Key Success Factors of Area Business Continuity Management Based on Stakeholders' Perspective Using AHP Method: A Case Study of an Automotive Component Company in Ayutthaya Province, Thailand

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A Thesis Submitted in Partial Fulfillment of the Requirements
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ปัจจัยที่ส่งผลต่อความสำเร็จในการจัดทำแผนการบริหารความต่อเนื่องทางธุรกิจในระดับพื้นที่จากมุมมองของผู้มีส่วนได้เสียโดยใช้กระบวนการวิเคราะห์ตามลำดับชั้น: กรณีศึกษา บริษัทผลิตชิ้นส่วนรถยนต์ในจังหวัดอยุธยา

น.ส.ศันสนีย์ สภาพไทย

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต
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Thesis Title	Key Success Factors of Area Business Continuity Management Based on Stakeholders' Perspective Using AHP Method: A Case Study of an Automotive Component Company in Ayutthaya Province, Thailand
By	Miss Sansanee Sapapthai
Field of Study	Industrial Engineering
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ศันสนีย์ สภาพไทย : ปัจจัยที่ส่งผลต่อความสำเร็จในการจัดทำแผนการบริหารความต่อเนื่องทางธุรกิจในระดับพื้นที่จากมุมมองของผู้มีส่วนได้เสียโดยใช้กระบวนการวิเคราะห์ตามลำดับชั้น: กรณีศึกษาบริษัทผลิตชิ้นส่วนรถยนต์ในจังหวัดอยุธยา. (Key Success Factors of Area Business Continuity Management Based on Stakeholders' Perspective Using AHP Method: A Case Study of an Automotive Component Company in Ayutthaya Province, Thailand) อ.ที่ปรึกษาหลัก : ผศ. ดร.ณัฏฐ์ ลีละวัฒน์

เหตุการณ์อุทกภัยในประเทศไทยปี 2554 สร้างความเสียหายอย่างกว้างขวาง โดยเฉพาะอย่างยิ่งภาคการผลิตที่ไม่เพียงส่งผลต่อบริษัท แต่ยังส่งผลต่อการหยุดชะงักของห่วงโซ่อุปทาน แผนการบริหารความต่อเนื่องทางธุรกิจในระดับพื้นที่ (Area-BCM) สามารถช่วยลดความเสียหายจากอุทกภัยให้กับภาคธุรกิจได้ เพื่อให้บรรลุเป้าหมายสูงสุดของโครงการ ปัจจัยสำคัญที่ส่งผลกระทบต่อกิจกรรม Area-BCM จึงมีความสำคัญ งานวิจัยนี้มีวัตถุประสงค์เพื่อระบุปัจจัยที่ส่งผลต่อความสำเร็จในการจัดทำแผน Area-BCM โดยใช้วิธีเดลฟาย (Delphi) กับผู้เชี่ยวชาญด้านการบริหารความต่อเนื่องทางธุรกิจ (BCM) 10 คนในการระบุปัจจัยที่ส่งผลต่อความสำเร็จในการจัดทำแผน Area-BCM จากนั้นใช้กระบวนการวิเคราะห์ตามลำดับชั้น (AHP) เพื่อตรวจสอบน้ำหนักความสำคัญทั้ง 20 ปัจจัย ซึ่งแบ่งออกเป็น 4 หมวดหมู่ ได้แก่ อิทธิพลขององค์กร การบริหารจัดการโครงการ กรอบการดำเนินงาน และความสามารถด้าน BCM จากนั้นทำการรวบรวมแบบสอบถามทั้งหมดจากพนักงานที่ทำงานเกี่ยวข้องกับ BCM ในบริษัทกรณีศึกษาและตัวแทนจากผู้มีส่วนได้เสียที่สำคัญรวมทั้งสิ้น 24 คน ค่าความสอดคล้อง ของทุกหมวดมีผลคำนวณน้อยกว่า 0.1 ซึ่งบ่งชี้ว่าพนักงานทุกคนใช้ดุลยพินิจที่สอดคล้องกัน พบว่าความสามารถด้าน BCM เป็นหมวดหมู่สำคัญที่นำไปสู่ความสำเร็จในการดำเนินการ Area-BCM นอกจากนี้ยังพบว่าปัจจัยที่ส่งผลต่อความสำเร็จในการดำเนินการ Area-BCM ได้แก่ 1.) ผู้บริหารโครงการที่มีความสามารถ 2.) ความเชี่ยวชาญด้าน BCM ของสมาชิกในทีม BCM 3.) การรับรู้ของผู้บริหารระดับสูงและการสนับสนุน BCM 4.) เป้าหมายของ BCM 5.) ความเข้าใจร่วมกันระหว่างสมาชิกในทีม BCM 6.) ความสัมพันธ์และการมีส่วนร่วมที่ดีของสมาชิกในทีม 7.) ความมุ่งมั่นในการบริหารจัดการโดยมุ่งเน้นจัดทำแผน BCM 8.) สมาชิกในทีมมีการตกลงความต้องการร่วมกัน 9.) วัตถุประสงค์ในการทำแผน BCM ที่ชัดเจนและเป็นไปได้ 10.) ประโยชน์ของแผน BCM 11.) การแบ่งปันข้อมูล BCM ภายในองค์กรที่มีประสิทธิภาพ และ 12.) การแบ่งปันข้อมูล BCM ระหว่างองค์กรในภาวะฉุกเฉินที่มีประสิทธิภาพ ตามลำดับ

สาขาวิชา วิศวกรรมอุตสาหการ ลายมือชื่อนิสิต .....

ปีการศึกษา 2563 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

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KEYWORD: Area Business Continuity Management, Key success factor, Analytic hierarchy process

Sansanee Sapapthai : Key Success Factors of Area Business Continuity Management Based on Stakeholders' Perspective Using AHP Method: A Case Study of an Automotive Component Company in Ayutthaya Province, Thailand. Advisor: Asst. Prof. NATT LEELAWAT, D.Eng.

The 2011 Thailand floods caused extensive damages widely areas. Especially in the manufacturing sector, it is not the only individual company but also the supply chain disruption. Area Business Continuity Management (Area-BCM) is a valuable system that helps businesses successfully reduce flood damage. To achieve the project's ultimate goal, a significant factor that impacts Area-BCM activities is essential. Delphi method with 10 Business Continuity Management (BCM) experts was employed to identify potential success factors. Further, Analytic Hierarchy Process (AHP) was applied to examine the relative weight of importance in a total of 20 factors that can be separated into 4 main categories: Organizational influence, Project management, Operational framework, and BCM capability. 24 effective questionnaires were gathered from employees who have worked on the BCM in a study company and representatives from important stakeholders. The consistency values of all categories are less than 0.1, indicating that all employees made consistent judgments. As a result, the *BCM Capability* is the most critical category leading to successful Area-BCM implementation. Furthermore, the result showed the factors influential a successful Area-BCM as 1.) Competent BCM project manager, 2.) BCM expertise of BCM team members, 3.) Top management perception and support of BCM, 4.) BCM goals, 5.) Mutual understanding among BCM team members, 6.) Strong relationship and involvement of BCM team members, 7.) Management commitment focusing on BCM, 8.) Aligned BCM needs of team members, 9.) Clear realistic BCM objectives, 10.) Benefit of BCM, 11.) Effective BCM internal information sharing, and 12.) Effective BCM external information sharing during the emergency situation, respectively.

Field of Study:	Industrial Engineering	Student's Signature .....
Academic Year:	2020	Advisor's Signature .....

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Sansanee Sapapthai

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Glossary

No.	Word	Definition
1	Area-BCM	"A cyclic process of sharing risk information or impact estimation, determining the strategy, developing the Area BCP, implementing preparedness measures and effective recovery actions and monitoring to continuously improve the Area BCM system, in coordination among stakeholders, in order to improve the capability of effective business continuity in the area" (Baba, Watanabe, Nagaishi, & Matsumoto, 2014, p. 298)
2	BCM	"A management process which identifies possible internal and external threats/risks and their impact to business processes and provides a framework for organizational resilience" (Torabi, Soufi, & Sahebjamnia, 2014, p. 309)
3	Category	"Factors to achieve the desired goal." (Keeley & Matsumoto, 2018, p. 338)
4	Consistency ratio	"The level of consistency among all the respondents regarding the weight of selection criteria" (Parvaneh & El-Sayegh, 2016, p. 42)
5	Disaster	"Sudden unforeseen events with natural, technological or social causes that lead to destruction, loss and damage"(Al-Dahash, Thayaparan, & Kulatunga, 2016, p. 1192)
6	Global weight	"The weight of the selection factor relative to overall selection criteria" (Parvaneh & El-Sayegh, 2016, p. 42)
7	Hierarchical structure	"The arrangement of the activities; first set of objectives, second set, and son to the single element objective." (Saaty, 1977, p. 235)
8	Interest	"The total of values and desires that an actor finds important, regardless of the specific situation." (B. Enserink et al., 2010, p. 54)
9	Key success factor	"The identification, assessment, and analysis of these few key areas in order to make specific steps to ensure a company's success" (Auruskeviciene, Salciuviene, Kuvykaite, & Zilys, 2007, p. 277)
10	Local weight	"The weight of the selection factor in its category" (Parvaneh & El-Sayegh, 2016, p. 41)

No.	Word	Definition
11	Pairwise comparison	“The comparisons are made using a scale of absolute judgments that represents, how much more, one element dominates another with respect to a given attribute.” (Saaty, 2008, p. 83)
12	Power	“The ability to influence others” (Lunenburg, 2012, p. 1)
13	Stakeholder	“Any group or individual who can affect or is affected by the achievement of an organization’s objectives” (Freeman & McVea, 2001, p. 193)
14	Sub-category	"The activities under major categories" (Baby, 2013, p. 220)
15	Weight	“The average of all possible ways of comparing the criteria and factors.” (Cho & Lee, 2013, p. 5318)

Chapter 1 Introduction

This chapter explains the background of the study. Then, it describes a statement of the problems also the detail of objectives, expectations of this study, and the research schedule.

1.1 Background of the study

The climate crisis has exponentially intensified over the past few years. A phenomenon delivers numerous natural disasters, including floods (IFRC, 2018). Flood is the most common natural disaster worldwide with the greatest economic and social impact (Gangrade, Kao, Dullo, Kalyanapu, & Preston, 2019). Statistically, a flood has the highest number of occurrences in the global report natural disaster from 2000-2018 by Our World in Data organization (OWD) show as **Figure 1.1** (OWID, 2019).

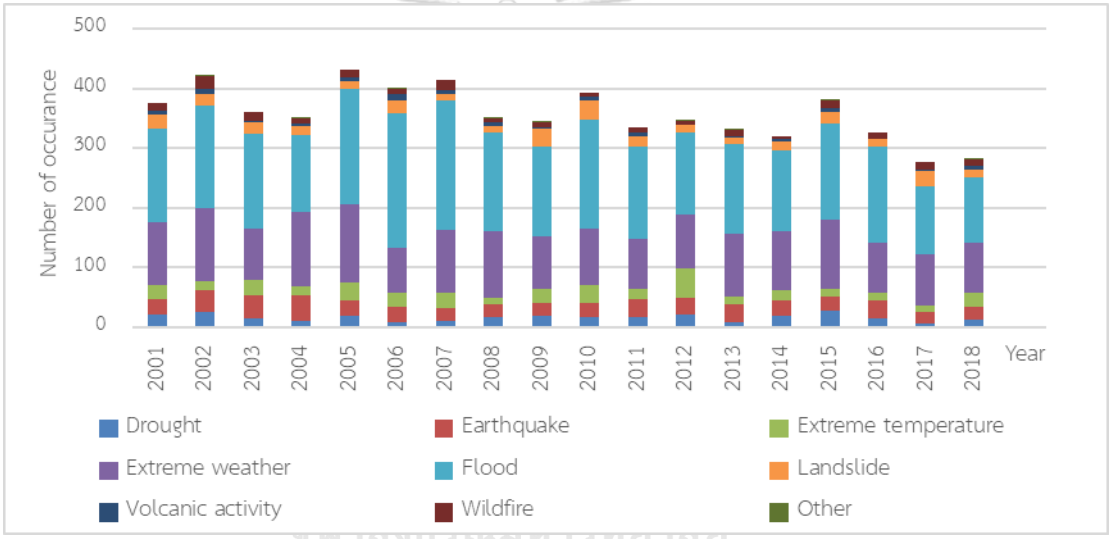

Figure 1.1 The number of natural disaster events between 2000-2018.

Note. Source: "Global reported natural disasters by type" by OWID. (2019). Retrieved December 2019, from https://ourworldindata.org/grapher/natural-disasters-by-type

Asia-Pacific region is one of the most vulnerable areas to the climate change effect which triggers higher storm surges, rainfall, and stronger winds (Busby, Smith, Krishnan, Wight, & Vallejo-Gutierrez, 2018). Tropical storms and typhoons are becoming more frequent and intense (IFRC, 2018). For example, the 2011 Thailand's floods were the enormous flood in Thailand which hit by five tropical storms from July 2011 to January 2012 (Marks, 2019). Flood drowned the total of 65 provinces, depressing the economy and the development of key sectors such as agriculture and infrastructure. The result were 1,007 billion THB losses in the manufacturing sector and 1.43 trillion THB overall economic damages and losses while there were reported 813 deaths and 2,500,000 affected people (Haraguchi & Lall, 2015).

In Thailand, Chao Phraya River is the major drainage basin to the Gulf of Thailand. The Global Coastal Digital Elevation Model (CoastalDEM) reveals the rising of global sea level including the coastal areas of Thailand which is expected to increase the recurrent of flooding in the downstream of Chao Phraya River Basin (Kulp & Strauss, 2019). Ayutthaya province is vulnerable to flood because of the geography where it is located in the valley of Chao Phraya River (Singkran, 2017).

In '*Thai Flood 2011'* which is the report by World Bank highlighted that there was the highest number of damage and losses in the Manufacturing sector shown as **Table 1.1**. Ayutthaya is top of the range of damages and losses in Thailand's flood 2011 (Hagiwara, Kuribayashi, & Sawano, 2016). Ayutthaya Province is considered as a crucial economy area with a number of economically valuable industrial estates such as Rojana Industrial Park, Hi-Tech Industrial Estate, Factory Land, Bang Pa-in Industrial Estate, and Saha Ratta Nanakorn Industrial Estate (Sahebjamnia, Torabi, & Mansouri, 2018) Most industries affected were automobiles, electronics, medical equipment, and food and beverage. For instance, the automobile sector was forced to halt their operations because some automobile companies faced flood and some companies faced automobile parts shipping shortage (Okazumi & Nakasu, 2015). The shipment of hard disk drives was lost 45% worldwide because their manufacturing plants in Bang Pa-in Industrial Estate was flooded (Haraguchi & Lall, 2015). A consequence of Thailand's 2011 flood was not just a domestic problem but also the global supply chain. It causes the world's industrial production to decrease by 2.5% and the World Bank (2012) estimated that the GDP growth plummets by 1.5% (from 4.4 to 2.9%) (Haraguchi & Lall, 2015)

Such significant damages and losses have brought flooding risk management to a top agenda, the Royal Thai Government had proposed a master plan of water management for Department of Water Resource (DWR). The plan aims to prevent and mitigate damages and losses from moderate and large floods, to improve the capability of flood emergency management information system and warning system and to create confidence and ensure stability in a water resources management system (DWR, 2012). Furthermore, the attempt to reduce the disruption caused by flooding at the business level attracted wide attention due to its disastrous impacts on not only factory but also the fundamental infrastructure and the community (Baba et al., 2014), which result in a shortage of resources to continue the business operation, prolonged recovery and delayed business operation (Baba et al., 2014). As all issues connected with the global supply chain, it needs an aspect and collaboration from the various organization in order to get the prompt solution.

Table 1.1 Summary of total damages and losses from the 2011 flood in Thailand separate by sectors. (in THB, millions)

No.	Sub sector	Disaster Effects			Ownership	
		Damage	Losses	Total	Public	Private
Infrastructure						
1.	Water Resources Management	8,715	-	8,715	8,715	-
2.	Transport	23,538	6,938	30,476	30,326	150
3.	Telecommunication	1,290	2,558	3,848	1,597	2,251
4.	Electricity	3,186	5,716	8,902	5,385	3,517
5.	Water Supply and Sanitation	3,497	1,984	5,481	5,481	-
Production						
6.	Agriculture, Livestock, Fishery	5,666	34,715	40,381	-	40,381
7.	Manufacturing	513,881	493,258	1,007,139	-	1,007,139
8.	Tourism	5,134	89,673	94,807	403	94,405
9.	Finance and Banking	-	115,276	115,276	74,076	41,200
Social						
10.	Health	1,684	2,133	3,817	1,627	2,190
11.	Education	13,051	1,798	14,849	10,614	4,235
12.	Housing	45,908	37,889	83,797	-	83,797
13.	Cultural Heritage	4,429	3,076	7,505	3,041	4,463
Cross-cutting						
14.	Environment	375	176	551	212	339
Total		630,354	795,190	1,425,544	141,477	1,284,067

Note. Source: "Thai Flood 2011: Rapid assessment for resilient recovery and reconstruction planning." by WorldBank. (2012). Retrieved May 2020, from http://documents.worldbank.org/curated/en/677841468335414861/pdf/698220WP0v10P106011020120Box370022B.pdf

In resilience of an area against the extensive disaster, Japan International Cooperation Agency (JICA) and the ASEAN Coordinating Center for Humanitarian Assistance on Disaster Management (AHA Center) developed a formulation of '*Area Business Continuity Management*' (Area-BCM) to enhance the collaboration among the private sector, public sector, and community for a more effective hazards information sharing, critical resource management integrating, and strategic planning (Ono & Watanabe, 2017). The cooperation creates an opportunity for the project to

balance and optimize the need and concerned points of each stakeholder to enhances coping of capacity level, mitigates impact from risk and quickly recovers in case of an emergency circumstance (Baba et al., 2014).

Area-BCM requires a lot of players, not only an individual company but all the concerned stakeholders. Therefore, it is not only to know about the concept but also how we can design the system and use the design concept in the actual management of the developing system. Some factors obstruct the efficient execution of a project. Understanding critical success factors will be easier to improve the likelihood of success in development programs since the findings recommend guidance on team member distribution and prioritization (Sanchez, Terlizzi, & de Moraes, 2017).

1.2 Problem Statement

The Area-BCM project is considered to be difficult for the company as there are challenges among the collaboration (Baba et al., 2014). Stakeholders might have different ideas towards the concept of the Area-BCM project which fuel conflicts. Thus, a standard model is necessary for a successful and sustainable project establishment. Many obstacles in the project implementation could delay the process and cause higher investment costs. For instance, a failure in human resources management, a misunderstanding in communication and information sharing among the working group, continuous organizational support. Therefore, a significant factor that impacts Area-BCM activities should be identified and use as a guideline for entrepreneurs to achieve the project's ultimate goal.

1.3 Research Objectives

1.3.1 To identify the success factors and factors that impact on the Area-BCM project implementation in the company in order to suggest guidance for Area-BCM project implementation based on stakeholder’s perspective.

1.4 Expected Outcomes

1.4.1 Factors that significantly impact on the Area-BCM project implementation in a company.

1.4.2 A guideline for successful Area-BCM project implementation in a company

1.5 Scopes of the Research

1.5.1 The study company is the automotive component company which had implemented BCM. And this company is located in the industrial park, in Ayutthaya Province where had flood experienced before.

1.5.2 This study is conducted among the managerial level and employees who are related to the company's BCM.

1.5.3 2 km radius from the industrial park is the scope of this study, to conduct with the other organization which is related to the study company.

1.5.4 This study is conducted before the actual implementation of the Area-BCM.

1.6 Expected Benefits of the Research

1.6.1 This study is a benefit to others who implement Area-BCM project in companies or industrial areas. It could be a suggestion in launching and implementing the plan as well.

1.6.2 This study would be a guideline to researchers who will study factors for implement project in organization.

1.7 Research Schedule

Figure 1.2 shows this study's schedule. The study steps start with reviewing literature about stakeholder analysis and key success factors in disaster management projects. Then, identify the success factors by using the Delphi method with the expert in BCM and related fields. After that, categorize the success factors in the Area-BCM project before developing a AHP questionnaire, and conduct a survey in the study area to identify key stakeholders. Finally, prioritizing key success factors in the Area-BCM project by using the Analytic Hierarchy Process (AHP) and explain the essential results from the survey and discuss for future research.

No.	Activity	Year	2019					2020											2021						
		Month	08	09	10	11	12	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07
1	Literature review	Plan																								
		Actual																								
2	Collect data to identify the potential factors of Area-BCM project	Plan																								
		Actual																								
3	Identify and categorize the success factors of Area-BCM project	Plan																								
		Actual																								
4	Construct AHP questionnaire	Plan																								
		Actual																								
5	Identify key stakeholders in Area-BCM project	Plan																								
		Actual																								
6	Collect data	Plan																								
		Actual																								
7	Prioritize key success of Area-BCM project	Plan																								
		Actual																								
8	Analyze and discuss the result	Plan																								
		Actual																								
9	Thesis preparation	Plan																								
		Actual																								

Figure 1.2 Research schedule

Chapter 2 Literature Review

This chapter provides an explanation of the BCM and Area-BCM. Then, it describes the possible factors that could impact the success of Area-BCM implementation. Besides, the multiple-criteria decision-making process and stakeholder analysis are explained.

2.1 BCM

A BCM is a process to deals with many disruptive events, according to the International Organization for Standardization 22301 (ISO22301: 2019) define BCM as a "holistic management process that identifies potential threats to an organization and the impacts to business operations those threats, if realized, might causes, and which provides a framework for building organizational resilience with the capabilities of an effective response that safeguards the interests of its key stakeholders, reputation, brand and value-creating activities" (ISO, 2019). To ensure the BCM activities are placed within an organization, (Ranjan, Kumar, & Abhishek, 2012) explained the Business Continuity Plan (BCP) is necessary. The BCP is a documented plan which describes the procedures and actions in order to maintain the critical business processes smooth functioning. For understanding the organization and the BCP preparing, Risk assessment (RA) and Business impact analysis (BIA) are the key elements (Torabi et al., 2014).

Risks could arise from internal threats, for instance, human error, utility system disruptions, etc. Besides, there might be obstacles from the outside such as natural disaster, malware as well. COSO ERM 2004 defines risk as the occurrence of an event that could affect the goals of organizational achievement. The organization may face enormous losses and even become bankruptcy if they were no planning to deal with it (Fani & Subriadi, 2019). In view of risk management, BCM could be used as an appropriate tool to handle the risks (Torabi, Giahi, & Sahebjamnia, 2016). (Faertes, 2015) explained about risk management framework and suggested that the development and implementation of business continuity management systems is one of key components. The organization should provide strong support for handling risks based on hazards and threats analysis and also the related impacts.

BIA is the analysis of operational functions and their impact on the business when they face a disruption event. The output of BIA is a list of key products based on the ranking of an organization's products also the estimating of the maximum tolerable period of disruption (MTPD) and the minimum business continuity objective (MBCO) for the key products and their identified critical functions (Sahebjamnia, Torabi, & Mansouri, 2015). They proposed the BIA framework. It consists of key products selection, key products' breakdown structure, determining

critical functions, and estimating the continuity parameters (MTPD and MBCO). The MTPD and MBCO should measure based on the organizational risk appetite (Ono & Watanabe, 2017).

The BCM cycle consists of four steps, which are represented in **Figure 2.1** including "Understanding the organization", "Selecting business continuity options", "Implementing a business continuity respond", and "Exercising and testing" (Torabi et al., 2014). As mentioned above, all the risk aspect issues and the BIA are the keys to understanding the organization. Thus, it is necessary to create options for BCP in order to operate the business against the disaster. After that, a BCP is implemented by considering several issues: disaster preparation, critical infrastructure protection, disaster response coordination, recovery plan, supply chain cooperation, etc. Then, monitoring activities and feedback is conducted to improve the plan by exercising throughout the BCM framework in the final steps.

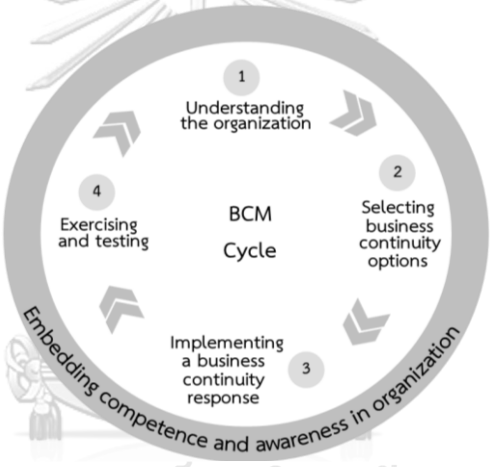

Figure 2.1 BCM Cycle

Note. Source: "A new framework for business impact analysis in business continuity management (with a case study)." by Torabi, S. A., Soufi, H. R., & Sahebjamnia, N. (2014). Safety Science, 68, p. 310.

2.2 Area-BCM

Even though the good preparation of BCP can help the private company have a quick response and recovery when they face a sudden disruption, it still not enough for confronting a high degree of disruption. In case of the massive disaster caused a cascading failure in a wide area, the company that implement BCM may manage their operations and resources, but they cannot manage the external resources such as electricity, water, transportation, telecommunication, etc. For example, many small and medium company losses their revenues during the hurricane Sandy because the power outage disrupted so they cannot operate their business, the transportation system shutdown caused the employees unable to get to work and also have the goods delivery issues (Comes & Walle, 2014). Furthermore, there was a hard disk

drive supply chain breakdown around the world during Thailand's flood 2011 due to the manufacturing plant which produces the critical part was flooded (Haraguchi & Lall, 2015).

There is the new framework for business continuation of the industrial agglomerated area, JICA and AHA center developed a formulation of Area-BCM, which leads to more robust BCM concept (Baba et al., 2014). The Area-BCP coordinates multiple BCPs from various companies in the affected area to minimize economic loses by sharing risk among stakeholders (Ono & Watanabe, 2017). There are two aspects of Area-BCP concept, which is cooperation with various sectors in the area for preparedness and prevention with disaster. Another aspect is coordination in critical resource management (Baba et al., 2014).

Area-BCM cycle can be divided into five key steps, which can explain as step1: "Understanding the area". This step will evaluate the vulnerability of the area, the current supply chain situation, including risk aspect issues and BIA. Step2: "Determining Area-BCM strategy" the outcome from step1 will be used to build a risk scenario to explore risk management strategies. Step 3: "Developing Area-BCP" will establish cooperative planning and infrastructure development. Step4: "Implementing and reviewing" in this step, the working group will look at the implementation stage, practice and test the plans, and keep track of the action plans. And step5: "Improving Area-BCP" after evaluation and get feedback from the previous step. This step will be the advisory to all the steps of the Area-BCM cycle to continual improvement (BABA , Shimano, & Matsumoto, 2014). **Figure 2.2** shown the Area-BCM Cycle.

Figure 2.2 Area-BCM Cycle

Note. Source: "Area Business Continuity Management, a new opportunity for building economic resilience." by Baba, H., Watanabe, T., Nagaishi, M. and Matsumoto, H. (2014). Procedia Economics and Finance, Vol. 18, p. 296-303.

As mentioned above, implementing BCM only one company it might become a bottleneck inside a company because the external resources are halted. The Area-BCM protects a core business of the company and external resources which are necessary for supporting business

operation (Baba et al., 2014). The examples of internal and external resources are presented in **Table 2.1**.

Table 2.1 Examples of internal and external resources

No.	Example	Internal Resources	External Resources
1.	Human	Manager, Workers, Employee	Public officers, Community, Neighboring Company
2.	Substance	Building and facilities, Equipment, Part and raw materials, Fuels	Energy and water supplies, transportation road, Airport, Port
3.	Finance	Money and assets, Account system, Insurance	Bank, Fund, Stock market
4.	Information	IT systems, Business documents	Internet, Communication system

Note. Source: "Area Business Continuity Management, a new opportunity for building economic resilience." by Baba, H., Watanabe, T., Nagaishi, M. and Matsumoto, H. (2014). Procedia Economics and Finance, Vol. 18, p. 296-303.

Participating with Area-BCM is a chance to start or raise a private company's BCM (BABA et al., 2014). It is an opportunity to enhance the strategic operation with business risks and sustainable growth of all parties. Furthermore, the process of Area-BCM enhances the resilience of the economy in the area as a whole and reflects the asset value of investment (Watanabe & Hayashi, 2016). Therefore, this study would like to investigate a significant factor that impacts Area-BCM activities. It could guide the company to consider such factors before performing the project and assist in creating the strategy for a long-term launch of the project.

2.3 Key Success factors of project implementation

Project success or failure is dependent on several factors. Through the literature review, many studies point out various success factors that lead to successful projects. However, this section would focus on factors that could influence the success of the Area-BCM project and separated them into categories: organization, project management, team members, coordination, and emergency management.

2.3.1 Organization

Organization refers to factors in the organizational context that impact the project setting (Gutierrez, 2014). Project success depends on organizational aims (Martens & Carvalho, 2017). Furthermore, it deliverables to be organizational innovative and create value (Mavi & Standing, 2018). In the beginning, the top management must thoroughly understand the project (Khan, Shameem, Kumar, Hussain, & Yan, 2019). Besides, (Jeffrey K. Pinto & Rouhiainen, 2001) suggest

that the project's goals should be in line with organizational goals and cultural norms. Nowadays, many organizations are in the position that they have to make a decision on the implementation of the Area-BCM project. **Table 2.2** represents the factors that could be the success factors of the organizational category. They are extracted from published articles searched from ScienceDirect and Google Scholar databases.

Table 2.2 The success factors of the organization category and their description.

No.	Factor	Description	Source(s)
1.	Full top management and sponsor support	The top management perception of project value, they put that project as a high priority and support to provide sufficient resources.	(Wong, 2019), (Mavi & Standing, 2018)
2.	Organizational maturity level	The maturity level, the responsible of the organization	(Mavi & Standing, 2018)
3.	Adequate resource availability (finance, labor, plant, materials)	Resources, notably money, personnel, logistics, material, plant, must be adequately allocated during a flood incident. Common resources of individual products and services need to be determined and prioritized to minimize the business's impact according to BCM objectives.	(Wong, 2019), (Mavi & Standing, 2018)
4.	Continuous performance measurement	Project should continuously improve all procedures by setting process improvement goals and continuous performance measurement.	(Mavi & Standing, 2018), (Hoyle, 2009)
5.	Lessons learnt from previous hazard/ disaster and applied to the future	The previous disaster experience increasing awareness of environmental issues share among the top managers, influencing the awareness of project value.	(Mavi & Standing, 2018), (Siegrist & Gutscher, 2006)
6.	Good relationship with stakeholders	The level of stakeholder alignment and background includes technical maturity and previous project experience.	(Mavi & Standing, 2018)

Table 2.2 The success factors of the organization category and their description. (Continued)

No.	Factor	Description	Source(s)
7.	Thorough technical understanding/ capability of project	Organizations that implement the most advanced technologies and the best techniques to monitor their resources and gain competitive advantage through allocating resources to the suitable projects	(Mavi & Standing, 2018)
8.	Management commitment	To ensure all members of the project understand their roles and the commitments they must make in order that the required outcomes/ benefits from the project are achieved.	(Khan et al., 2019), (D. f. B. I. a. S. Enserink, 2010), (Wong, 2019)
9.	Organizational culture	The involvement of the headquarters in the BCM programmed serves to provide symbolic support to affect a BCM cultural shift that underpins business continuity as a priority.	(Wong, 2019)

2.3.2 Project Management

There is mentioned in the Project Management Body of Knowledge (PMBOK) Guide (2013) which describes a project as a temporary group that attempts to achieve a unique product, service, or result (Mavi & Standing, 2018). Also, there is summarized by (Radujković & Sjekavica, 2017), project management is planning, organization, monitoring, and control of all aspects of a project in order to reach project goals. The application of project management helps project teams to execute their project in the long run, within the agreed schedule, budget, and performance criteria (Grau, 2013). **Table 2.3** represents the factors that could be the success factors of the project management category. They are extracted from published articles searched from ScienceDirect and Google Scholar databases.

Table 2.3 The success factors of the project management category and their description.

No.	Factor	Description	Source(s)
1.	Clear realistic objectives	Having a clear realistic objective of project, including the general project philosophy or general mission of the project.	(Mavi & Standing, 2018)

Table 2.3 The success factors of the project management category and their description. (Continued)

No.	Factor	Description	Source(s)
2.	Project size and level of complexity	A level of complexity of BCM project that makes company difficult to predict project outcomes, to control or manage the project.	(Khan et al., 2019), (Tappura, Nenonen, & Kivistö-Rahnasto, 2017)
3.	Minimal scope change	Minimum number of agreed scope changes	(Mavi & Standing, 2018), (Joslin & Müller, 2015)
4.	Project's alignment with corporate strategy	The alignment between BCM goals and organizational goals	(Wong, 2019) (Torabi et al., 2014)
5.	Urgency	Urgency of project	(Mavi & Standing, 2018)
6.	Cost effectiveness of work	Minimization of project life cycle costs	(Mavi & Standing, 2018)
7.	Met planned quality standard	The project meets the prespecified targets of time, quality and cost	(Mavi & Standing, 2018),
8.	Project risk and liability management	The management of undesired events that may come from uncertainty task itself, the scope change, the project manager change, emerging risk, the new hazard during BCM project implementation.	(Wong, 2019)
9.	Continuous organizational support	The top management should continuously support the distributed project teams by providing the required resources and engaging in the project implementation process.	(Wong, 2019) (Mavi & Standing, 2018), (Khan et al., 2019)
10.	Reliability	Ability of the technology to perform its required functions under stated conditions for a specified period of time	(Cho & Lee, 2013)

Table 2.3 The success factors of the project management category and their description. (Continued)

No.	Factor	Description	Source(s)
11.	Project pilot implementation	The implementation methodology has satisfied with the performance in the pilot projects	(Khan et al., 2019),
12.	Setting process improvement goals	BCM should continuously improve all procedures by setting process improvement goals and continuous performance measurement.	(Hoyle, 2009) (Khan et al., 2019), (Wong, 2019)
13.	Applicability	Applicability to another particular set of products so it can be progressively expanded to further groups and similar uses.	(Cho & Lee, 2013)
14.	Clear and measurable indicators	Having a clear implementation method and procedure. This is also including a reliability of method	(Tappura et al., 2017)

2.3.3 Team members

To achieve the project goals, the project teams should have appropriate skills and capabilities (Khan et al., 2019). Moreover, the competence of a project manager impacts successful projects (Kandelousi, Ooi, & Abdollahi, 2011). It is the knowledge of technology, markets, trends and business environment related to the projects, and the knowledge of psychological and technical influences (Kandelousi et al., 2011). For example, during the project execution, it might have different perceptions, sometimes fuel emotion and conflict among team members. It is essential to build trust and compromise between all the parties who are involved in the project. **Table 2.4** represents the factors that could be the success factors of the team members category. They are extracted from published articles searched from ScienceDirect and Google Scholar databases.

Table 2.4 The success factors of the team members category and their description.

No.	Factor	Description	Source(s)
1.	Competent oject manager	The project manager who places a high priority project and excellent power to communicate, , decision making regarding project issues.	Mavi & Standing, 18), (Radujković & kavica, 2017)

Table 2.4 The success factors of the team members category and their description. (Continued)

No.	Factor	Description	Source(s)
2.	Project expertise	Staffs need to have the right set of management and technical capabilities to undertake the necessary business continuity activities during business as usual as well as under adverse conditions.	(Wong, 2019)
3.	Motivated and well-integrated team	Strong relationship and involvement among team members with a highly motivated and well-integrated team. Including the trust between the manager and team members.	(Khan et al., 2019)
4.	Effective consultation with key stakeholders and beneficiaries (trust)	All potential stakeholders of the BCM project are consulted with and keep up to date on project status. Further, clients receive assistance after the project has been successfully implemented.	(Mavi & Standing, 2018)

2.3.4 Coordination

Communication and coordination among team members are more challenging to Area-BCM because it involves many organizations (Ono & Watanabe, 2017). Proper information sharing between the distributed teams is vital, and it supports the coordination and control activities. Appropriate communication, coordination, and control generate trust and mutual understanding among the team members and create an effective partnership (Khan et al., 2019). **Table 2.5** represents the factors that could be the success factors of the coordination category. They are extracted from published articles searched from ScienceDirect and Google Scholar databases.

Table 2.5 The success factors of the coordination category and their description.

No.	Factor	Description	Source(s)
1.	3C's (Communication, coordination, and control)	A proper 3C's (communication, coordination, control)	(Khan et al., 2019)

Table 2.5 The success factors of the coordination category and their description. (Continued)

No.	Factor	Description	Source(s)
2.	Information sharing	A process through which team members collectively utilize their information including effective emergency information system, information accessibility, information security, a clear procedure of reporting and submitting information, and the information sharing when the method and procedure is updated.	(Khan et al., 2019)
3.	Staff involvement	Strong relationship and involvement among team members. Including the trust between the manager and team members.	(Khan et al., 2019)
4.	Strong relationship between team members	Strong relationship and involvement among team members with a highly motivated and well-integrated team. Including the trust between the manager and team members.	(Khan et al., 2019)
5.	Mutual understanding between team members	Among team members, no one understand less or more than the others.	(Khan et al., 2019), (Mohr & Bitner, 1991)

2.3.5 Emergency management

Emergency management is a particular part of Area-BCM to deal with an emergency during the disaster (BABA et al., 2014). (Zhou, Huang, & Zhang, 2011) studied on Identifying critical success factors in emergency management. They reviewed and summarized that it is essential to develop the emergency plan to quickly respond and control disaster and the effectiveness of the emergency information system to assure information transformation includes the timely and accurate transmission of information. Besides, a well-planned emergency relief supply system is vital. In addition, government unity of leadership ensures the activities of emergency disposal efficiently. And the financial can deliver aid to the disaster area and carry out disaster relief effectively and timely. So, these success factors below are mentioned by (Zhou et al., 2011).

- Well-planned emergency relief supply system
- Clear responsibilities

- Applicable emergency response plan and regulations
- Financial ensuring measures and prior planning of logistic centers and shelters
- Education campaign on disaster prevention and response
- Specific training of professionals such as rescue workers and medical staff
- Strong ability to send out specific early warning about potential hazards
- Regular organization of simulated disaster exercise
- Very short response time to start the emergency plan
- Government unity of leadership to plan and coordinate as a whole
- The involvement and support of army
- Timely and accurate relief needs assessment
- The security of relief aids during distribution and transportation
- Clear procedure of reporting and submitting information.
- Effective emergency information system to ensure information transferring.
- Application of modern logistics technology
- Reconstruction and staff comforting
- Evaluation on the efficiency and effectiveness of the management system
- Continuous improvement of the operational system of emergency management
- Awareness of environmental issues and related legislation
- Lessons learnt from the previous

Although the extensive literature review process noticed that many researchers were mentioning such various success factors that contribute to the successful projects, this study would like to prioritize which factors can lead to the Area-BCM project's success.

2.4 Multiple criteria decision-making techniques

The multi criteria decision-making (MCDM) approach is a tool for decision-making in complex problems that support qualitative and quantitative factors (Singh & Malik, 2014). The MCDM has been designed for a complex issue as it can deal with alternatives such as choice, strategy, policy, and scenarios to choose the best option (Sitorus, Cilliers, & Brito-Parada, 2019). There are various MCDM methods to handle a different complex situation and require different information to create a ranking model and prioritize the alternatives. In the sustainability engineering field, the *Analytic Hierarchy Process (AHP)* is the MCDM which commonly used (Stojčić, Zavadskas, Pamučar, Stević, & Mardani, 2019). According to this study, we want to identify key success factors. So, this study reviewed the application of MCDM methods that have been used in a variety of research shown in **Table 2.6**.

Table 2.6 Application of MCDM Methods for decision-making support case studies

No.	Research topic	Research aspect	Type of MCDM usage	Source(s)
1.	Identifying critical success factors in emergency management using a fuzzy DEMATEL method	To identify critical success factors in emergency management	Fuzzy DEMATEL (Fuzzy Decision Making and Evaluation Laboratory)	(Zhou et al., 2011)
2.	Development of a new technology product evaluation model for assessing commercialization opportunities using Delphi method and fuzzy AHP approach	To prioritize the success factor for the commercialization of new technology products	F-AHP (Fuzzy Analytic Hierarchy Process)	(Cho & Lee, 2013)
3.	A Fuzzy TOPSIS Model to Rank Automotive Suppliers	To rank automotive suppliers	Fuzzy TOPSIS (Fuzzy Technique for Order of Preference by Similarity to Ideal Solution)	(Azizi, Aikhuele, & Souleman, 2015)
4.	Fuzzy AHP as a tool for prioritization of key performance indicators (KPI)	To prioritize KPI	F-AHP	(Kaganski, Majak, & Karjust, 2018)
5.	Critical success factors of sustainable project management in construction: A fuzzy DEMATEL-ANP approach	To identify Critical success factors of sustainable project management in construction	Fuzzy DEMATEL, ANP (Analytic Network Process)	(Mavi & Standing, 2018)

Table 2.6 Application of MCDM Methods for decision-making support case studies (Continued)

No.	Research topic	Research aspect	Type of MCDM usage	Source(s)
6.	Ranking the success factors to improve safety and security in sustainable food supply chain management using fuzzy AHP	To rank the success factors to improve safety and security in sustainable food supply chain management	F-AHP	(Sharma, Yadav, Mangla, & Patil, 2018)
7.	Prioritizing the performance outcomes due to adoption of critical success factors of supply chain remanufacturing	to identify and prioritize the performance outcomes due to adoption of supply chain remanufacturing	F-AHP, Fuzzy TOPSIS	(Ansari, Kant, & Shankar, 2019)
8.	Fuzzy AHP based prioritization and taxonomy of software process improvement success factors in global software development	To prioritize the success factor for software process improvement implementation	F-AHP	(Khan et al., 2019)

The Decision Making and Evaluation Laboratory (DEMATEL) is one of the MCDM approaches which is suitable to assemble a network structure of interdependent factors. It visualizes the causal relationship among factors by a cause-effect relationship diagram (Zhou et al., 2011). As stated above, the AHP methods have been integrated into research to support the decision-making process and identify key success factors for many business fields. It decomposes a MCDM problem into a hierarchy of criteria and sub-criteria to be recomposed systematically to generate the rankings of decision alternatives (Cho & Lee, 2013). Identifying criteria weights is challenging and is mainly influenced by the decision-makers judgments and preferences (Si, Marjanovic-Halburd, Nasiri, & Bell, 2016). To compare with the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), which applicable to decision problems that involve few criteria with a large number of alternatives (Si et al., 2016).

2.5 Stakeholder Analysis

The Area-BCM concept involves a wide range of organizations. The public-private partnership is one of the challenges in successful of Area-BCM. The standardization of project management processes (ISO21500) that emphasize the stakeholder within the project suggests that stakeholders should be defined roles and responsibilities to appropriately communicate based on the project goals (Grau, 2013). **Figure 2.3** shown the typical project stakeholders. Stakeholder Analysis enables systematic identification by assessing and comparing a stakeholder about their role, intentions, interrelations, and interest (Raum, 2018). Therefore, the use of Area-BCM requires a thorough understanding of the various stakeholders involved in a system.

Figure 2.3 Project stakeholders

Note. Adopted: "Standards and Excellence in Project Management–In Who Do We Trust." by Grau, N. (2013). Procedia-Social and Behavioral Sciences, 74, p. 16.

Since stakeholder analysis is the key to understanding complex relationships among all parties involved, a variety of methods and approaches for stakeholder analysis have been developed in several fields and with different objectives. In this study, we explore several stakeholder analysis methods applying in the disaster management field, particularly the concept of Area-BCM. By exploring the research articles published and indexed by ScienceDirect database, there are various stakeholder analysis methods. The popular methods are shown as **Table 2.7** which summarize the advantages and disadvantages of each stakeholder analysis methods.

Table 2.7 The advantages and disadvantages of each stakeholder analysis methods.

No.	Technique	Description	Advantages	Disadvantages
1.	Focus group	A small group brainstorm	- Rapid - Useful for generating data on complex issues.	- Difficult to control and reach a consensus. - Might have some hidden stakeholders.
2.	Interviews	Directly interview with stakeholders	- Convenient - Direct communication - Easy to understand the respondent's feeling.	- Time-consuming - Biased by the interviewer skill and Area-BCM knowledge.
3.	Scenario workshop	Stakeholder representatives discuss specific issues and provide feedback	- Both dominant and withdrawn side can express their opinion. - Real-time data collection	- Time-consuming
4.	Snowball sampling	During the interviews or questionnaire surveys are conducted, the new stakeholder is more identified by the initial stakeholder	- Fewer interviews - Time and cost-saving - A hidden stakeholder might be found.	- Not cover all of stakeholders. - Biased by the initial snow-ball sample.
5.	Power-Interest matrix	Stakeholders are placed on a matrix according to their relative power and interest	- Easy to understand. - An encourage and discourage stakeholders are highlighted.	- Different stakeholders belong to a single category and treated in the exact same method. - Prioritization may marginalize certain groups.

Table 2.7 The advantages and disadvantages of each stakeholder analysis methods. (Continued)

No.	Technique	Description	Advantages	Disadvantages
6.	Importance-Influence matrix	Stakeholders are placed on a matrix according to their relative importance and influence	- Easy to understand. - Stakeholders who are the most influential and/or more central than others in the network are highlighted.	- Prioritization may marginalize certain groups.
7	Q methodology	Stakeholders rank the statements along an ordinal scale on Q-grid to represent how much they agree or disagree	- Marginal viewpoints are easily overlooked. - Support external stakeholder management.	- Limit the respondents to express their opinion. - Some of the viewpoints are overlooked.
8	Social network analysis	Map linkages and flows of information between key stakeholders and measuring relational between stakeholders	- Show the overall interconnection of each stakeholder. - A useful starting point for discussing relationship and flow of information in a system.	- Easy to confuse when many linkages are described.

The area-BCM project is considered to be difficult for the company as there are challenges among the collaboration. The stakeholder that can be the potential initiator of area-BCM should be categorized. Regarding the previous research, the identified potential factors are based on the research from other projects that might not fit with Area-BCM. This study uses the Delphi method to determine the possible factors associated with Area-BCM. Then combine the method between stakeholder analysis and key success factors identification to understand the need or concern point among the team member which would create a well-engagement and achieve the Area-BCM project implementation. AHP, an analytical decision-making process tool, will be used to identify success factors because it could effectively prioritize the key success factors (Cho & Lee, 2013).

Chapter 3 Research design and methodology

This chapter explains the study design. It consists of the research procedure, data collection, and methodology which include a Delphi method and AHP method.

3.1 Research Procedure

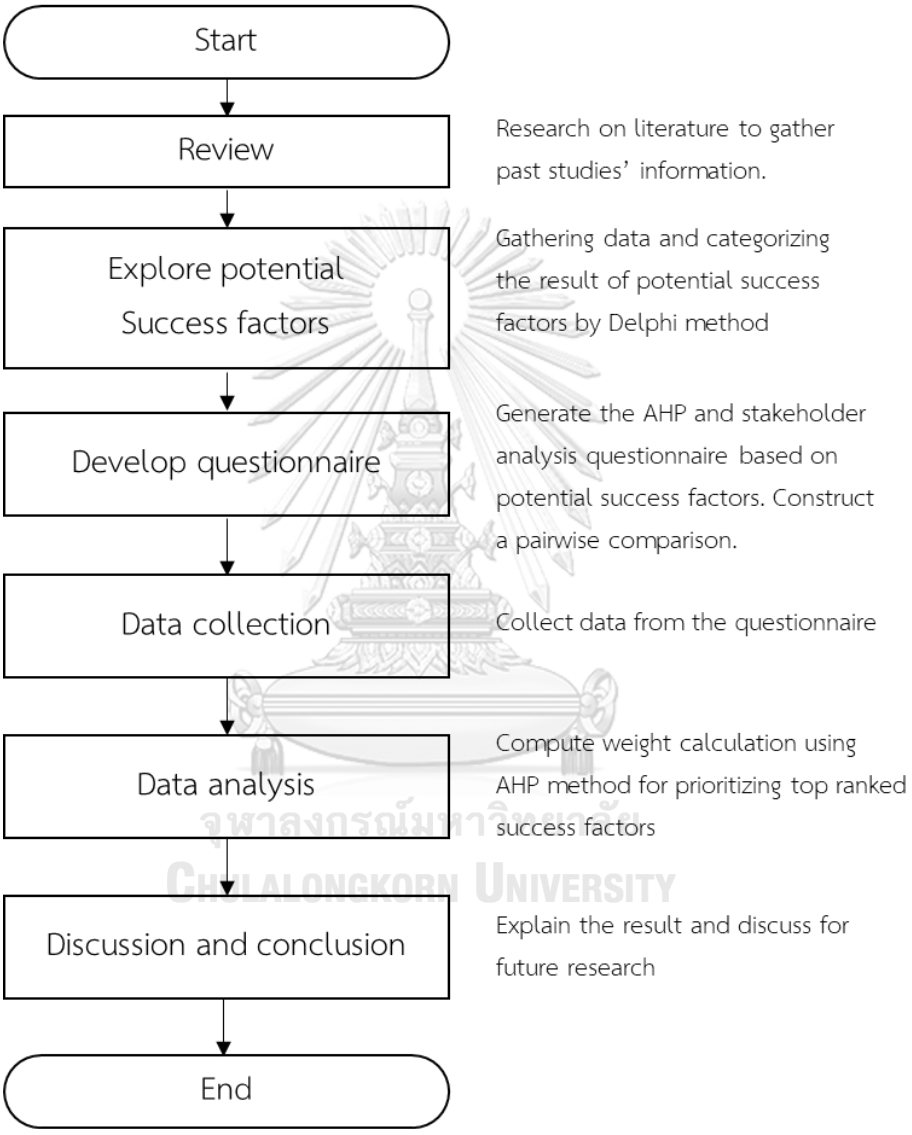

Figure 3.1 Research procedure and description

3.2 Potential success factors

Referring to Section 2.3, there were the factors that we gathered from the previous research. Much literature suggested factors from multiple dimensions; however, what factors should be primarily considered for the success of Area-BCM. This research applied the Delphi method to

determine the potential factors associated with Area-BCM. The Delphi method is a beneficial technique for gaining group opinions on the critical success factors in which a consensus is to be reached (Adnan & Morledge, 2003). (Frinsdorf, Zuo, & Xia, 2014) explained the steps of Delphi, which start with conduct an interview with experts. After that, ask experts to rate the importance of each factor. Then, ask experts to re-consider the rating and compare the result from the previous step. The processes will continue until it gets a consensus among the participants.

This research selected ten experts, which consist of experts from a theoretical group and a practical group. The theoretical experts are composed of researchers and consultants in the BCM and related fields, including the disaster management field, risk, and project management field. And practical experts who are employees in the BCM field. The expert panel in this study is shown in **Table 3.1**.

Table 3.1 The expert panel

Expert no.	Field of expert	Experience (Years)	Position
Expert1	Business Continuity Management	8	BCM Consultant
Expert2	Business Continuity Management	3	Professor
Expert3	Business Continuity Management	5	Professor
Expert4	Disaster Management	5	Professor
Expert5	Business Continuity Management	20	Professor
Expert6	Project and Risk Management	10	Professor
Expert7	Business Continuity Management	4	BCM Specialist
Expert8	Project and Risk Management	3	Professor
Expert9	Project and Risk Management	15	BCM Consultant
Expert10	Project and Risk Management	4	BCM Specialist

Round 1 of the Delphi begins with an open question as "*Do you think, what are the potential factors to success Area-BCM implementation in the company?*". During an interview, all experts will be asked this question in order to list the potential factors that they think and deep into details. It is expected for 20 minutes for each interview. Then, the information will be summarized and sent back to them via email for checking.

After finish round 1, the factors will be separated belong to their categories. Next, all experts will be emailed, based on the definition of each factor and their respective category that mentioned whether they agree or not before creating the scoring form for round 2. The objective of round 2 is to validate the identified success factors and their respective categories that could

positively impact the success of BCM implementation. A questionnaire survey will be sent to all of the experts by email. It is two-part in the questionnaire. Firstly, it provides the table of the potential factors in each category and their definition. While the second part is the form for scoring each factor based on their importance that impacts the success of BCM. There are five degree of importance which are describe as Most important = 5, Important = 4, Neutral = 3, Somewhat Important = 2, Least important = 1 (Frinsdorf et al., 2014). It is expected for one month to get feedback from all of the experts.

As the goal of a Delphi method is to attain consensus among its panel members (Markmann, Darkow, & Gracht, 2013). The result from round 2 will be calculated and summarized as reported in **Table 3.2**. Then, ask all experts to reconsider their score in round 3.

Table 3.2 The example of the result from Delphi round 2.

Categories/ Factors	The result from round 2			
	Mean	Median	Mode	Std Dev
xxxx	xx	xx	xx	xx

The result between round 2 and 3 will be compared in **Table 3.3**. (Gualtier, 2015) mentioned that setting a percentage level is one common approach to achieve a consensus and defined 80% as the minimum level of consensus for the participants. Therefore, in this study, we define a score 4 (important) or 5 (the most important) is positively impact the success of BCM implementation. That's mean the score 4 or 5 by 8/10 of the experts is accepted. Factors below this rate are excluded from the model because the lack of consensus indicated a low degree of importance to measure coopetition. Finally, there will be the factors to develop AHP questionnaire.

Table 3.3 The comparison of result between round 2 and 3

Factors	Average		% Consensus	
	Round 2	Round 3	Round 2	Round 3
xxxx	xx	xx	xx	xx

3.3 Stakeholder analysis: Power-Interest matrix

Stakeholder analysis enables the understanding of stakeholders by assessment and comparison of their interests, powers, roles, and the consideration of the inherent conflicts (Raum, 2018). Distinguishing between a wide range of stakeholders into their respective characteristics, such as their degree of interest, degree of power, or role, can assist in assessing the feasibility and facilitate the Area-BCM project implementation (Varvasovszky & Brugha, 2000). The power and interests of stakeholder classifies different stakeholder, a definition of "power" by (Lunenburg, 2012) as "the ability to influence others" while "interest" by (B. Enserink et al., 2010) as "the total of values and desires that an actor finds important, regardless of the specific situation.".

One of the popular methods to classify stakeholders is a power-interest matrix. **Figure 3.2** shown the power-interest matrix which divides stakeholder into four groups as a Players who have high potential to be intended users, Subjects might be an important supporter who can strengthen their capacity to be involved, Context setters who need an incentive, and Crowd who may need to be informed about the evaluation and its finding with very careful (Bryson, Patton, & Bowman, 2011).

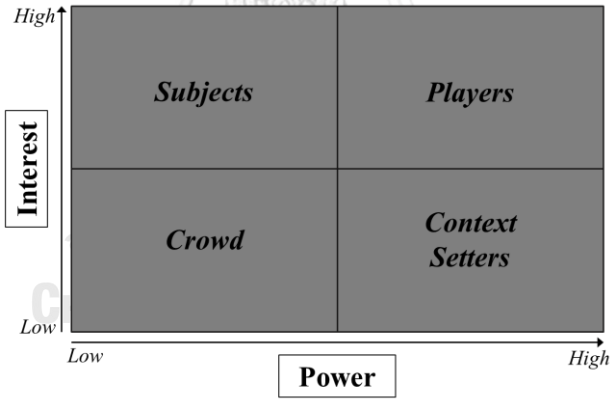

Figure 3.2 Power-Interest matrix

Note. Adopted: "Working with evaluation stakeholders: A rationale, step-wise approach and toolkit." by Bryson, J. M., Patton, M. Q., & Bowman, R. A. (2011). Evaluation and program planning, 34(1), p. 5.

3.4 Research model

Although, identifying the significant factor that impacts Area-BCM activities could guide the company to consider such factors before operating the Area-BCM project and help create a potential strategy to launch the project sustainably. However, stakeholders typically might have diverse and often competing interests. Therefore, the stakeholder analysis and key success factors identification are integrated into this research to understand each stakeholder group's point of view. The research model is illustrated in **Figure 3.3**

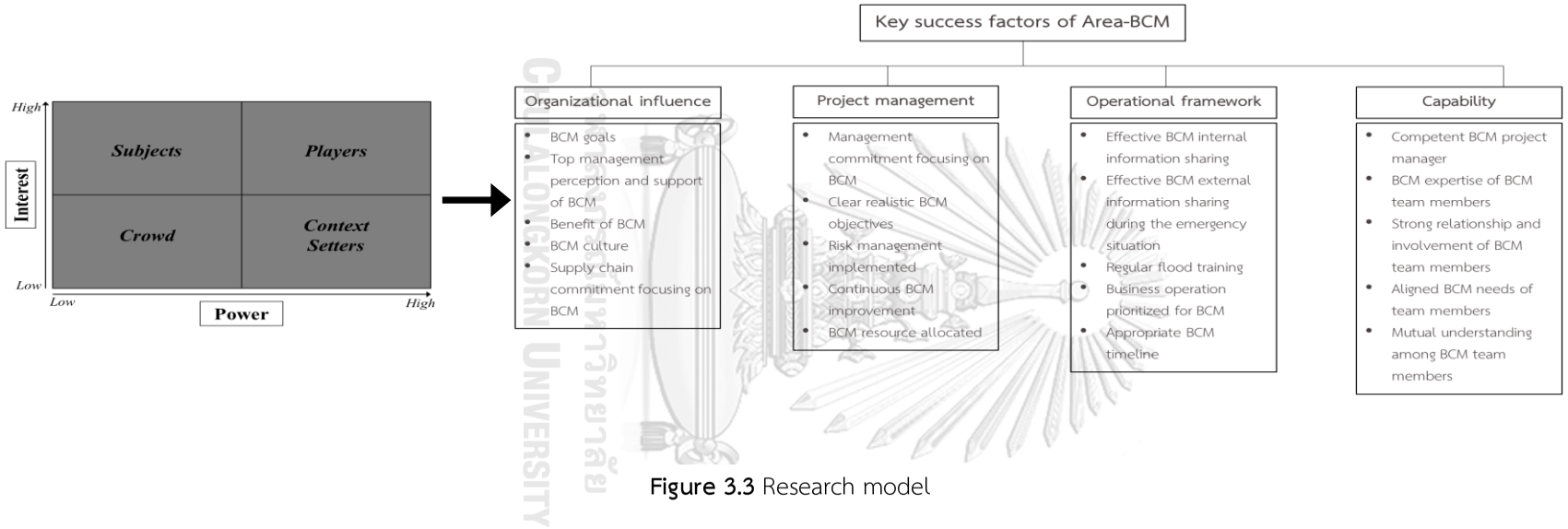

Figure 3.3 Research model

3.5 AHP method

AHP is a decision-making approach that supports prioritizing the alternatives (Cho & Lee, 2013). It has been used in various decision-making, for example, business planning, resource allocation, priority setting, and selection among alternatives (Chin, Xu, Yang, & Lam, 2008). The step of AHP can be described as illustrated in **Figure 3.4.** The weight of criteria at each level of the hierarchy is based on comparative importance from 1 to 9 (see **Table 3.4** (Saaty, 2008)).

Figure 3.4 The step of AHP

Note. Adopted: "Fuzzy AHP based prioritization and taxonomy of software process improvement success factors in global software development." by Khan, A. A., Shameem, M., Kumar, R. R., Hussain, S., & Yan, X. (2019). Applied Soft Computing, 83, 105648.

Table 3.4 Saaty's scale

Intensity of important	Definition	Explanation
1	Equal importance	Two factors contribute equally to the objective
3	Somewhat more important	Experience and judgement slightly favor one over the other
5	Much more important	Experience and judgement strongly favor one over the other
7	Very much more important	Experience and judgement very strongly favor one over the other. Its importance is demonstrated in practice
9	Absolutely more important	The evidence favoring one over the other is of the highest possible validity
2, 4, 6, 8	Intermediate value	The intermittent values between two adjacent scales

Note. Source: "Decision making with the analytic hierarchy process" by Saaty, T. L., (2008). International journal of services sciences, 1(1), p. 86.

As the AHP's goal in this research is the success factor for BCM, the potential factors from Delphi study are separated into each category as seen in the AHP model shown in **Figure 3.5**. (Nikou & Mezei, 2013)

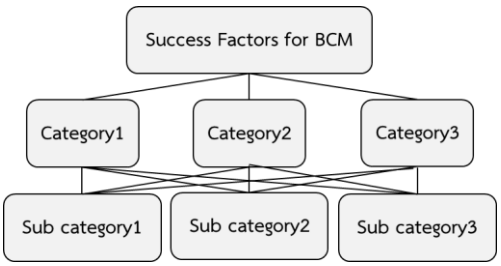

Figure 3.5 The AHP model

Note. Adapted: "Evaluation of mobile services and substantial adoption factors with Analytic Hierarchy Process (AHP)." by Nikou, S., & Mezei, J. (2013). Telecommunications Policy, 37(10), p. 915-929.

The result of this model is transformed into matrix A = [aij]. Both category and sub-category are shown in Equation (1).

$$A = \begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ \frac{1}{a_{12}} & 1 & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ \frac{1}{a_{1n}} & \frac{1}{a_{2n}} & \dots & 1 \end{bmatrix} \qquad (1)$$

Then normalize this matrix by calculating the sum of each column value. Then make the sum of each column equal to 1 by dividing each value by the total number of factors vertically. When the sum of each column is equal to 1, calculate the sum of each row and make the sum of each row equal to 1 by dividing each value by the total number of factors horizontally. The value of each row will be weight criteria.

Next, the results are rechecked with the Consistency Ratio (CR), which is considered consistent when it is less than 0.1, as shown in Equation (2), (3), and (4). The RI (Random index) is calculated from the number of matrix elements based on Alonso-Lamata (Alonso & Lamata, 2004). Alonso- Lamata RI value show in **Table 3.5**.

$$\lambda_{max} = the\ average\ of\ (\frac{weight\ sum\ value}{weight\ criteria}) \qquad (2)$$

$$CI = \frac{\lambda_{max} - n}{n-1} \qquad (3)$$

$$CR = \frac{CI}{RI} \qquad (4)$$

Table 3.5 Alonso- Lamata RI value

n	3	4	5	6	7	8	9	10
RI	0.5	0.9	1.11	1.25	1.34	1.41	1.45	1.49

Note. Source: "Consistency in the analytic hierarchy process: a new approach" by J. A. Alonso, M. T. Lamata, (2006). International journal of uncertainty, fuzziness and knowledge-based systems, 14(04), p.445.

3.6 Construction of the hierarchy

AHP hierarchy has been created to represent the potential key success factors. The factors have been categorized into 4 main criteria along with sub-criteria which is assigned as the symbols as per shown in **Table 3.6**. And the hierarchical structure is illustrated as **Figure 3.6.**

Table 3.6 AHP hierarchy for potential key success factors (draft)

No.	Main criteria	Sub-criteria	Symbol
1.	Organizational influence	1. BCM goals	S1
		2. Top management perception and support of BCM	S2
		3. Benefit of BCM	S3
		4. BCM culture	S4
		5. Supply chain commitment focusing on BCM	S5
2.	Project management	1. Management commitment focusing on BCM	S6
		2. Clear realistic BCM objectives	S7
		3. Risk management implemented	S8
		4. Continuous BCM improvement	S9
		5. BCM resource allocated	S10
3.	Operational framework	1. Effective BCM internal information sharing	S11
		2. Effective BCM external information sharing during the emergency situation	S12
		3. Regular flood training	S13
		4. Business operation prioritized for BCM	S14
		5. Appropriate BCM timeline	S15
4.	Capability	1. Competent BCM project manager	S16
		2. BCM expertise of BCM team members	S17
		3. Strong relationship and involvement of BCM team members	S18
		4. Aligned BCM needs of team members	S19
		5. Mutual understanding among BCM team members	S20

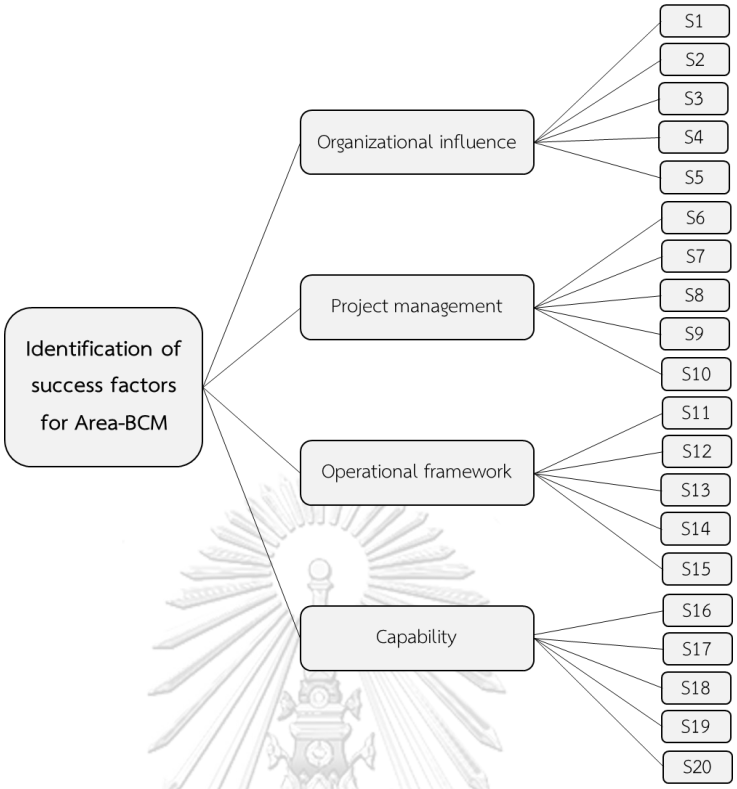

Figure 3.6 Draft of hierarchical structure

Owing to this study would like to understand key success factors of Area-BCM based on stakeholder's perspective. The stakeholder analysis and key success factors identification will be integrated into the questionnaire. It will be divided into four parts; General information, Knowledge and responsibilities regarding the BCM project, Interest and power in launching the BCM project, and Identification of success factors. The questionnaire will be constructed in order to compare the relative importance factor by factor in each category. The response format is designed by having a pairwise comparison score divided as follows: 1 = Equally important 3 = Somewhat more important 5 = Much more important 7 = Very much more important 9 = Absolutely more important.

3.7 Stakeholder Identification

The Asian Disaster Preparedness Center (ADPC) states that the scope of Area BCM depends on local conditions or the size of stakeholder cooperation, so that can be an industrial park, an industrial agglomerated area, or even a country (ADPC, 2017). The Ministry of Economic, Trade, and Industry (METI) suggests creating an Area collaborative BCP initiative to connect with the community. It is required to identify the stakeholders such as companies in an industrial park, necessary infrastructure providers, and government agencies (METI, 2019). This research selected a plastic automobile component manufacturer located in an industrial park, Ayutthaya Province,

Thailand, as a study company. Since the company faced the 2011 Thailand's floods, they had decided on BCM implementation. Two kilometers distance which is the area within the employees' commuter shuttle bus routes show in **Figure 3.7**, is the scope.

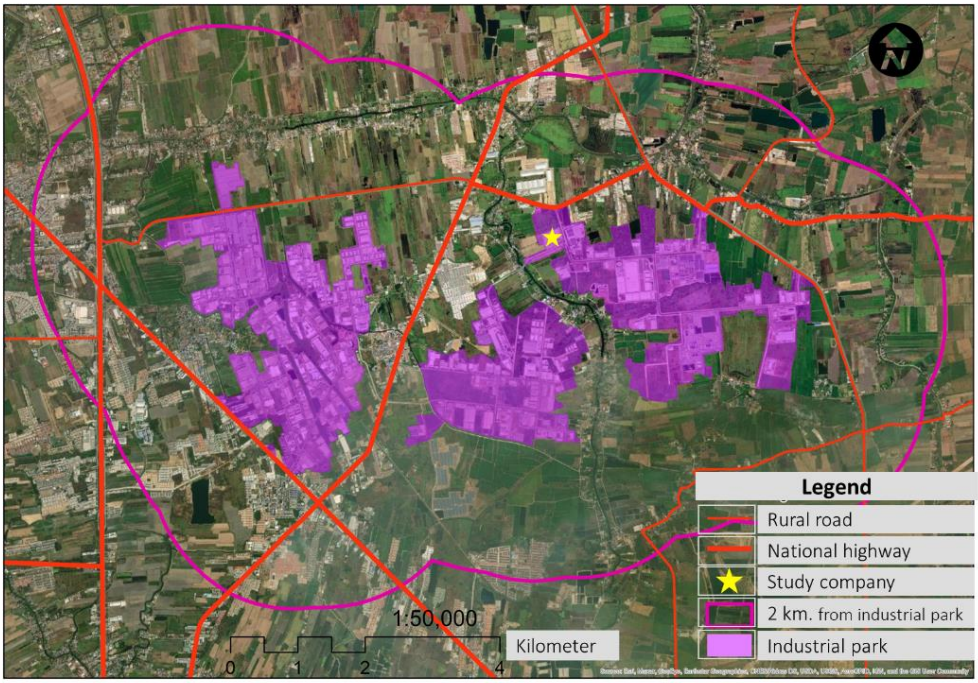

Figure 3.7 Two kilometers radius around Rojana industrial park.

Within the scope of this study, a list of Area-BCM stakeholder consists of study company and their relevant stakeholders such as Rojana Power (electricity provider), Rojana Management (water supply and waste management provider), Rojana industrial park who maintain road and facilities inside the industrial park, Kanham Subdistrict Administrative Organization (SAO Kanham) who maintain facilities in Kanham subdistrict Including; sub road, fire protection, inform water situation to the community and the industrial park, and Department of Disaster Prevention and Mitigation (DDPM) Ayutthaya who provide water situations, issue evacuation advisory to industrial parks, disaster responses, prevention and mitigation planning. A range of referred stakeholders has been listed in **Table 3.7.**

Table 3.7 Stakeholder list

Stakeholder criteria	Organization	Description
Company level (Individual company including supplier and customer located in the Rojana industrial park.)	Study company	Representative of individual company

Table 3.7 Stakeholder list (Continued)

Stakeholder criteria	Organization	Description
Industrial estate level (The infrastructure providers support the company within the industrial park, such as electricity, water supply, road.)	Rojana Power	Electricity provider
	Rojana Management	Water and waste management provider
	Rojana industrial park	road and facilities
Government level (The local government and government agencies support local infrastructure and provide water situation to Rojana industrial park.)	SAO Kanham	local government
	DDPM Ayutthaya	government agency

3.8 The target sample

According to the research, the aim was to capture the management level's opinion, which controls and has the power to force to gain a response from employees regarding specific issues that relate to and impact Area-BCM activities. The target group of respondents was identified primarily are the managerial level and employees who have experience involving the development of BCM projects in the study company. A list of 24 Managers and employees in charge of a company's BCM, such as a group of BCP leaders, response and recovery team, support team, have been constructed. While the relevant stakeholders will represent by the three managers from three infrastructure providers, including Rojana management, Rojana power, and Rojana industrial park, are listed. Also, two representatives from government agencies. Totally 29 respondents will be target samples from the questionnaire sent out via hard copy.

3.9 The pilot test

The participants in the pilot test will be four people who have work experience. They will be asked to complete the questionnaire. After that, some items were appropriately revised based on respondents' comments such as confusing content and a suggestion.

Chapter 4 Results

The factors from the Delphi study and the results of the AHP questionnaire are presented in this chapter. In addition, stakeholder analysis is included.

4.1 Delphi study

This research selected ten experts consisting of experts from a theoretical group and a practical group with at least three years of experience involving the development of BCM. The theoretical experts are composed of researchers and consultants in the BCM and related fields, including disaster management field, risk and project management field. And practical experts who are employees in the BCM field. The expert panel in this study is shown in **Table 4.1**.

Table 4.1 The expert panel

Expert no.	Field of expert	Field of BCM	Experience (Years)	Position
1	Business Continuity Management	Flood	8	BCM Consultant
2	Business Continuity Management	Flood	3	Professor
3	Business Continuity Management	Flood	5	Professor
4	Disaster Management	Flood	5	Professor
5	Business Continuity Management	Flood	20	Professor
6	Project and Risk Management	Enterprise risk	10	Professor
7	Business Continuity Management	Individual BCM	4	BCM Specialist
8	Project and Risk Management	Enterprise risk	3	Professor
9	Business Continuity Management	Flood	15	BCM Consultant
10	Project and Risk Management	Individual BCM	4	BCM Specialist

Round 1 of the Delphi begins with an open question as “Do you think, what are the potential factors to success Area-BCM implementation in the company?”. During an interview, all experts will be asked this question in order to list the potential factors. After finished round 1, there are 25 factors. Definition of factors shown in **Table 4.2.**

Table 4.2 The success factor in each category and their definition.

Categories / Factors	Definition
Category 1. Organizational influence refers to factors in the organizational context that impact the BCM project setting (Gutierrez, 2014).	
1.1 BCM goals	The alignment between BCM goals and organizational goals (Torabi et al., 2014).
1.2 Top management perception and support of BCM	The top management perception of BCM value, they put BCM as a high priority and support to provide sufficient resources (Wong, 2019).
1.3 Benefit of BCM	The flood lost quite high, so BCM is quite beneficial (ADPC, 2017).
1.4 Previous flood experience	The previous flood experience increasing awareness of environmental issues share among the top managers, influencing the awareness of BCM (Siegrist & Gutscher, 2006).
1.5 BCM culture	The involvement of the headquarters in the BCM programmed serves to provide symbolic support to affect a BCM cultural shift that underpins business continuity as a priority (Wong, 2019).
1.6 Supply chain commitment focusing on BCM	The impact of supply chain stakeholder, for example, the requirement from your customer or the requirement from your supplier (D. f. B. I. a. S. Enserink, 2010).
Category 2. Project management refers to planning, organization, monitoring and control of all aspects of a project to meet the project requirements and to manage the project throughout its life cycle **(Mas, Mesquida, & Pacheco, 2020)**.	
2.1 Management commitment focusing on BCM	All BCM members and department should understand their roles (D. f. B. I. a. S. Enserink, 2010).
2.2 Clear realistic BCM objectives	BCM should have very clear an operational implementable objective (Mavi & Standing, 2018).
2.3 Risk management implemented	There are already evaluated and identify all the risk including the emerging risk that might occur (Wong, 2019).
2.4 Clear BCM method and procedure	The BCM process has been very clearly identify (Tappura et al., 2017).
2.5 Continuous BCM improvement	BCM should continuously improve all procedures by setting process improvement goals and continuous performance measurement (Hoyle, 2009).
2.6 Appropriate timeframe and complexity of project.	Having an appropriate timeframe and complexity of project .

Table 4.2 The success factor in each category and their definition. (Continued)

Categories / Factors	Definition
2.7 BCM resource allocated	The necessary resources must be allocated in a proper manner whenever and wherever they are needed (Wong, 2019).
Category 3. Operational framework refers to a framework of applying technology, planning, and management to better prepare for respond and recover from the crisis **(IOM, 2020)**.	
3.1 Effective BCM information collecting	Having an effective route of information sharing system through which team members collectively utilize their information, including information accessibility, information security (Mesmer-Magnus & DeChurch, 2009).
3.2 Effective BCM internal information sharing	Timely and accurate information sharing by team members and intermediate response by the manager (Mesmer-Magnus & DeChurch, 2009).
3.3 Effective BCM external information sharing during the emergency situation	Collaboration information sharing between a company in the same area for sharing information and resources (Mesmer-Magnus & DeChurch, 2009).
3.4 Response time limitation	Very short response time since the moment that the departments are notified of an incident (Zhou et al., 2011).
3.5 Regular flood training	Having a regularly flood simulated exercise and training for staff (Zhou et al., 2011).
3.6 Business operation prioritized for BCM	To prioritized business operation; the necessary operations, assets, and inputs are identified along with setting “time-critical operations” (Kato & Charoenrat, 2018).
3.7 Appropriate BCM timeline	Create a common timeline of business operation including an emergency response plan, and relief plan in order to appropriate management (Wong, 2019).
Category 4. BCM capability refers to the ability of an organization to emphasizes the role of strategic management in appropriately adapting, integrating, and reconfiguring internal organizational resources and competencies to match the requirement of BCM (Wong, 2019).	
4.1 Competent BCM project manager	The project manager who places a high priority on BCM and excellent power to communicate, act, decision making regarding BCM issues (Jeffrey K Pinto & Slevin, 1987).
4.2 BCM expertise of BCM team members	Staff need to have the right set of management and technical capabilities to undertake the necessary business continuity activities during business as usual as well as under adverse conditions (Wong, 2019).

Table 4.2 The success factor in each category and their definition. (Continued)

Categories / Factors	Definition
4.3 Strong relationship and involvement of BCM team members	Strong relationship and involvement among team members with a highly motivated and well-integrated team. Including the trust between the manager and team members (Mesmer-Magnus & DeChurch, 2009)
4.4 Aligned BCM needs of team members	There are aligned needs for BCM establishment within the same direction among the team members (Sagie, 2002).
4.5 Mutual understanding among BCM team members	Among team members, no one understands less or more than the others (Mohr & Bitner, 1991).

In round 2, all the experts get an email to score each factor based on their importance that impacts the success of BCM. In round 3, there is the form for re-scoring each factor whether they still the same as a previous score or change after they see the result from round 2. The result from round 2 and 3 are calculated and summarized as reported in **Table 18, 19, 20, 21,** respectively.

Table 4.3 shows the comparison of the importance score in the ***Organizational influence*** category between round 2 and round 3. In this category, all the average score in round 3 gets higher than round 2 except for BCM culture. Despite there is a slightly decreased average score when compared with round 2, but the result shows some of the experts change their score to align with other experts. As mentioned earlier in chapter 3, we define a score 4 (important) or 5 (the most important) as positively impacting the success of BCM implementation. That means the average score at least 4, or the score 4 or 5 by 8/10 of the experts, is accepted. Even the average score of BCM culture is below 4, but almost all experts give 4 for this Factor. So, BCM culture still uses as a potential success factor to develop the AHP questionnaire. Therefore, there are five factors in the Organizational influence category: *BCM goals, Top management perception and support of BCM, Benefit of BCM, BCM culture, Supply chain commitment focusing on BCM*.

Table 4.3 The comparison of the importance score in the Organizational influence category between round 2 and round 3

Organizational influence category	Average Score (round2)	Importance Scores each expert (round3)										Average Score (round3)
		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	
1.1 BCM goals	4.50	5	5	4	4	5	5	5	5	4	5	4.7
1.2 Top management perception and support of BCM	4.56	5	5	5	5	5	5	5	5	4	5	4.9
1.3 Benefit of BCM	3.50	4	4	2	4	4	4	4	4	4	4	3.8
1.4 Previous flood experience	3.30	3	3	4	4	3	4	5	4	4	5	3.9
1.5 BCM culture	4.10	4	4	2	4	5	4	4	4	4	4	3.9
1.6 Supply chain commitment focusing on BCM	4.00	4	4	5	4	4	4	5	4	4	5	4.3

The comparison of the importance score in the ***Project management*** category between round 2 and round 3, shows in **Table 4.4**. Although the risk management implemented has an average score below the acceptable level. But in round 3, some of the experts change their score to be more consensus. Almost all the experts give 4 for this Factor. So, the risk management implemented still uses as a potential success factor to develop the AHP questionnaire. In contrast, there are not passed the minimum level of consensus and still a low degree of average important score in clear BCM method and procedure, and appropriate timeframe and complexity of project. Therefore, there are five factors in the Project management category: *Management commitment focusing on BCM, Clear realistic BCM objectives, Risk management implemented, Risk management implemented, Continuous BCM improvement, BCM resource allocated.*

Table 4.4 The comparison of the importance score in the Project management category between round 2 and round 3

Project management category	Average Score (round2)	Importance Scores each expert (round3)										Average Score (round3)
		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	
2.1 Management commitment focusing on BCM	4.50	5	5	5	5	5	5	5	5	4	5	4.9
2.2 Clear realistic BCM objectives	4.20	5	4	3	5	4	4	5	5	4	5	4.4
2.3 Risk management implemented	3.90	4	4	4	4	4	4	4	3	3	4	3.8
2.4 Clear BCM method and procedure	3.50	3	4	2	4	3	4	5	3	3	5	3.6
2.5 Continuous BCM improvement	4.40	4	5	2	4	5	4	5	4	3	5	4.1
2.6 Appropriate timeframe and complexity of project.	3.70	3	3	2	4	3	4	5	4	3	5	3.6
2.7 BCM resource allocated	4.20	4	4	4	5	4	4	4	4	3	4	4

The comparison of the importance score in the ***Operational framework*** category between round 2 and round 3, shows in **Table 4.5**. The result shows all the factors get the average score in round 3 higher than round 2. However, the average score of response time limitation, and effective BCM information collecting still have a low degree of important. Therefore, there are five factors in the Operational framework category: *Effective BCM internal information sharing, Effective BCM external information sharing during the emergency situation, Regular flood training, Business operation prioritized for BCM, Business operation prioritized for BCM, Appropriate BCM timeline.*

Table 4.5 The comparison of the importance score in the Operational framework category between round 2 and round 3

Operational framework category	Average Score (round2)	Importance Scores each expert (round3)										Average Score (round3)
		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	
3.1 Effective BCM information collecting	3.60	4	3	3	5	4	4	4	5	3	4	3.9
3.2 Effective BCM internal information sharing	4.30	4	4	5	5	5	4	5	4	3	5	4.4
3.3 Effective BCM external information sharing during the emergency situation	3.90	4	4	5	4	5	4	5	4	3	5	4.3
3.4 Response time limitation	3.40	4	3	3	3	5	3	4	3	3	4	3.5
3.5 Regular flood training	4.00	4	4	4	4	5	4	5	4	4	5	4.3
3.6 Business operation prioritized for BCM	3.80	4	4	3	4	5	4	5	3	3	5	4
3.7 Appropriate BCM timeline	3.90	4	4	4	4	3	4	5	4	3	5	4

The comparison of the importance score in the ***BCM capability*** category between round 2 and round 3, shows in **Table 4.6.** Overall, the average score in round 3 gets higher than round 2 except for the aligned BCM needs of team members, which slightly decreased. Nevertheless, considering the consensus of all experts show this factor is still important to the success of BCM. So, there are still five factors in the BCM capability category: *Competent BCM project manager, BCM expertise of BCM team members, Strong relationship and involvement of BCM team members, Aligned BCM needs of team members, Mutual understanding among BCM team members.*

Table 4.6 The comparison of the importance score in the BCM capability category between round 2 and round 3

BCM capability category	Average Score (round2)	Importance Scores each expert (round3)										Average Score (round3)
		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	
4.1 Competent BCM project manager	4.30	4	5	5	5	5	5	5	5	5	5	4.9
4.2 BCM expertise of BCM team members	4.00	4	4	2	5	5	4	5	5	4	5	4.3
4.3 Strong relationship and involvement of BCM team members	3.90	4	4	4	4	5	4	5	4	4	5	4.3
4.4 Aligned BCM needs of team members	4.00	4	4	2	4	5	4	4	4	4	4	3.9
4.5 Mutual understanding among BCM team members	4.40	4	5	4	5	5	4	4	5	4	4	4.4

Finally, there are 20 factors to develop an AHP questionnaire in the next step. **Figure 4.1** shows the hierarchical structure for Identification of success factors for BCM.

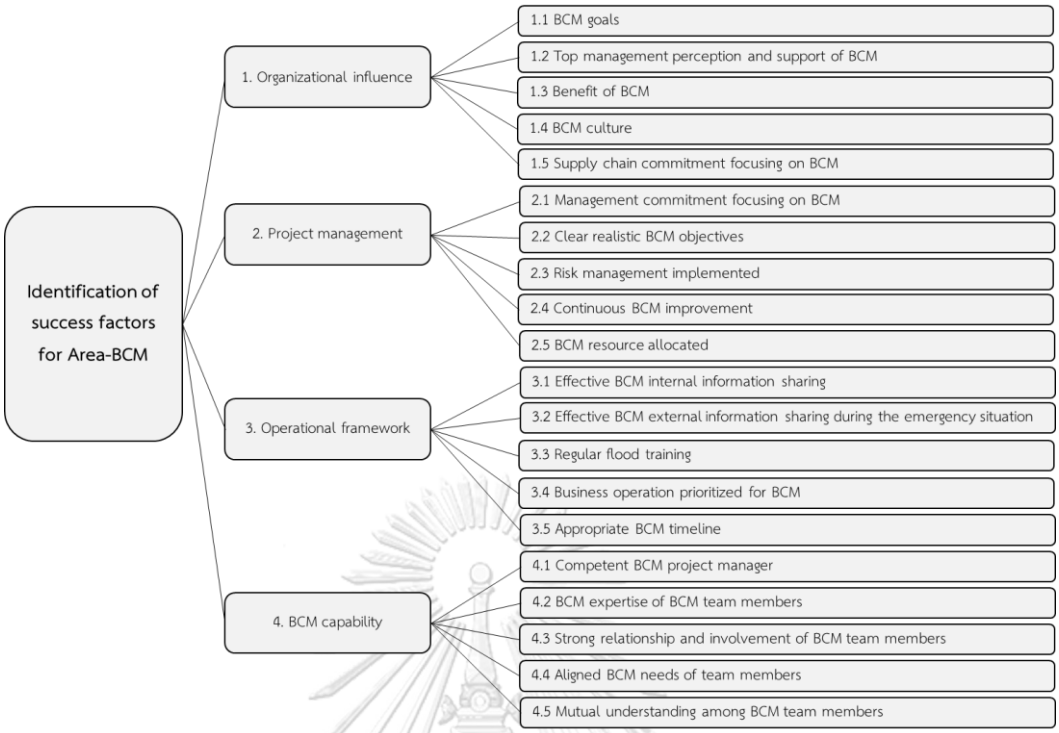

Figure 4.1 Hierarchical structure for Identification of success factors for BCM

4.2 AHP questionnaire

4.2.1 The respondents' overview

The questionnaire distributed to the study company, a plastic automobile component manufacturer located in an industrial park, Ayutthaya Province, Thailand, shows that the study company had adopted BCM. The total number of respondents is 24 persons; the response rate is 83 percent. There are three types of respondents' organizations shows in **Figure 4.2**. **Figure 4.3** shows managerial-level employees make up 79 percent of the respondents. Most respondents have moderately BCM understanding, as **Figure 4.4**. About 70 percent of the respondents said they are in charge of the company's BCM project, as **Figure 4.5**.

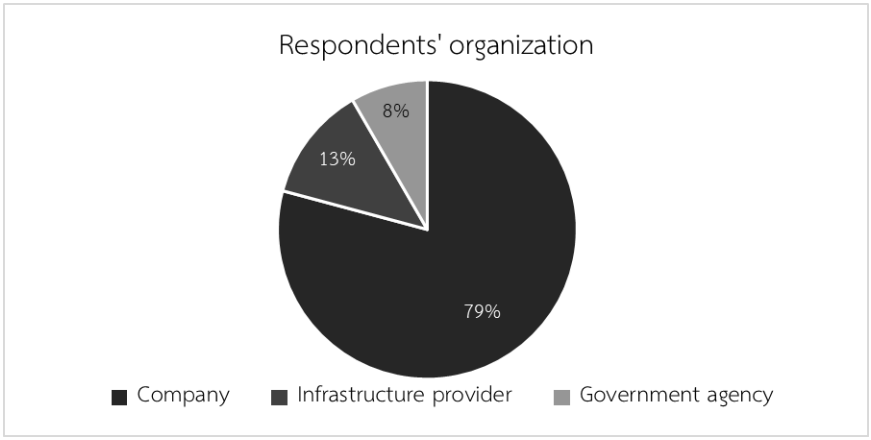

Figure 4.2 Organization of respondents

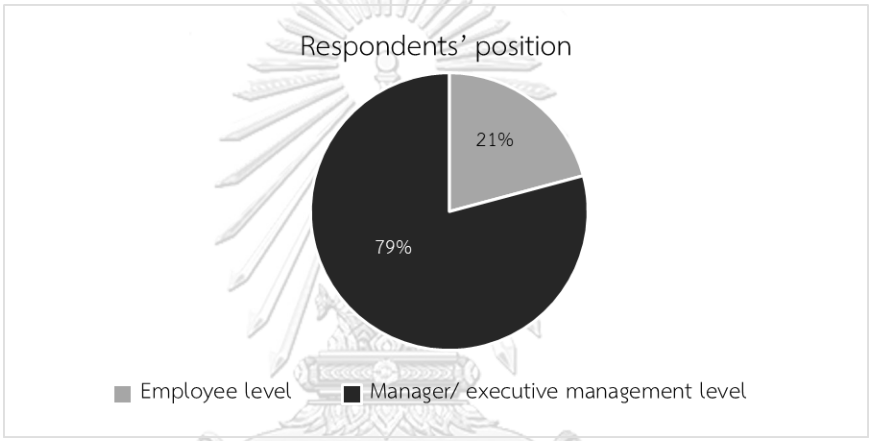

Figure 4.3 Position of respondents

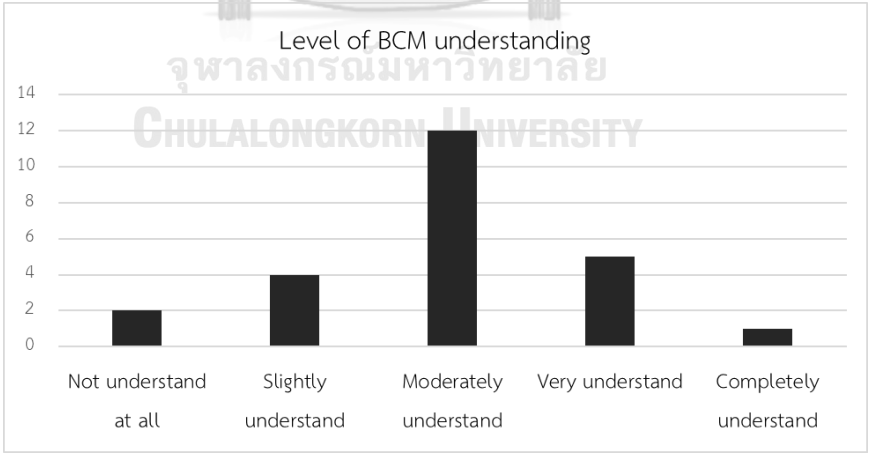

Figure 4.4 Level of BCM understanding

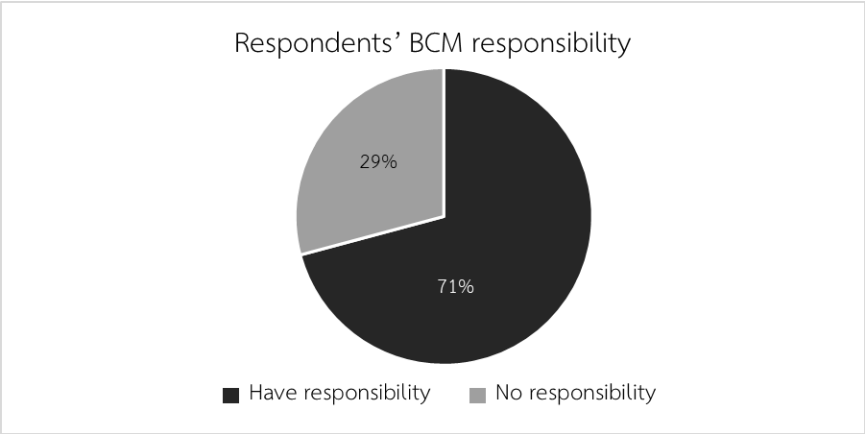

Figure 4.5 Responsibility in BCM

4.2.2 AHP results

The results from the AHP questionnaire were achieved by asking the respondents to compare and assign a numerical scale for the category in the hierarchy based on their relative importance. It is transformed into matrix $A = [a_{ij}]$ show in **Table 4.7**.

$$\mathrm{A} = \begin{bmatrix} 1.00 & 1.44 & 1.70 & 0.51 \\ 0.69 & 1.00 & 1.12 & 0.68 \\ 0.59 & 0.90 & 1.00 & 0.37 \\ 1.94 & 1.46 & 2.73 & 1.00 \end{bmatrix}$$

Table 4.7 Matrix A

Categories	Organizational influence	Project management	Operational framework	BCM capability
1. Organizational influence	1.00	1.44	1.70	0.51
2. Project management	0.69	1.00	1.12	0.68
3. Operational framework	0.59	0.90	1.00	0.37
4. BCM capability	1.94	1.46	2.73	1.00
Summation	**4.23**	**4.80**	**6.54**	**2.57**

Then, a pairwise comparison matrix A was normalized as:

$$\mathrm{A} = \begin{bmatrix} 0.24 & 0.30 & 0.26 & 0.20 \\ 0.16 & 0.21 & 0.17 & 0.27 \\ 0.14 & 0.19 & 0.15 & 0.14 \\ 0.46 & 0.30 & 0.42 & 0.39 \end{bmatrix}$$

The category weight is being calculated by the sum of normalized number of each row and divided by the total number of the criteria (n), where (n) = 4 which is the average of each row. **Table 4.8** shows the computed criteria weight.

Table 4.8 The category weight

Categories	Organizational influence	Project management	Operational framework	BCM capability	**Sum row**	**Category weight**
1. Organizational influence	0.24	0.30	0.26	0.20	1.00	0.25
2. Project management	0.16	0.21	0.17	0.27	0.81	0.20
3. Operational framework	0.14	0.19	0.15	0.14	0.62	0.16
4. BCM capability	0.46	0.30	0.42	0.39	1.57	0.39
Summation	**1.00**	**1.00**	**1.00**	**1.00**	**4.00**	**1.00**

Next, the results are rechecked with the Consistency Ratio (CR) as shown in Equation (2), (3), and (4). The RI (0.9) is calculated from the number of matrix elements based on Alonso-Lamata.

$$\boldsymbol{\lambda}_{max} = 4.05$$

$$\mathrm{CI} = \frac{(4.05 - 4)}{(4 - 1)}$$

$$\mathrm{CI} = 0.02$$

$$\mathrm{CR} = \frac{0.02}{0.9}$$

$$\mathrm{CR} = 0.02$$

So, the CR = 0.02 which is considered that the comparisons of the respondents were consistent. The Ranking of categories of Area-BCM success factor shows in **Figure 4.6.**

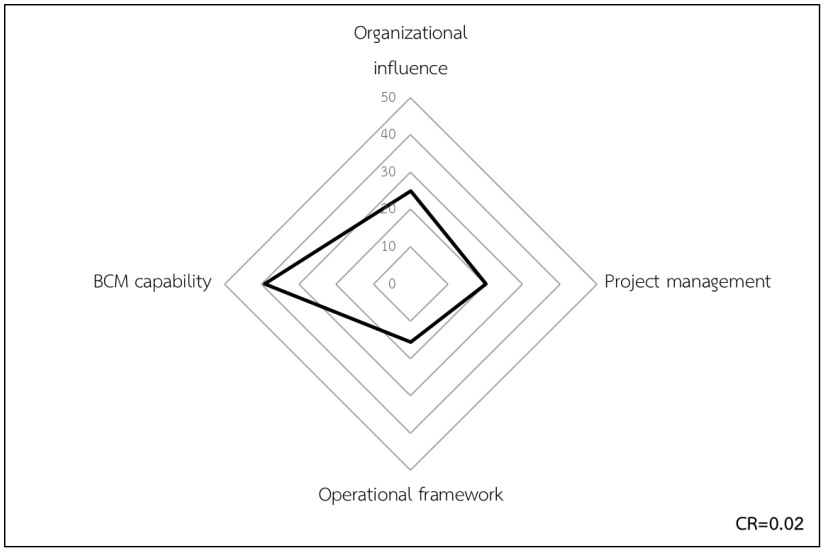

Figure 4.6 Ranking of categories of Area-BCM success factor

In order to rank the sub-categories, the sub-categories in each category are prioritized by pairwise comparison executing the same steps as above. **Figure 4.7** shows the ranking of sub-categories of Area-BCM success factors in each category.

The sub-categories with the highest weight in the Organizational influence is determined as Top management perception and support of BCM (0.31), followed by BCM goals (0.30), Benefit of BCM (0.20), BCM culture (0.10), and Supply chain commitment focusing on BCM (0.09).

The sub-category with the highest weight in the Project management is determined as Management commitment focusing on BCM (0.31), followed by Clear realistic BCM objectives (0.27), Risk management implemented (0.16), Continuous BCM improvement (0.14), and BCM resource allocated (0.11).

The sub-category with the highest weight in the Operational framework is determined as Effective BCM internal information sharing (0.31), followed by Effective BCM external information sharing during the emergency situation (0.25), Regular flood training (0.17), Business operation prioritized for BCM (0.14), and Appropriate BCM timeline (0.13).

The sub-category with the highest weight in the BCM capability is determined as Competent BCM project manager (0.29), followed by BCM expertise of BCM team members (0.20), Mutual understanding among BCM team members (0.18), Strong relationship and involvement of BCM team members (0.18), and Aligned BCM needs of team members (0.15).

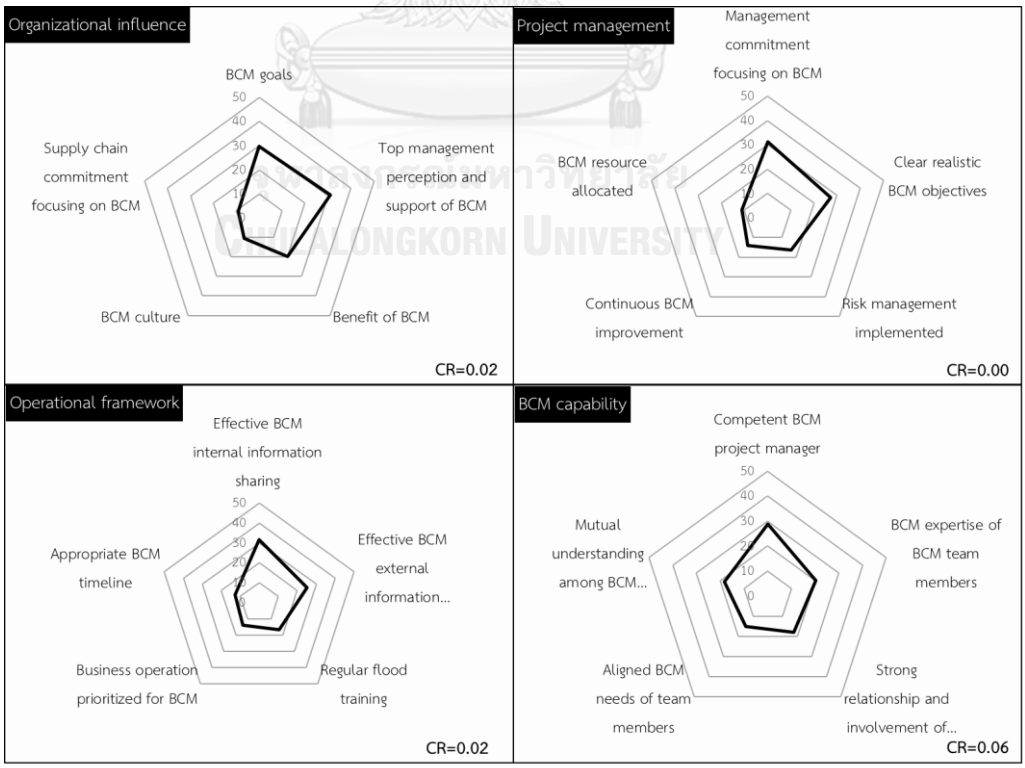

Figure 4.7 Ranking of sub-categories of Area-BCM success factors in each category

To decide the significance order of all factors corresponding to the success of BCM, Global weight (GW) is gained by comparing all sub-categories. It is determined by multiplying the Local weight (LW) which is the coefficients of each category by the weight of each sub-category. The weights and ranks of categories and sub-categories are shown in **Table 4.9**. Competent BCM project manager (0.1127), BCM expertise of BCM team members (0.0794), Top management perception and support of BCM (0.0773), BCM goals (0.0741), and Mutual understanding among BCM team members (0.0719) are the five most importance factors.

Table 4.9 The weights and ranks of categories and sub-categories

Categories	Local weights (LW)	Sub-categories	Local weights (LW)	Global weights (GW)	Rank
1. Organizational influence	0.25	1.1 BCM goals	0.30	0.0741	4
		1.2 Top management perception and support of BCM	0.31	0.0773	3
		1.3 Benefit of BCM	0.20	0.0496	10
		1.4 BCM culture	0.10	0.0260	15
		1.5 Supply chain commitment focusing on BCM	0.09	0.0224	18
2. Project management	0.20	2.1 Management commitment focusing on BCM	0.31	0.0635	7
		2.2 Clear realistic BCM objectives	0.27	0.0548	9
		2.3 Risk management implemented	0.16	0.0331	13
		2.4 Continuous BCM improvement	0.14	0.0283	14
		2.5 BCM resource allocated	0.11	0.0227	17
3. Operational framework	0.16	3.1 Effective BCM internal information sharing	0.31	0.0489	11
		3.2 Effective BCM external information sharing during the emergency situation	0.25	0.0390	12
		3.3 Regular flood training	0.17	0.0260	15
		3.4 Business operation prioritized for BCM	0.14	0.0214	19
		3.5 Appropriate BCM timeline	0.13	0.0120	20
4. BCM capability	0.39	4.1 Competent BCM project manager	0.29	0.1127	1
		4.2 BCM expertise of BCM team members	0.20	0.0794	2
		4.3 Strong relationship and involvement of BCM team members	0.18	0.0699	6
		4.4 Aligned BCM needs of team members	0.15	0.0589	8
		4.5 Mutual understanding among BCM team members	0.18	0.0719	5

The significance order of all factors corresponding to the success of Area-BCM shown in **Figure 4.8**.

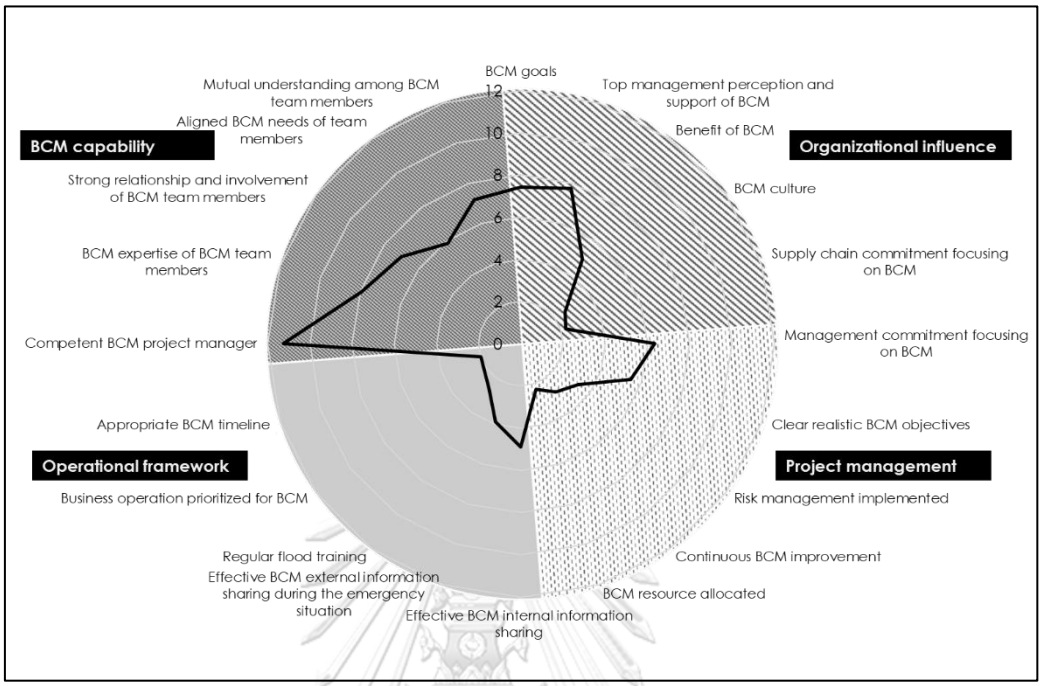

Figure 4.8 Significance order of all factors corresponding to the success of Area-BCM

The Pareto chart represents the arrangement of each factor based on the important weight, shows in **Figure 4.9.** It highlights 80 cumulative total percentages, which are the most significant factors that should prioritize first. There are 12 essential factors to concern and prepare primarily including *4.1 Competent BCM project manager, 4.2 BCM expertise of BCM team members, 1.2 Top management perception and support of BCM, 1.1 BCM goals, 4.5 Mutual understanding among BCM team members, 4.3 Strong relationship and involvement of BCM team members, 2.1 Management commitment focusing on BCM, 4.4 Aligned BCM needs of team members, 2.2 Clear realistic BCM objectives, 1.3 Benefit of BCM, 3.1 Effective BCM internal information sharing, and 3.2 Effective BCM external information sharing during the emergency situation.*

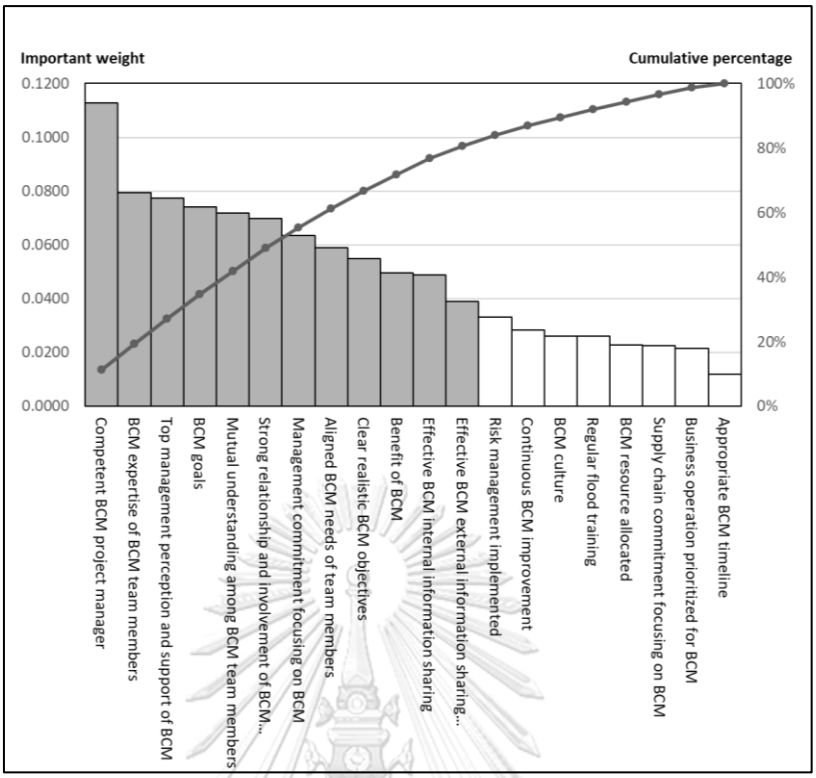

Figure 4.9 Pareto of the significance order of factors corresponding to the success of Area-BCM

4.3 Stakeholder analysis

According to the proposed research model, to identify the success factors and factors that impact the Area-BCM project implementation in the company and the stakeholder's perspective. 24 respondents are divided into four group by use power-interest matrix. As **Figure 4.10**, they are grouped based on the level of interest and the power to influence on BCM.

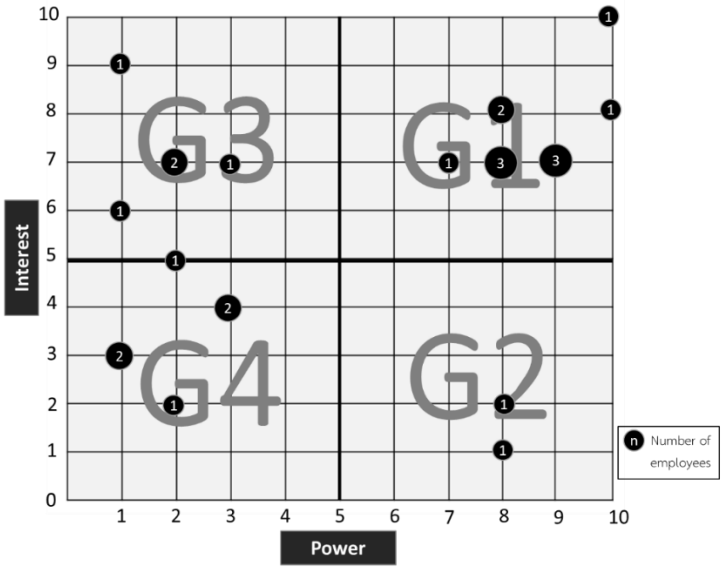

Figure 4.10 Power-Interest matrix

To understand each stakeholder group's point of view, the answers from each respondent are divided into four groups as follows.

- G1; the group of stakeholders with high power to influence (power score; 6-10) and high level of interest in BCM (interest score; 6 – 10). There are eleven persons include employees inside the company, industrial park, and government agencies.

- G2; the group of stakeholders who has high power to influence BCM (power score; 6-10) but has a low level of interest in BCM (interest score; 1 – 5). Two persons from the infrastructure provide inside the industrial park are in this group.

- G3; the group of stakeholders who has low power to influence BCM influence (power score; 1-5) but has a high level of interest in BCM (interest score; 6 – 10). There are five employees in the company in this group.

- G4; the group of stakeholders who has low power to influence (power score; 1-5) and low level of interest in BCM (interest score; 1 – 5). There are five employees in the company in this group.

Then, the result of each group has been calculated. The ranking of categories corresponding to the success of Area-BCM each stakeholder group. The results show that BCM capability is the highest ranking in all the stakeholder groups. Although, there are combine between employees inside the company and the related stakeholders outside within G1. The calculated result separate between these employees is still the same order in all categories. So, the ranking of categories of Area-BCM success factors in each stakeholder group shows in **Figure 4.11.**

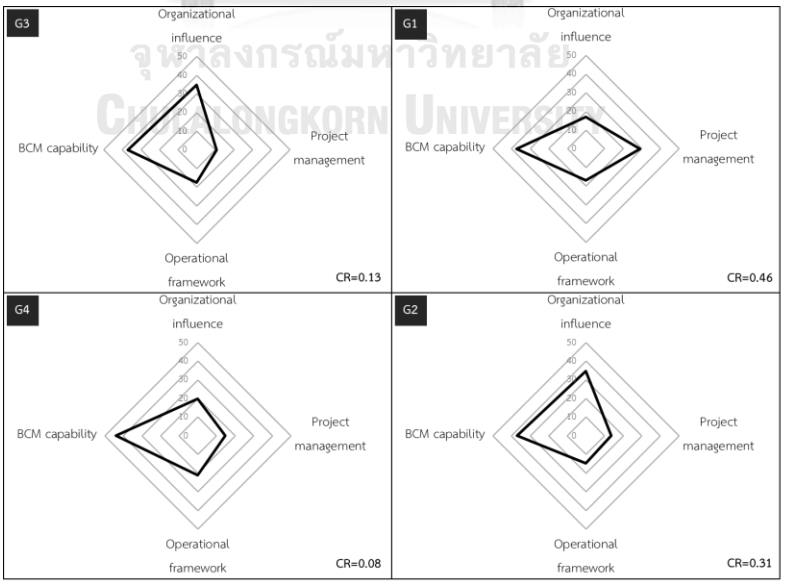

Figure 4.11 Ranking of categories in each stakeholder group

Although the CR within three stakeholder groups (G1, G2, and G3) have been calculated over the acceptance level. The significance order of all factors corresponding in sub-category within the G4 group was also calculated over the acceptance level. Therefore, the factor ranking will be discussed based on the overall result in the next chapter.

Chapter 5 Discussion

According to the results that have been calculated and shown in chapter 4. The discussion for this research based on the two objectives will be explained and clarified in this chapter.

5.1 The success factors identification

Since identified the potential factors by using the Delphi study with BCM experts, it has been divided into four major categories: Organizational influence, Project management, Operational framework, and BCM capability. Based on the importance weights of each factor that we derived, the result has been shown in **Table 4.9**. It indicates that the BCM capability is the most significant category that plays an important role in the success of Area-BCM implementation, followed by, Organizational influence, Project management, and Operational framework. The discussion will be explained separately as per below.

5.1.1 BCM capability

BCM capability refers to an organization's ability to adapt, integrating organizational competencies to match the requirement of BCM. The result shows that BCM capability is very crucial to succeed in Area-BCM execution. Most respondents said that they moderately understand BCM. According to this, they might feel Area-BCM might be complicated to do. There are currently few successful Area-BCM implementation stories in Thailand. It is difficult for an organization to find the implementation guidance that fits its needs. Therefore, the more BCM capability increases more confidence that the Area-BCM implementation direction can create in the right way. The important thing is before launching Area-BCM development, you have to ensure that your organization has sufficient capabilities. According to this, the importance weight in this category shows that the competent project manager significantly impacts successful Area-BCM. To get along with this factor, the project manager should prioritize BCM and excellent power to communicate, act, and make decisions regarding BCM issues. It is not only the project manager but also the expertise of BCM team members. The result shows the importance weight of BCM expertise of BCM team members in the second ranking. This result matches the survey of BCP Status of the SMEs in the Asia-Pacific Region by Asian Disaster Reduction Center (ADRC) which reported “lack of company BCP knowledge and expertise” is the biggest obstacle for respondents who have not written the BCP (ADRC, 2012). Nowadays, there is no Area-BCM guideline, but when considered Area-BCM as an approach that integrates organizational BCMs within the area. The organization can use ISO22301 and ISO22313, which are standardized for developing BCP and managing BCM, as the first step in helping them get more understand in BCM. Then, they can adapt this into Area-BCM.

5.1.2 Organizational influence

The effects of organizational influence impact the BCM project setting. The result shows that top management perception and support of BCM has significant. It reflects that the critical drivers for project initiatives must have board-level support in order to succeed. As mentioned in the literature review, the top management should support to provide sufficient resources notably money, personnel, logistics, material, and plant must be adequately allocated. As mentioned before, there are currently few successful Area-BCM implementation stories in Thailand. The top management may not be able to visualize the outcome from it. According to this, they might decide not to support. It is also related to the stakeholder analysis part in G1 and G2 group, which are the person who has high power to influence Area-BCM implementation, many respondents are interested in Area-BCM by following the regulation. It can be implied that if there is no law and regulation, they might decide not to support Area-BCM development. Creating a perception of Area-BCM is the solution to increasing more interesting in Area-BCM. In practice, it is necessary to clearly explain the concept of Area-BCM to board-level that why the corporate should decide to implement it, and what is the benefit of this project that the corporate will get. Moreover, one corporation cannot create Area-BCM so the project initiator must expand a perception to all the stakeholders in the area to get more collaborating entities. Besides, the result shows the importance weight of BCM goals is very close to top management perception and support of BCM. Once the top management recognized that Area-BCM they have invested in does not align with the corporate context, they might decide to stop to support. So, the project cannot continue. Therefore, to get long-term support, it is necessary to ensure that Area-BCM is setting align with corporate needs.

5.1.3 Project management

Based on the result, Management commitment focusing on BCM has the highest importance weight in this category. In practice, Area-BCM must be conducted as a continuous cycle of improvement. Area-BCM might be an attractive approach after the organization faced a disaster, but disaster maybe not come every year. Then, Area-BCM becomes an inactive project and employees may not be a willingness to do Area-BCM because they feel not important. Finally, cycle of Area-BCM cannot continue.

5.1.4 Operational framework

Despite the operational framework has the lowest importance weight within the main four categories. But implementing Area-BCM is a cooperation between private sectors, national government, municipalities, operators of infrastructure and utilities, and local communities in the area. The information sharing is a key. The result shows both internal information sharing, and

external information sharing have high importance weight. Working on Area-BCM, the collaborating entities might have different information. They may need information from each other. It necessary to find out an effective route of information sharing both reporting and submitting information together. Besides, making people believe that information is also necessary.

The result derived from AHP shows the ranking of which factor is the most important to concern and prepare. Additionally, the expert (Delphi result) rank and the study company (AHP result) show similar results: the highest level, competent BCM project manager, and top management perception and support of BCM. The BCI competency framework describes the competencies relevant to BCM into two board groups: leadership and management competencies and professional practice competencies (BCI, 2020). This research highlights that leadership and management competencies are more important than professional practice competencies. Therefore, to succeed in Area-BCM implementation, the organization has to develop this competency first.

Moreover, the 12 significant factors corresponding to the success of Area-BCM have been verified by asking experts to give an important score. The survey form was sent to ten experts via email and set the meeting agenda. With four emails back from all the experts, the feedback shows that they agree with the 12 significant factors. In Addition, this survey includes the draft of preliminary guidance for the Area-BCM project implementation to ask them for a suggestion. Experts give some advice to add more details, such as some guidance should think more about feasibility, and some guidance should have more activities. According to the suggestion, the completed preliminary guidance for the Area-BCM project implementation is explained in **section 5.2**.

Nevertheless, the other factors that have less weight are still considered factors that also impact Area-BCM development. AHP is good at prioritizing factors, but it cannot answer about the relationship between factors. Some factors may affect each other, so examining affecting factors can help understand and balance the concerned factors. Therefore, research in investigating the affecting factor is also necessary for the future.

5.2 Guidance for Area-BCM project implementation

In this study, a framework has been developed for conducting a critical success factor for Area-BCM implementation. Based on stakeholders' perspectives, the result can be used as a preliminary guideline for Area-BCM implementation. As mentioned in chapter 2, there are five steps in Area-BCM cycle: Step1 Understanding the area, Step2 Determining Area-BCM strategy,

Step3 Developing Area-BCP, Step4 Implementing and reviewing, Step5 Improving Area-BCP (BABA et al., 2014). The BCM capability is considered as the critical element. We should always concern about this factor in the whole cycle. The next is organizational influence, which is related to Step1, 2, 5. Followed by the project management and operational framework. The associated factors which impact each step illustrated in **Figure 5.1**.

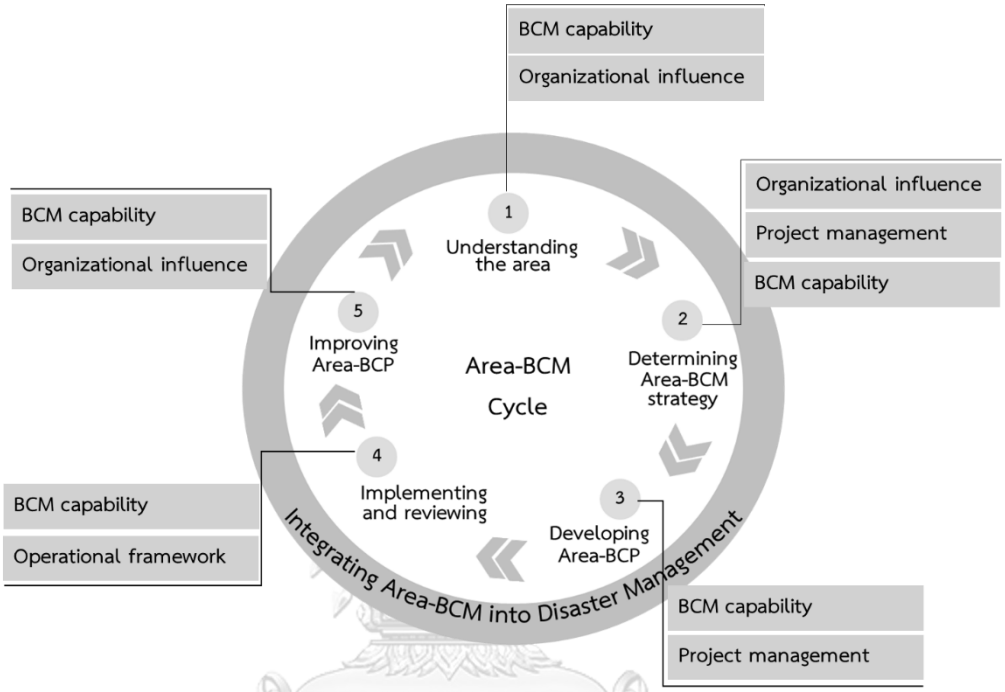

Figure 5.1 The associated factors which impact each step of Area-BCM Cycle

Based on the importance weight comparison factor by factor, the significance order of factors corresponding to the success of Area-BCM has been shown in **Figure 4.9.** There are 11 essential tips to managing Area-BCM development from the beginning.

5.2.1 Ensuring BCM capabilities are placed in your organization.

- Select the competence BCM project manager

To get the right person to be in charge of launching the Area-BCM program; you need to find a project manager who has a fundamental understanding of the core concepts of BCM. You have to ensure that he/she has a certain level of BCM expertise, Business Continuity Specialist Certified, which provides essential skills and knowledge of the concepts of developing business continuity, is the recommendation. A reasonable level of operational knowledge and experience will be an advantage if he/she does not have a certificate yet. In addition, he/she must

prioritize BCM and excellent power to communicate, act, and make decisions regarding BCM issues.

- Select the BCM team members

Select suitable members who fill specific needs to participate on the Area-BCM team. For example, they might come from various departments such as IT, Emergency, Customer service, etc. In addition, they might have different fields of expertise to creating BCM training, BCM workshop, or hiring a BCM consultant. Therefore, they are one of the alternatives to ensure that they have sufficient basic BCM capabilities to operate the project smoothly.

5.2.2 Create top management perception and support Area-BCM.

It is necessary to clearly explain the concept of Area-BCM to top management in order to influence investment decisions in Area-BCM and continuous support to provide sufficient resources, notably money, personnel, logistics, material, and plant. You have to find organizational risk and how it impacts the critical organizational processes, measure the amount of business impact. According to this, you make the BC strategy and present it with the top management to see the different effects between having/ no BCP in the organization for further management decisions.

5.2.3 Share common goals of Area-BCM among the collaboration

The Public-Private Partnership in Area-BCM is currently interdependent. The concern is that collaboration within a room may not be fruitful as organizations' objectives are not the same. Therefore, it is essential to arrange a meeting to discuss and set Area-BCM goals together for the same operating direction among the collaboration.

5.2.4 Create mutual understanding among Area-BCM team members.

Working on Area-BCM is multi-organization. So, communication between team members must be crystal clear. Therefore, the recommendation is to create a BCM scenario workshop to develop mutual understanding among Area-BCM team members since the beginning to prevent the misunderstanding and track the issue is essential. It is not only a workshop once but also a series of workshops in every important milestone of the project.

5.2.5 Develop a strong relationship and involvement of Area-BCM team members.

Create an environment to encourage team members to share the progress of their tasks, asking for help and feedback to keep in touch and strengthen

relationships within Area-BCM team members. The recommendation is to set a regular meeting and a communication tool, such as email or an online app for communication, that allows the teams to communicate about any BCM issues or request some help.

5.2.6 Management commitment focusing on BCM.

All the management involve in Area-BCM should understand their role and put BCM as an important priority. The recommendation is to create a scenario and the most significant impact on the organization if we do not have the BCP during a flood disaster. Try to emphasize to them the outcome of BCM continually, and they will put afford into BCM.

5.2.7 Align the Area-BCM needs of team members.

You have to survey to gather the needs from stakeholders then set a discussion meeting to consider and agree on the need that necessary for every involved organization. It is essential to share a common understanding of weaknesses and bottlenecks in the area to create aligned needs for Area-BCM establishment within the same direction.

5.2.8 Set clear Area-BCM objectives.

The unclear objective may create misleading in the processes of The Area-BCM. To create BC strategy and plan, it is necessary to set the specific objective of Area-BCM such as to protect the critical operations, to save employees, to protect the community. You should clearly explain, by document, presentation, or both of them to the team. The Area-BCM objectives must be clear, realistic, measurable, timely, and flexible in the real context of a disaster.

5.2.9 Expand the perception of the benefit of Area-BCM.

Only one corporation cannot create Area-BCM by itself. Therefore, the project initiator must expand the perception of the benefit of involving in Area-BCM to all the stakeholders in the area to get more collaborating entities and more investment decisions. A risk assessment which can help you determine hazard of the area is the recommendation; you have to identify risks in the area, measure and evaluate those risk. Then, you select the significant risk that affects the area, and you have to set a meeting to present it to them. For example, you can use the lesson learned from the previous flood disaster and show them the benefit of Area-BCM, reducing that loss.

5.2.10 Create effective Area-BCM internal information sharing.

It is necessary to have an effective system for BC data sharing among team members. Including data accessibility, data security, and ensuring that team members can access the required data even during an emergency. You should create handbooks for all related team members and organize the training workshop to certify an understanding and the ability of system usage. And conduct the re-curing training to ensure the ability of them.

5.2.11 Create effective Area-BCM external information sharing during the emergency situation.

It is necessary to develop the system for information sharing between a company in the area. To know the current situation, early warning, and sharing resources during the emergency situation. The system should provide information such as hazard information sharing, hazard map, etc. Create the sharing database for every organization inside the area is recommended to operate effectively. This database should be updated real-time or nearly real-time for management during crises that need urgent decision-making. Additionally, crucial information regarding risks must be updated as needed and do not always have to communicate to other people outside or the BCM team or organization to avoid misunderstanding. However, people can raise questions, and the BCM team should promptly respond to those questions to avoid rumors.

However, a research survey is conducted before launching Area-BCM. We hope this research can be a preliminary guideline for companies to managing their Area-BCM development.

5.3 Stakeholder analysis

Based on the study company is located in Ayutthaya province, where had submerged in the 2011 flood. This company was struck by a flood and started to restore operations about two months after the disaster. However, it took several months to resume operations. Based on this experience, stakeholder analysis is surveyed as an expectation that the lesson learns from the 2011 Thailand flood will create employees in the study company more interested in Area-BCM. The result, similar to expectations, is that employees will have a high level of interest in Area-BCM in common. But some of the employees still have a low level of interest. According to **Figure 22**, this section will discuss as follows.

G1, employees in this group are valuable employees for Area-BCM development because they have high power to run the project. And they have a high level of interest. That means they

will put their effort into succeeding in the project outcome. Mainly employees in this group are the management level in the company, such as top management, general manager in the company, general manager from the industrial park, and government agencies. As mentioned earlier, this company faced the 2011 flood. After the flood had gone, they decided to implement the BCM in their company. However, they realized that only individual BCM could not deal with the extensive disaster. So, they looked further to improve some gaps of BCM and found that Area-BCM is beneficial. The result also shows that G1 put the BCM capability as an important prioritize. Therefore, to encourage employees in this group involve in Area-BCM sustainably. Ensuring the BCM capability is placed in an organization is essential

G2, two employees in this group are general managers from the company that provides infrastructure inside the industrial park. The important thing is the individual company in the area cannot operate the business without electricity and water. To put employees in this group to have a higher level of interest and get more involved in Area-BCM. Area-BCM may be complicated to understand or worry that they are insufficient BCM capability to be involved in this project. First of all, it is necessary to introduce them more to the Area-BCM concepts and the importance of their role in this project.

G3, all of the employees in this group are the employees inside the company. They are from a department that connects with people such as human resources, marketing, and security. Besides, the employees in this group were involved in the company BCM project. Thus, they may have some idea and understanding of the concept of Area-BCM. Although they have an indirect influence on BCM, they have a high level of interest. Therefore, this group will be a good participant in the project. There is a very close significant weight between BCM capability and organizational influence in this group. Therefore, it is not only BCM capability but the perception and support from the organization as well.

Lastly, G4 which is deviated from expectation. In this group, they are from the production and maintenance departments. The interesting is even their department had halted operations due to the flood. However, they still have a low level of interest in Area-BCM. To be successful in Area-BCM, the company should find a way for them in order to get a higher level of interest and get more involvement. Discussion sessions and exercises together are good ways to share a common understanding of the Area-BCM concept and collaboration.

Owing to this study company, they learned from the extensive flood, so they decided to go on the BCM concept. Therefore, this result will be effective in specific areas such as the industrial park where had flood experience. However, they might have some differences if survey in another place.

Chapter 6 Conclusion

This chapter contains conclusions, recommendations, and limitations of research. Also, future research directions are discussed in this chapter.

6.1 Conclusion

Developing Area-BCM is considered to be difficult for the company as there are challenges among the collaborating entities. In addition, stakeholders might have different ideas towards the concept of the Area-BCM, which obstructs the implementation. Therefore, this research aims to identify the significant factor that impacts successful Area-BCM. This research was beginning with three rounds of Delphi study with BCM experts. There were four categories to develop the AHP questionnaire: Organizational influence, Project Management, Operation Framework, and BCM capability. Then, the questionnaire was distributed to target samples at the managerial level in the study company and stakeholders in the survey. Finally, the AHP method, which can prioritize the identified factors, was used in research analysis. This research highlights BCM capability is the most significant factor that impact Area-BCM implementation. The 1.) Competent project manager become the top ranked significant impact towards Area-BCM implementation followed by; 2.) BCM expertise of BCM team members, 3.) Top management perception and support of BCM, 4.) BCM goals, 5.) Mutual understanding among BCM team members, 6.) Strong relationship and involvement of BCM team members, 7.) Management commitment focusing on BCM, 8.) Aligned BCM needs of team members, 9.) Clear realistic BCM objectives, 10.) Benefit of BCM, 11.) Effective BCM internal information sharing, and 12.) Effective BCM external information sharing during the emergency situation, respectively. As the research objective, the result derived from AHP shows the ranking of which factor is the highest important to concern and prepare firstly. Nevertheless, the other factors that have less important weight are still considered factors that also impact Area-BCM development.

6.2 Recommendation

Currently, there are a few successful stories of Area-BCM in Thailand. The significant factors arising from this research are key developments for Area-BCM. The author hopes it can use as a preliminary guideline for whoever wants to implement Area-BCM. Those factors are important that they should be prepared at the first step. It is a recommendation for any organization that wants to improve the local resilience of the economy to disasters on an area-wide, especially the industrial park, the government agency to gain more collaboration entities in the agglomerated area.

6.3 Limitation

This research has limitations due to it survey opinions before implementing the Area-BCM system. Therefore, some factors maybe overlook. When completing the full implementation, other factors will be added. Additionally, the results were collected from BCM team members from one company and representatives of their relevant stakeholders. Thus, it might not be able to represent all the perspectives of success factors of BCM Implementation. Another point is about the analyze method that has been used. AHP is good at prioritizing factors, but there will be a problem with the consistency ratio if we separate the respondent into small groups and some of the respondents have confused with their judgments.

6.4 Future research direction

Future research could expand the survey with a full range of stakeholders in the area for more perspective, such as all the companies in the area, public and private infrastructure providers such as telecommunication company, and government agencies in the area. An online questionnaire survey will be easy to use for conducting a survey. Secondly, the scope of research focuses on flood disasters. Nowadays, there is a disaster that people are more interested in, such as drought and epidemic. Further study is suggested to gather more opinions on other disasters. Thirdly, AHP can prioritize factors, but it cannot answer the relationship between factors. Some factors may affect each other, so examining affecting factors can help understand and balance the concerned factors. Therefore, research in investigating the affecting factor is also necessary for the future. Additionally, further study in sensitivity analysis can be useful in eliminating some factors in order to enhance a group decision process more robustness.

Appendix A

Questionnaire survey of the establishment of Area-BCM

Questionnaire survey of the establishment of Area Business Continuity Management (Area-BCM)

You are invited to participate in a survey on the research which is investigating the success factor of the establishment of Area-BCM project in the company. This survey is a part to collect data and identify key stakeholders. We use the company case study, which is [redacted] The word "company" in this questionnaire means "[redacted]". The questionnaire is divided into 4 parts which are General information, Knowledge and responsibilities regarding the BCM project in the company, Interest and power in launching the BCM project in the company, and Identification of success factors for Area-BCM. A total of 12 pages, it will take approximately 15 minutes to complete.

Purpose of questionnaire

To know individual opinions and separate the group of stakeholders in the establishment of the Area-BCM project in the company which target respondents are stakeholders involved with the company.

Participation

Your participation in this survey is voluntary. You may refuse to take part in the research or exit the survey at any time without penalty.

Benefits

You will receive no direct benefits from participating in this research study. However, your responses may help us learn more about the factor that could consider before operating the Area-BCM project and help to create a potential strategy to launch the project sustainably.

Confidentiality

Your survey answers will be scanned and sent to a document file and stored in an independent hard disk drive without exposure to third parties. This survey does not collect identifying information such as your name, email address, or IP address. Therefore, your responses will remain anonymous. No one will be able to identify you or your answers, and no one will know whether you participated in the study or not. So, it is also in any publications or presentations based on these data, and your responses to this survey will remain confidential.

Part 1 General Information

1.1 What is your relationship with the company? (Please check ✓ in ☐)

- ☐ Manager/ executive management in the company
- ☐ Employees who in charge of the company's BCP
- ☐ Supplier
  - ➢ Where is your company located? (Please check ✓ in ◯)
    - ◯ Inside Rojana industrial park, Ayutthaya
    - ◯ Outside Rojana industrial park, Ayutthaya
- ☐ Government agency
  - ➢ Which organization do you work in? (Please check ✓ in ◯)
    - ◯ Province authorities, Provincial Administrative Organization
    - ◯ Local authorities, municipality, Sub-district Administration Organization
    - ◯ IEAT
    - ◯ DDPM
    - ◯ TMD
    - ◯ NESDB
- ☐ Infrastructure Provider
  - ➢ Which type of infrastructure provider company do you work in? (Please check ✓ in ◯)
    - ◯ Electricity
    - ◯ Water
    - ◯ Internet
    - ◯ Roads
    - ◯ Rojana industrial park, Ayutthaya
- ☐ Customer
  - ➢ Which type of company do you work in? (Please check ✓ in ◯)
    - ◯ Car maker
    - ◯ Part maker
    - ◯ Wire harness maker

1.2 Which department do you currently work in? (Please fill in _)

_____

1.3 How many people are there under your control? (Please check ✓ in ☐)

- ☐ Less than 10
- ☐ 10-50
- ☐ 51-100
- ☐ 101-500
- ☐ More than 500

1.4 Have you ever heard about Area-BCM (Area Business Continuity Management)? (Please check ✓ in ☐)

- ☐ Yes
- ☐ No

1.5 Have you ever had flood experience? (Please check ✓ in☐)

☐Yes (e.g. your house, the company where worked, or the transportation route was flooded)

☐No

Part 2 Knowledge and responsibilities for the [redacted]'s BCM project

2.1 Have you ever had BCP training/ emergency drills/ evacuation exercise?

(Please check ✓ in☐)

☐Yes, I have been BCP training

☐Yes, I have been emergency drills/ evacuation exercise

☐No

2.2 How much do you understand BCM? (Please check ✓ in☐)

☐1 ——— ☐2 ——— ☐3 ——— ☐4 ——— ☐5

[don't understand at all] [Completely understand]

2.2 How much do you involve in the [redacted]'s BCM project now? (Please check ✓ in☐)

☐ Officially involved

☐ Felt involved

☐ Not involved

2.3 Do you have responsibility for the [redacted]'s BCM project? (Please check ✓ in☐)

☐ Yes, I have

What are your responsibilities (for the [redacted]'s BCM project) now? (Please fill in _)

_____

_____

_____

☐ No, I have no responsibility at this moment

2.4 Do you feel that you should be involved in the [redacted]'s BCM project but not yet? (Please check ✓ in☐)

☐ Yes

If Yes, please explain why? (Please fill in _)

_____

_____

_____

☐ No

Part 3 Interest and power in launching the [redacted]'s BCM project

3.1 Please select your **interest** in the [redacted]'s BCM project

Please check ✓ **only one answer** which is close to you in ☐)

		(✓)
Extremely interest in BCM, and **having both capacity and authority**		
Very interest	in BCM, and having capacity, **but not authority**	
Very interest	in BCM	
Interest mainly	in BCM	
Little interest	in BCM	
Interest	in BCM by following regulations and **having capacity and authority to implement BCM**	
Interest	in BCM by following regulations	
Interest in particular part of BCM by following regulations		
No interest	in BCM **at this moment**	
No interest	in BCM **at all**	

3.2 Please select your **power** on the [redacted]'s BCM project

(Please check ✓ **only one answer** which is close to you in ☐)

☐ Having **direct** influence on BCM

☐ Having **indirect** influence on BCM

(Please check ✓ **only one answer** which is close to you in ☐)

	(✓)
having **authority to influence** policy making	
Having **direct influence** on policy making	
Having **indirect influence** on policy making	
Having **less indirect influence** on policy making	
Having **no influence** on policy making	

Part 4 Identification of success factors for Area-BCM

4.1 Please indicate how important each of the following potential factors that impact on the successfulness of Area-BCM implementation (Please check ✓ in the table below)

Categories/ Factors	Not Important (1)	Somewhat not important (2)	Important (3)	Somewhat important (4)	Very important (5)
1. **Organizational influence**					
1.1 BCM goals					
1.2 Top management perception and support of BCM					
1.3 Benefit of BCM					
1.4 BCM culture					
1.5 Supply chain commitment focusing on BCM					
2. **Project management**					
2.1 Management commitment focusing on BCM					
2.2 Clear realistic BCM objectives					
2.3 Risk management implemented					
2.4 Continuous BCM improvement					
2.5 BCM resource allocated					
3. Operational framework					
3.1 Effective BCM internal information sharing					
3.2 Effective BCM external information sharing during the emergency situation					
3.3 Regular flood training					
3.4 Business operation prioritized for BCM					
3.5 Appropriate BCM timeline					
4. Capability					
4.1 Competent BCM project manager					
4.2 BCM expertise of BCM team members					
4.3 Strong relationship and involvement of BCM team members					
4.4 Aligned BCM needs of team members					
4.5 Mutual understanding among BCM team members					

4.2 Identification of success factors for Area-BCM
This section is the comparison of the relative important between factors by giving a score which is divided as follows criteria: 1 = Equally important 3 = Somewhat more important 5 = Much more important 7 = Very much more important 9 = Absolutely more important

For example: The comparison between *Organizational influence factor* and *Project management factor*

If you think the *organizational influence factor* is **very much more important**, circle the number 7 on the left-hand side which is organizational influence factor side.

	Factor A	Absolutely more important								Equally important								Absolutely more important	**Factor B**
1	Organizational influence	9	8	(7)	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Project management

If you think the *project management factor* is **absolutely important**, circle the number 8 on the right-hand side which is project management factor side.

	Factor A	Absolutely more important								Equally important								Absolutely more important	**Factor B**
1	Organizational influence	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	(8)	9	Project management

If you think the *organizational influence factor* and *project management factor* are **equally important**, circle the number 1

	Factor A	Absolutely more important								Equally important								Absolutely more important	**Factor B**
1	Organizational influence	9	8	7	6	5	4	3	2	(1)	2	3	4	5	6	7	8	9	Project management

Comparison of the relative important with the respect to: **Identification of success factors for Area-BCM**
Please circle one number per row below using the scale:
1 = Equally important 3 = Somewhat more important 5 = Much more important 7 = Very much more important 9 = Absolutely more important

	Factor A	Absolutely more important							Equally important							Absolutely more important	Factor B
1	Organizational influence	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Project management
2	Organizational influence	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Operational framework
3	Organizational influence	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Capability
4	Project management	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Operational framework
5	Project management	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Capability
6	Operational framework	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Capability

Comparison of the relative important with the respect to: **Organizational influence**
Please circle one number per row below using the scale:
1 = Equally important 3 = Somewhat more important 5 = Much more important 7 = Very much more important 9 = Absolutely more important

	Factor A	Absolutely more important								Equally important								Absolutely more important	Factor B
1	BCM goals	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Top management perception and support of BCM
2	BCM goals	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Benefit of BCM
3	BCM goals	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	BCM culture
4	BCM goals	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supply chain commitment focusing on BCM
5	Top management perception and support of BCM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Benefit of BCM
6	Top management perception and support of BCM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	BCM culture
7	Top management perception and support of BCM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supply chain commitment focusing on BCM
8	Benefit of BCM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	BCM culture
9	Benefit of BCM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supply chain commitment focusing on BCM
10	BCM culture	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supply chain commitment focusing on BCM

Comparison of the relative important with the respect to: **Project management**
Please circle one number per row below using the scale:
1 = Equally important 3 = Somewhat more important 5 = Much more important 7 = Very much more important 9 = Absolutely more important

	Factor A	Absolutely more important ←								Equally important	→							Absolutely more important	Factor B
1	Management commitment focusing on BCM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Clear realistic BCM objectives
2	Management commitment focusing on BCM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Risk management implemented
3	Management commitment focusing on BCM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Continuous BCM improvement
4	Management commitment focusing on BCM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	BCM resource allocated
5	Clear realistic BCM objectives	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Risk management implemented
6	Clear realistic BCM objectives	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Continuous BCM improvement
7	Clear realistic BCM objectives	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	BCM resource allocated
8	Risk management implemented	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Continuous BCM improvement
9	Risk management implemented	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	BCM resource allocated
10	Continuous BCM improvement	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	BCM resource allocated

Comparison of the relative important with the respect to: **Operational framework**
Please circle one number per row below using the scale:
1 = Equally important 3 = Somewhat more important 5 = Much more important 7 = Very much more important 9 = Absolutely more important

	Factor A	Absolutely more important ←								Equally important	→							Absolutely more important	Factor B
1	Effective BCM internal information sharing	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Effective BCM external information sharing during the emergency situation
2	Effective BCM internal information sharing	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Regular flood training
3	Effective BCM internal information sharing	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Business operation prioritized for BCM
4	Effective BCM internal information sharing	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Appropriate BCM timeline
5	Effective BCM external information sharing during the emergency situation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Regular flood training
6	Effective BCM external information sharing during the emergency situation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Business operation prioritized for BCM
7	Effective BCM external information sharing during the emergency situation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Appropriate BCM timeline
8	Regular flood training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Business operation prioritized for BCM
9	Regular flood training	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Appropriate BCM timeline
10	Business operation prioritized for BCM	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Appropriate BCM timeline

Comparison of the relative important with the respect to: **Capability** of organization
Please circle one number per row below using the scale:
1 = Equally important 3 = Somewhat more important 5 = Much more important 7 = Very much more important 9 = Absolutely more important

	Factor A	Absolutely more important	←							Equally important	→							Absolutely more important	Factor B
1	Competent BCM project manager	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	BCM expertise of BCM team members
2	Competent BCM project manager	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Strong relationship and involvement of BCM team members
3	Competent BCM project manager	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Aligned BCM needs of team members
4	Competent BCM project manager	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Mutual understanding among BCM team members
5	BCM expertise of BCM team members	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Strong relationship and involvement of BCM team members
6	BCM expertise of BCM team members	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Aligned BCM needs of team members
7	BCM expertise of BCM team members	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Mutual understanding among BCM team members
8	Strong relationship and involvement of BCM team members	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Aligned BCM needs of team members
9	Strong relationship and involvement of BCM team members	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Mutual understanding among BCM team members
10	Aligned BCM needs of team members	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Mutual understanding among BCM team members

***** Thank you so much for your cooperation *****

Your decision to complete and return this survey will be interpreted as an indication of your agreement to participate.

- **Ethics**
  This study has been approved for the ethics examination by an authorization number [SDM-2020-E005] of the Graduate School of System Design and Management, Keio University.

- **Please return the completed questionnaire to distributor or Asst. Prof. Natt Leelawat, D.Eng.**
  Department of Industrial Engineering, Faculty of Engineering, Chulalongkorn University
  254 Phayathai Road, Pathumwan, Bangkok 10330 Thailand

- **Contact**
  If you have further questions or concerns about your rights as a participant in this study, please feel free to contact responsible faculties: Sansanee Sapapthai
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