map. These measures are allocated in strategic perspectives structured by the BSC method, including learning and growth, internal processes, sustainability, and stakeholders' satisfaction. Through the case study, it should recognize the importance of learning and growth as the basis for companies' advancement. Internal controls of time, technology, quality, legislation, and project resources, and related elements are drivers of operational processes. Besides, financial, social and environmental performances need to be administrated and managed effectively and flexibly to warrant the success of the business with high predictability, while environment, health, and safety-related requirements also need to be acquired. Overall, the strategy map, which is a product of implementation of the proposed model, helps decision-makers map out which strategic objectives should be highly focused to achieve better operational goals, which organizational elements are the foundation of growth and development, and how to obtain the satisfaction of stakeholders.

In terms of managerial implications, the proposed strategy map following the integrated framework in this study has the role of a strategic decision-support-system tool to assist CUPs in deploying strategic actions, monitoring the organizational operation during the project administration process. After each operational cycle (month, quarter, year), the strategic objectives/performance measures need to be quantified and evaluated to find out which ones are lagging and leading. An accurate selection of the lag and the lead measures is important in assessing and monitoring the status of the objectives of the project because it helps managers in deciding corrective actions to refine for better project performance. In monthly strategy reviewing meetings, the use of this strategic framework can help identify scores of strategic objectives to develop the project scorecard.

Overall, the proposed model helps to solve two problems that have not been adequately paid attention in previous studies. The first is a lack of integration of sustainable development goals with regular goals of successful management for project development for CUPs. The second is the tools that propose strategies for managing coastal projects are mainly general and qualitative, without rigorous quantification at the project level and lack of connection between technical project requirements and sustainable development goals.

A comparison with the other MCDM models applied for strategic planning and performance management can explain the superiority of the proposed model. Among relative researches shown in Table 2, several noteworthy studies followed the approach of developing strategy maps

to support decision-makers. Hsu et al. (2011) applied four techniques of BSC, Delphi, ANP, and fuzzy logic to create the sustainability framework to measure the sustainable strategic performance of Taiwanese semiconductor companies. The authors suggested 25 performance measures grouped in four BSC aspects and then employed ANP to rank them based on their weights. Similarly, Lee et al. (2011) tried to use DEMATEL for their research. But the authors only exploited this method to survey inter-dependences between studied factors before they applied ANP to calculate and rank the factors. Both Hsu et al. (2011) and Lee et al. (2011) did not disclose the causal relations among performance criteria so that decision-makers could clearly understand they should focus on which strategic activities. Wu (2012) used DEMATEL to determine causal relationships of KPIs in the strategy map created by the BSC method for banking institutions. But Wu (2012) did not overcome the main weakness of DEMATEL, which was the consistency guarantee of input data. This weakness limited the reliability of DEMATEL application results. In following years, Shafiee et al. (2014), Shaik and Abdul-Kader (2014), or Büyüközkan and Güleriyüz (2016) have still not solved this disadvantages of DEMATEL in the field of strategic management. Quezada et al. (2018) and Balsara et al. (2019) presented remarkable contributions in dealing with the reliability of DEMATEL by using ANP to check consistency data and then estimate the direct influences between those elements in a matrix. Although Quezada et al. (2018) and Balsara et al. (2019) presented some findings, they had not paid attention to the logic of measures used in ANP and DEMATEL matrices that the BSC method evinces its usefulness. This paper presents the integration of the BSC, ANP, and DEMATEL methods with trying to overcoming the limitations of the previous studies. The three strengths of these methods are united in this paper. Firstly, the strategic measures are developed logically and scientifically by using the BSC method. Secondly, it guaranteed the data inputs about the consistency through employing the ANP. And thirdly, the causal relationships in the strategic frameworks can be determined as the results of applying the DEMATEL. In the other hand, this proposed model does not avoid two weaknesses: (1) The calculation load can be increased if the number of factors is too much; (2) Because this model uses data collected by human judgment, the techniques to strengthen the reliability such as fuzzy logic or machine learning show the potential contributions.

The obtained result of this study also compared with the other researches. In terms of highlighting the importance of strategic sustainability performances toward sustainable organizations, this study presents the convergence with other research published in top-quality journals. For example, Baumgartner and Rauter (2017) also agreed that a sustainability output should focus on the environment, the economic and social effects of the company's capital, and on the goods and the services it provides. They emphasized that sustainability focus could also make the

business sector more competitive. They recognized the organizational culture as a significant impact on the different steps needed to become a sustainable organization. After a survey of 389 construction industry practitioners in China, Yan et al. (2019) also concluded similar findings that financial performance and project quality were highlighted as the most promote criteria for project success. Yan et al. (2019) also recommended companies for the dimensions related to strategic organizational objectives, social stability, project performance, and satisfaction of project stakeholders. Nevertheless, these studies did not disclose the causal relationships among strategic goals to help decision-makers find a balanced and optimized strategy toward success.

Conclusions

To assist enterprises in planning, assessing, and monitoring project performance, this study contributes to a strategic management tool. This research has suggested a quantitative approach integrating the BSC, ANP, and DEMATEL methods to build the impact relationship diagram to complete the strategic map for coastal projects. The ANP is employed to determine the direct relations between strategic goals structured in the BSC perspectives. The benefit of using the ANP is that it helps to evaluate the consistency of the survey data. The ANP also allows for the integration of interdependent information between goals. In that context, the DEMATEL method helps to identify the direct/indirect relationships and quantifies the mutual influences of the strategic objectives. A threshold value is determined and exploited as the basis for selecting important relations to be shown in the strategy map. Quantifying relationships is a powerful and useful tool that helps project managers/decision-makers to know where to put more efforts to improve project performance and to complete strategies.

The suggested model combines sustainable development dimensions with organizational foundation factors and internal measures of successful project management for CUPs. It is different from the other MCDM models in explanation of the causal relationships among performance criteria. This advantage helps decision-makers to understand better they should focus on what strategic activities.

Overall, this study presents the convergence with the other researches on strategic performance measures that a sustainable organization should pursue. Besides, this research reveals that the achievement of “internal processes” criteria can be affected by “learning and growth” factors such as human resource, organizational culture, and IT system/automation level. It should pay more attention to financial performance, health and safety, environmental impacts, and predictability of the project to obtain the stakeholders’ satisfaction. Stakeholders’ satisfaction is an essential effect. The most leading cause in a CUP is project quality, whereas human resources are the root cause of the growth of the project.

One of the drawbacks of the method used in this study is that it takes quite a lot of time, particularly when applying the ANP. A large number of comparisons need to make. Like other empirical studies, the reliability of the results much depends on the feedback data from respondents. In the interview process, data may not be consistent (evaluated by the ANP technique). But thank the data validation process, managers also have to think and discuss to understand more about the strategic issues; so that they can better implement the project in the future. The application of the whole process of this research can help the communication between stakeholders in the project, which will improve long-term development goals.

Notably, it is not possible to have a single strategy map for all projects or all companies investing in CUPs projects because each project and each enterprise have different characteristics. For example, the internal and external environments of the company and the project are different. The approach proposed for CUPs in this study should be flexibly applied depending on the characteristics of projects.

Acknowledgements

This research is funded by Ho Chi Minh City University of Technology (HCMUT), VNU-HCM, under grant [number BK-SDH-2021-1680960].

Author contributions

Long Le-Hoai and Truc Thi-Minh Huynh conceived the study and were responsible for the design and development of the data analysis. Anh-Duc Pham was responsible for data collection and methodology while Long Le-Hoai and Truc Thi-Minh Huynh were responsible for data analysis and interpretation.

Disclosure statement

The authors have declared that no competing interests exist.

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Notations

Abbreviations

- AHP – Analytic Hierarchy Process;
 ANP – Analytic Network Process;
 BSC – Balanced Scorecard;
 CUP – Coastal Urban Project;
 DEMATEL – Decision Making Trial and Evaluation Laboratory;
 ELECTRE – ELimination Et Choice Translating Reality;
 ICZM – Integrated Coastal Zone Management;
 IPCC – Intergovernmental Panel on Climate Change;
 IRM – Impact Relation Map;
 KPI – Key Performance Indicator;
 MCDA – Multi-Criteria Decision Analysis;
 PMBOK – Project Management Body of Knowledge;
 SWOT – Strength Weakness Opportunity Threat analysis.