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Geospatial Approach for MSMEs Business Continuity Plan in Post Pandemic Era in Malaysia

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Abstract. Malaysia's Shared Prosperity Vision 2030 Strategic Thrust 1 stated that the business and industry ecosystem to be strengthened and expected to contribute almost 50% of the country's GDP. This agenda is indeed in line with Goal 11 of UN-SDG that aims to develop sustainable and resilient cities and communities by 2030. However, due to the result of the global pandemic in 2020, many micro, small and medium enterprises (MSMEs), particularly tourism-services oriented, were heavily affected and, unfortunately, the last to recover. The industry suffered a significant decline in revenue due to halting of operations, travel bans, and lockdowns resulting in delays to the continuity plan of business operations. As a result, there was a reduction in workforce and some of MSMEs were forced to cease their operations. Based on questionnaire-guided interviews of 53 respondents, this paper firstly will deliberate extensive review of the impacts of COVID-19 pandemic on MSMEs in East Malaysia state of Sabah, particularly in tourism-centric regions of Kundasang and Kota Belud areas. Secondly, the explanation of smart GIS solutions through network analyses, in helping MSMEs rejuvenate their business operations as soon as possible during and after the disaster events. The results from GIS Network Analysis for disaster event simulation and outputs show that each case study region reflected differently according to different disaster types and intensities. From the outputs, the study proposed an integrated framework consisting of MSMEs' capital of economic, social, and environmental problem-solving phase, together with an operational framework of Disaster-Business Continuity Plan (DBCP).

Keywords: *BCP, Geospatial Technologies, MSMEs, Post pandemic*

1. Introduction

Rapid urbanization, population growth, disease outbreaks and extreme climate change are leading to an increasing number of disasters and uncertainties, causing significant economic losses, and posing threats to many business activities and its survivability. In the context of this study, further investigation shall be given into the business continuity of Micro, Small, and Medium Enterprises (MSMEs) in post pandemic era in Malaysia. As mentioned by Mohd Lehan [1], for many economies worldwide, MSMEs are the backbone of economic growth. In this light, micro-enterprises, such as street market vendors, to manufacturing facilities with significant financial investments in equipment and employee training are all examples of MSMEs [2]. The Asia-Pacific Economic Commission (APEC) and ASEAN both see them as critical to socioeconomic growth in Southeast Asia, which is the world's most vulnerable region to natural catastrophes [3]. As a result, disaster resilience is also essential for long-term development.

Micro, Small, and Medium Enterprises (MSMEs) play a crucial role within communities and face similar natural disaster risks as their residential neighbors. However, their vulnerability differs significantly in a global economy, as they are exposed to systemic risks related to supply chains and market access, even from events that may occur just a few feet away [1]. In Malaysia, MSMEs hold a significant share, accounting for 98.5 percent of businesses, and in 2016, they contributed 36.6 percent to the country's Gross Domestic Product (GDP) [4]. Unfortunately, the global spread of COVID-19 in early 2020 severely impacted the Malaysian economy. During the fourth quarter of 2020, the country's GDP decreased by 3.4 percent, compared to 2.6 percent in the previous quarter. This decline in economic performance was primarily attributed to the implementation of Movement Control Orders (MCO) from March 2020, aimed at combating the COVID-19 outbreak.

The fourth quarter of 2020 witnessed a decline in GDP across all economic sectors in Malaysia, except for the manufacturing sector, which showed positive growth. Notably, the services sector, a significant contributor to economic activity, experienced a decline of 4.9 percent during this period [1]. The main factor behind this decline was the contraction of sub-sectors related to tourism, primarily due to travel restrictions and closed borders among COVID-19 affected countries. In contrast, the manufacturing sector maintained positive growth at 3.0 percent, driven by industries such as petroleum, chemical, rubber, and plastic products. In addition to the challenges posed by the COVID-19 pandemic, it was observed that few MSMEs had contingency plans or alternative locations to relocate their stock or plants. Some MSMEs also faced vulnerabilities by keeping sensitive equipment and supplies on-site, and only a few had appropriate healthcare insurance [5].

Table 1 shows the MSMEs losses globally due to the disaster events and impact to business operation. Because of their importance in these countries' economy and their linkages to communities, this study has chosen to focus on MSMEs instead of SMEs because the micro enterprises in Malaysia represented 76.5 percent from overall registered SMEs in Malaysia [6].

Table 1. MSME losses and impact on business operations.

Source (Author; year)	Issues	Losses
Egbelakin et al. [7]	Conducted five years after the devastating Canterbury earthquakes and sought to examine the level of earthquake preparedness of SMEs by investigating the actions undertaken in two different suburban locations having differing seismicity	Least obtained preparedness action was related to survival support actions such as maintaining necessary emergency supplies. overall adoption rate of the preparedness actions was less than 30%, with no significant difference between the regions studied, and close to 50% of SMEs having adopted less than five preparedness actions
Kukanja et al. [8]	Tourism SMEs affected by COVID-19 state that there are three critical aspects to save SMEs in times of pandemic.	Only three managers of the firm had a written crisis management plan.
Khalid & Khaver [9]	Businesses with access to relief and assistance were more likely to reopen and resume operations when compared to those without such support. It found that in the aftermath of floods, access to credit was the most important factor determining whether a business survived flood damage	Judicious and fair distribution/ provision of assistance can significantly reduce the time to resume business operations and enhance economic resilience of small businesses in rural areas
Sharif [10]	Investigate the full range of impacts (short term and long term) experienced by SMEs located in coastal region of Bangladesh following floods, cyclone, river bank erosion, saline water intrusion and earthquake	Work and family change transactions were human capital (employees, absence, sole proprietorship; Gender ownership and the age of business), event costs and financial resources and loans from the government).

Losses of MSMEs with the impact to their business operations were significant and mostly came from the disaster events [11]. To address these vulnerabilities and enhance preparedness for disaster events, it is crucial for MSMEs to have a well-structured Business Continuity Plan (BCP). A BCP helps organizations possess the required resources and data to effectively confront and recover from disaster events [12,13]. Interestingly, research by [14] found that even well-established private and multinational companies had insufficient BCPs for their core business infrastructures to recover quickly after disasters. This was primarily due to disruptions in essential resources such as energy, water, transportation, and communication in disaster-affected areas. As a result, the concept of Area BCP was introduced to address these gaps [1]. The aim and purpose of this study is to enhance the resilience of MSMEs and facilitate their recovery in the post pandemic era, due to there is a pressing need for an integrated practical approach [15]. Geospatial technologies work as a mechanism scope throughout this paper as they offer immense potential in quantifying disaster risk profiles and providing essential inputs for preparing Business Continuity Plans (BCP) tailored to MSMEs. By smartly integrating geospatial data into BCPs and conducting Business Impact Analysis (BIA), we can address the demands and needs of MSMEs operating in disaster-prone areas in Malaysia. This approach will significantly improve their resilience and enable them to build back better after facing adversities.

1. 1 Disaster-based Business Continuity Planning

Recognizing the significant impact of disasters, including pandemic outbreaks, on MSMEs, it is concerning that there is still a lack of awareness regarding the importance of area-driven Business

Continuity Plans (BCP) for their operations. According to a report by Ono [11] based on ASEAN economies, only 13% of MSMEs have a BCP, with 34.8% in the process of developing BCP, and almost half of the respondents having no knowledge about BCPs at all. This variation in awareness might be attributed to some respondents experiencing disaster effects while others have not. Additionally, MSMEs lack proper guidelines and effective utilization of various public support systems in developing their BCPs. The key reasons for these gaps are the lack of BCP knowledge and expertise, inadequate information for BCP development, and low awareness among management. To improve awareness, exposure to BCPs and MSMEs' resilience must be increased at all levels of management (district, state, and national) in every country [16].

What is Business Continuity Planning (BCP)? BCP can be defined as a structured process involving the following steps: 1) Identifying critical business processes that are essential for the organization's operation; 2) Assessing and understanding the risks associated with these crucial operations; 3) Developing strategies to reduce or eliminate these risks effectively; 4) Formulating a comprehensive plan to ensure business operations can continue during emergencies or disasters; and 5) Creating a roadmap for swift recovery and resuming operations as soon as possible [17]. Any stakeholders seeking to implement BCP for their organizations can easily follow these steps. The primary goal of developing and implementing a BCP is to ensure the organization's ability to continue functioning during emergencies, thus safeguarding three vital aspects: customer trust, job security for employees, and the vitality of the local economy [1]. According to Mukherjee et al. [18], BCP aims to establish, deliver, and sustain control and management capabilities that allow an organization to continue operating during interruptions. It outlines the organization's strategic objectives, guiding values, and sets safe industrial standards for wealth and resilience during challenging times. Figure 1 shows the main concept of BCP which is illustrated in the chart. In the chart, there are two significant lines, showing the recovery curve with or without BCP measures.

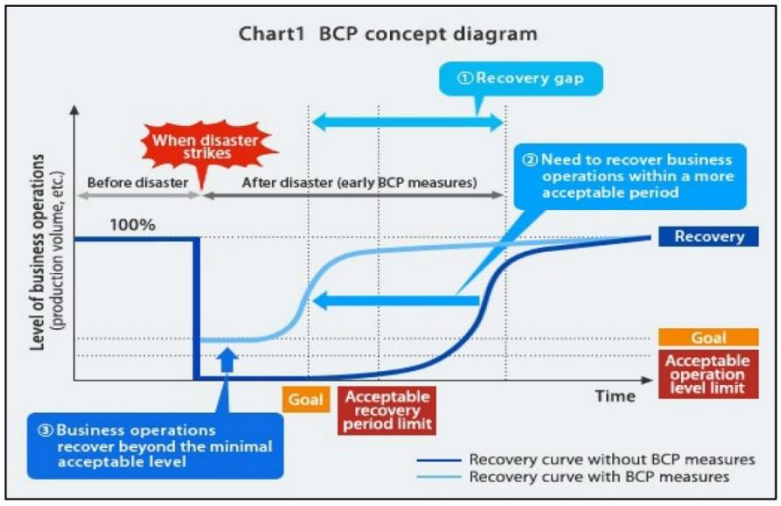

Figure 1. BCP Concept Diagram (Adapted from Hitoshi, 2015)

A BCP outlines an organization's essential functions and the potential consequences of threats. Figure 1 illustrates the concept of business continuity and the recovery curve, showing how the organization's service level is affected before, during, and after a disaster. The deep blue line represents the drop-in service during the disaster, and the light blue line shows the recovery with the implementation of the BCP. The BCP helps the organization recover beyond the minimal acceptable level, aligning with the recovery period and operation level goals. Creating a BCP enables an organization to take necessary measures before a disaster strikes, safeguarding its people, assets, ICT systems, information, and reputation. It provides effective strategies for responding to and recovering

from disasters, ensuring businesses can continue to operate at acceptable levels without disruptions for a set period.

Moreover, as we enter the post-pandemic era with COVID-19, innovation becomes a crucial driver for long-term growth in MSMEs. The pandemic has presented unprecedented challenges to society and commerce. Embracing geospatial technologies has enabled various innovations that are transforming the way businesses operate and creating new opportunities [19]. During economic and disease crises, MSMEs have proven to be effective in driving economic growth post-crisis. Rajabifard Abbas [20] highlighted in their publication the significant use of geospatial technologies and location intelligence in understanding and combating COVID-19. A comprehensive understanding of geospatial principles, data monitoring, planning, and mapping is essential to comprehend the outbreak's impact on infrastructure, people, businesses, and other location-based information. Therefore, there exists a crucial gap in awareness regarding the importance of assessing Area-derived BCPs in Malaysia's post-pandemic era, and promoting this awareness is of utmost importance.

1. 2 Geospatial Technologies in Managing Pandemic Risk Analysis

Climate change and the emergence of new infectious diseases pose significant challenges to the world, exacerbated by the way modern society is structured. A recent example of this is the COVID-19 pandemic [21]. Geospatial data and technology have become integral to various daily services and have driven digital disruptors' prominence in business models during the 2010s. They are widely utilized to enhance social support systems and facilitate planning in multiple domains, including infrastructure, town planning, telemedicine, tele-education, and poverty mapping in numerous countries. Geospatial data also plays a crucial role in hazard mapping, preserving cultural heritage sites, and making informed decisions about the optimal locations for essential services and infrastructure such as transportation, schools, and hospitals [22,23].

The use of geospatial information and related tools is instrumental in integrated disaster risk and crisis management. It provides valuable insights and support for various decision-making processes, including hazard and risk assessment, damage scenarios, early-warning planning, resource distribution during recovery, and risk communication. At every stage of the disaster risk management cycle, from risk identification and reduction to preparedness, response, and recovery, geospatial information plays a critical role in data interpretation and information dissemination [24]. Silalahi et al. [22] for instance, utilizing geospatial analysis to evaluate the demand in contrast to the capacity of Referral Hospitals and to model the spreading case of COVID-19 in order to support and organize an effective health service.

The International Charter on Space and Major Disasters, along with Sentinel Asia, is increasingly utilized by countries in the region. Sentinel Asia, led by APRSAF, disseminates near-real-time disaster information across the Asia-Pacific using Web-based Geographic Information Systems (GIS). It serves as an internet-based information distribution backbone for the region, providing essential satellite and in situ spatial data on various risks [16], GIS has evolved into a valuable tool for local communities in disaster management, improving preparedness and response. Its integration into the disaster response framework has enhanced planning, reaction times, collaboration, and communication, especially during challenging dynamic conditions.

Large-scale disasters require extensive geospatial data on affected areas, infrastructure, and resource needs. Izumi et al. [25] identified ten key innovations in DRR, with five relating to GIS and remote sensing, disaster risk insurance, social media, drones, and disaster-resilient materials. The other innovations are diverse approaches like Community-based DRR (CBDRR), hazard mapping, assessments and index approach, national platforms, indigenous DRR technology, and crowdsourcing. GIS is a computer-based tool that maps the locations of MSMEs and COVID-19 hotspots, and evaluates events, creating dynamic displays by linking databases and maps. It connects seemingly unrelated data sources and aids in analyzing asset locations in relation to potential interruptions, providing value to normal BCPs. During both catastrophes and routine operations, GIS ensures overall situational awareness.

2. Data & Methods

2.1 Research Area and Respondents

After a thorough consideration of a few criteria for study areas selection, the two (2) selected case studies for this research were (i) Kundasang; and (ii) Kota Belud (refer to Table 2). The location and distribution of study areas were shown in Figure 2.

Table 2. Comments of Assessment Criteria for Study Areas (adapted from NPP-3 and NADMA report; research fieldwork 2016 & 2018)

State		**Sabah**	
District		**Ranau**	**Kota Belud**
Sub-district		**Kundasang**	**-**
Comments on the assessment / selection criteria	C1	Having disaster risk impact as stated in NPP-3 and NADMA report	having disaster risk impact as stated in NPP-3 and NADMA report
	C2	Local MSMEs exposed to seismic activities, flooding, landslide on frequent basis	local MSMEs exposed to flooding, landslides on frequent basis
	C3	Opportunity to develop Area BCP best practices and DRR approach	Opportunity to develop Area BCP best practices and DRR approach
	C4	Local MSMEs willing to learn and practice the geospatial technologies	local MSMEs adapted with practice of geospatial technologies (Early warning system)
	C5	Participate in DRR activities, programs and training	participate in DRR activities, programs and training

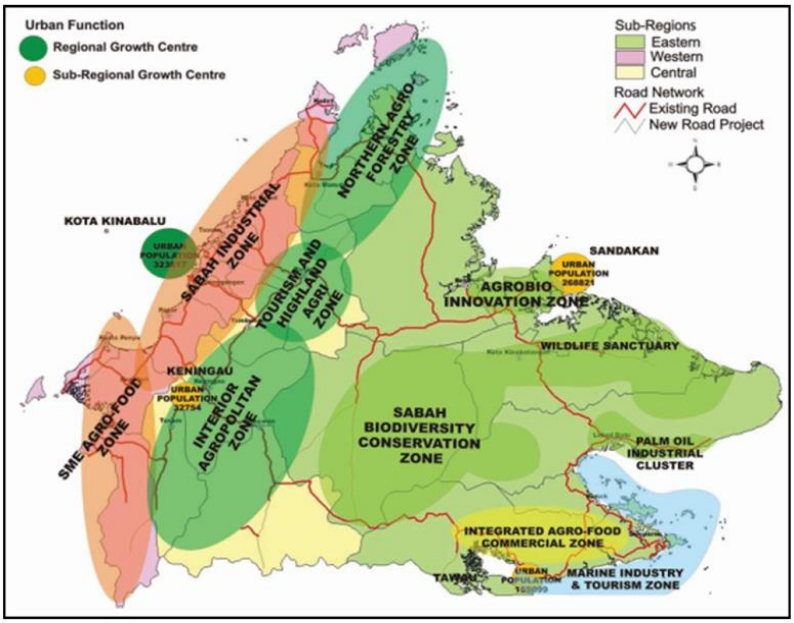

Figure 2. Core components within Sabah Development Corridor (SDC) that highlighted the study areas of Kundasang and Kota Belud within the tourism and highland agricultural zone (Source: [26])

In this study, the authors used a questionnaire survey to assess the perceptions of respondents in East Malaysia, specifically in the tourism-centric regions of Kundasang and Kota Belud areas, regarding

the impacts of the COVID-19 pandemic on MSMEs. The survey also aimed to gather information on the common challenges faced by MSMEs in terms of disaster and pandemic resilience, including their knowledge and preparedness for Business Continuity Plans (BCPs) in their business operations. The sample size for the survey was determined using the simple random sampling technique based on population size, as calculated by Chong [27] and Kamarudin [28].

$$n = \frac{N}{1 + N\,(e)^2}$$

To draw meaningful inferences about a population from a sample, the sample size must be adequate to prevent sampling errors or biases. Previous studies used a 90% confidence level and 10% error in their sampling methods (refer to studies by Kamarudin [28]; Taheerdost [29]). In this study, the authors followed the same approach. The sample size (n=53) was determined using the formula mentioned earlier, and the stratified random sampling was adopted for distribution of survey samples (Table 3). The distribution was based on MSMEs registered with Sabah Economic Development and Investment Authority (SEDIA) latest annual report in 2019.

Table 3. Distribution of survey samples according to study areas (n=53)

No.	Study Area				Num. of registered MSMEs	% of each area	Sampling size (n=53)
	State	District		Sub-district			
1	Sabah	1.	Ranau	Kundasang	55	49	26
		2.	Kota Belud		57	51	27
	TOTAL				112	100	53

Source: Number of MSMEs were collected from SEDIA [26] annual report, supported with a series of fieldwork from 2015 until 2019.

2.1.1 Kundasang

The Ranau area in the state of Sabah is known for its hilly topography, making it the largest producer of highland vegetables in the region. With an elevation of 1,176 meters above sea level, tourism and highland agriculture are the primary industries in this district. The main river in Ranau is Sungai Liwagu, and the district is characterized by its undulating landscape, featuring ripples in certain areas. Kundasang, located within Ranau, is famous for its tourist attractions, including Mount Kinabalu, Malaysia's first UNESCO World Heritage Site, Desa Dairy Farm, and an eco-tourism camping site (Figure 3).

Figure 3. Location of Ranau district and Kundasang sub-district in Sabah (Source: GoogleMap, accessed in 2023)

Kundasang is a small town situated approximately 15 km from Ranau, with a population of around 10,000 residents belonging mainly to the Dusun ethnic group. The town's economy relies on tourism and agriculture industries. However, these sectors are exposed to various natural hazards, including flooding, landslides, and debris flow, particularly affecting five villages: Dumpiring Atas, Dumpiring Bawah, Mesilou, Lembah Permai, and Kundasang Lama. These areas were identified in the Slope and Hazard Mapping Project (PBRC) and development planning guidelines for earthquake-prone regions by the Town and Country Planning Department (PLANMalaysia). On June 5, 2015, a large-scale earthquake with a magnitude of 6.0 hit the area, causing significant damage to the economy of Kundasang. The primary shock, along with 130 aftershocks occurring three months later, triggered extensive landslides on Mount Kinabalu's steep slopes, impacting approximately 1500 hectares of vegetation [30]. While the tourism sector showed signs of recovery after the disaster, it experienced a decline during the COVID-19 outbreak and subsequent movement control order (MCO) and travel restrictions implemented from March 2020 until the government lifted the MCO on December 31, 2021.

2.1.2 Kota Belud

Another selected research case study is Kota Belud, situated north of Kota Kinabalu in Sabah's West Coast Division. Positioned halfway between Kota Kinabalu and Kudat, it serves as the unofficial capital and gateway to the heartland of the West Coast Bajau people. Figure 4 highlights Kota Belud's tourism landmarks, and the Kedamaian River, originating from Mount Kinabalu, is a crucial water source for the district's water treatment plant. However, the water quality was questioned after the June 2015 earthquakes, leading to contamination and dangerous conditions due to fast flow and suspended particulates. Consequently, the water treatment facility had to close, affecting clean water supply to residents, requiring them to find alternative water sources for daily consumption [31]. A study by Kamarudin et al [32,33] analysed the survival of tourism places in the area post-earthquake, and positive changes were observed, with new eco-tourism places opening. However, similar to Kundasang, the tourism sector in Kota Belud also faced difficult times during pandemic COVID-19 and decline in tourist visitation and revenue. At the same time, Kota Belud continuously struggles to cope with recurrent flooding and landslide events [34] as significant impacts after the earthquake.

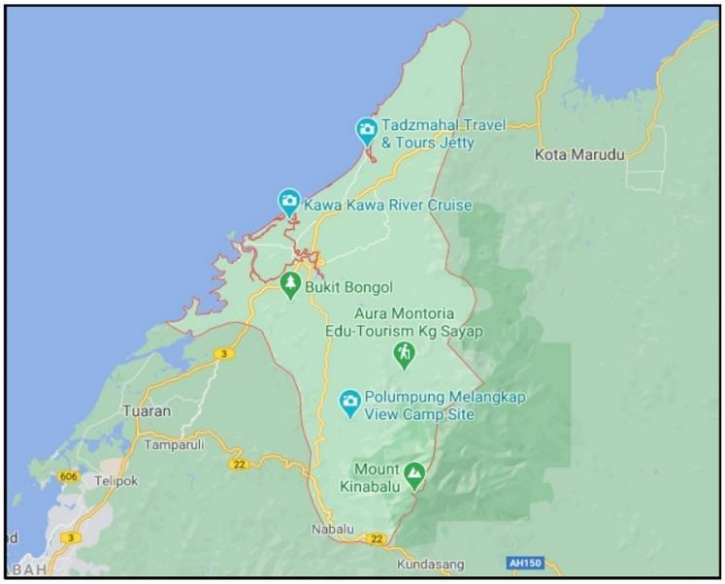

Figure 4. Location of Kota Belud district (marked in red line) in Sabah (Source: GoogleMap, accessed in 2023)

2.1.3 MSMEs within Study Areas

The growth of MSMEs in East Malaysia, particularly in Sabah, has been slower compared to those in Peninsula Malaysia [1]. The government has taken necessary initiatives to support MSMEs in Sabah, providing funding assistance, access to capital, and promoting entrepreneurial skills to enhance their competitiveness and reduce "fear of failure" among entrepreneurs. Despite being Malaysia's second-largest state, Sabah has a surprisingly lower number of MSME businesses compared to smaller states with larger numbers. Despite ongoing efforts by the Malaysian government to promote SME activity, retaining staff has been a challenge for these businesses [35]. Ranau, an essential source of agricultural and tourist revenue in Sabah, faces water supply issues due to heavy water flows and sedimentation in the Liwagu River during the rainy season. The water treatment plant's operation is suspended, causing disruptions in water supply. Rainwater and groundwater hold potential as primary or supplementary water sources during water scarcity, especially in areas with high yearly rainfall like western and eastern Sabah.

After the 2015 earthquake, MSMEs in Ranau experienced clean water supply issues for months, impacting their operations, agriculture, and services to customers in hotels and homestays near the affected water treatment plant. Moreover, during the MCO enforcement with the spreading of COVID-19, local MSMEs faced a drastic drop in their source of income. Hence, the much-needed aid from the government such as PRIHATIN (translated as “concern”) Economic Stimulus Package, PRIHATIN Special Grant, Wage Subsidy Program (PSU), and Moratorium I-Sinar KWSP and recently was Economic and People Protection (Perlindungan Ekonomi & Rakyat Malaysia, PERMAI). All assistance is to support business continuity and enhance existing business [36].

After the 2015 earthquake, Kota Belud experienced positive changes, with farmlands transforming into tourism spots like the Polumpong Melangkap View Campsite, offering stunning views of Mount Kinabalu. Local people took advantage of this opportunity, providing visitors with a scenic experience at a low entrance fee and a comfortable temperature of 20 Celsius. Another must-see spot near Kota Belud is Kuala Abai Village, a popular fishing village facing the South China Sea and serving as the departure point for Mantanani Island. As travel restrictions eased after COVID-19 waves, locals started revisiting recreational spots in the Kadamaian area, leading to slow but steady tourism growth. The community aims to make Kadamaian a world-class rural tourism destination by 2025, focusing on community-based tourism knowledge, hospitality management, organizational skills, and infrastructure facilities. The Sabah Tourism, Culture, and Environment Ministry plans to implement a travel bubble inter-state, allowing people from green zone areas to travel to Sabah, boosting the state's economy. The strategic geographical location of Kota Belud, with oceans in the northwest and highlands in the southeast, adds to its potential for agriculture, fisheries, and tourism [37].

2.2 Methods of Collecting Data

2.2.1 Questionnaire-Guided Interview

In this study, the authors utilized a semi-structured interview method guided by a set of questionnaires to survey local stakeholders, including local communities, business owners, informants, and senior management in the business organization, among others. The quantitative data collected through these interviews helped identify the challenges faced by MSMEs in the study areas during disasters and pandemics. The semi-structured interview comprised a mix of closed and open-ended questions, allowing the interviewer to gather information about local knowledge practices regarding BCPs and their adaptation to disaster events, thus measuring their resiliency. To ensure efficiency and prevent fatigue between the interviewer and respondents, each interview session lasted between 20 to 30 minutes, within an acceptable time restriction.

2.2.2 GIS Data Mapping

GIS connects a variety of seemingly unrelated data sources. Because establishing the location of a company's assets is such an important aspect of constructing a BCP, even the most basic GIS application (determining where things are) provides value to a normal BCP. When BCP analysts use GIS to display asset locations, they can analyse them in relation to probable interruptions in ways that text or tabular representations of the same data cannot. During catastrophes and routine operations, GIS allows organizations to see and retain overall situational awareness [38]. A BCP that is tied to a community's disaster management strategy will allow for a quick recovery of the community as a whole, meaning the public, private, and citizen sectors are collaborating toward a common goal of resuming normal operations. It is important to understand the GIS software capabilities in handling the disaster event data, including the historical data, to represent as regional analysis for risk assessment. Within this study, only three (3) selected GIS network analyst elements were implemented. They are the best routes, service areas and closest facilities. This is due to the spatial data constraint. However, this study shall not eliminate all of the functions in future research direction because it is indirectly related to the disaster event and would definitely help in boosting the BIA phase within the BCPs. Next section will discuss the results and analysis, according to the three (3) elements selected, with preferences to case study in this research.

2.3 Data Processing and Data Analysis

In this paper, GIS data was collected on site and using historical archives. The data were digitized and processed using the ArcGIS 10.8 software. There are two main conceptualizations used for digital spatial data. The first conceptualization defines discrete objects using a vector data model. Vector data models use discrete elements such as points, lines, and polygons to represent the geometry of real-world entities. In this GIS component, the preparation of data is to elevate the capabilities of Business Impact Analysis (BIA) in identifying the risks at their workplace. Furthermore, they can monitor the nearest evacuation centre in case there is an emergency or disaster alert. Malaysia also used the GIS capabilities when dealing with the natural disaster management [34,39,40] but most of their study is focusing on the single disaster effect in East Malaysia. GIS Network Analyst extensions were being run in the data analysis phase. GIS network analysis was extensively being implemented in disaster studies, however only three elements were selected to be executed in this paper. This is because New Area, Closest Facilities and Service Area are the common elements that are being implemented in disaster field analyses.

2.4 Data Analysis Based on Interviews and Questionnaires

In this research, a semi-structured interview method was adopted for the survey with local stakeholders (comprising local communities, local business owners, local informants, senior management in the business organization, etc.). Data from the survey provided inputs for the improvement of the proposed DBCP framework, to give the better outputs for the conceptual framework developed in this study into the more practical approach on site for local MSMEs. The semi-structured interview consists of a combination of closed and open-ended questions [41]. Interviewer would be able to obtain information about local knowledge practices on BCPs and their adaptation to disaster events, in measuring their resiliency. This semi-structured interview would be conducted within the acceptable time restriction to avoid the fatigue between interviewer and respondents.

Overall, an important part of developing a BCP is a business continuity impact analysis which identifies the effects of disruption of business functions and processes. It also uses the information to make decisions about recovery priorities and strategies. Business Impact Analysis (BIA) is defined; "Process that confirms the impact on operations and financing by the business interruption. It identifies critical business operations and processes and relevant business resources and performs analysis of the impact on business continuity." Today, when management system processes are identified in a standard, each process is categorized into one of the four PDCA phases. ISO 22301 is no different. In PDCA

phases, normally the steps started with created a business strategy, business objectives and BCP standards (**Plan**). It is follow with the performance of business analysis steps, such as the business inventory, risk analysis, and BIA. All the steps are documented (**Do**). The testing and auditing the solution is needed in (**check**) phase in order to find out the missing elements in bottleneck measures and initiate the mitigation activities. Lastly in the (**Act**) phase, the results need to be audited, find the gap analysis and assessment, perform steps to improve the overall solution, and at the same time maintaining the BCP documentation. Figure 5 show a schematic schema of how the data and methods were used within this study, which later play an important role in the proposed DBCP framework.

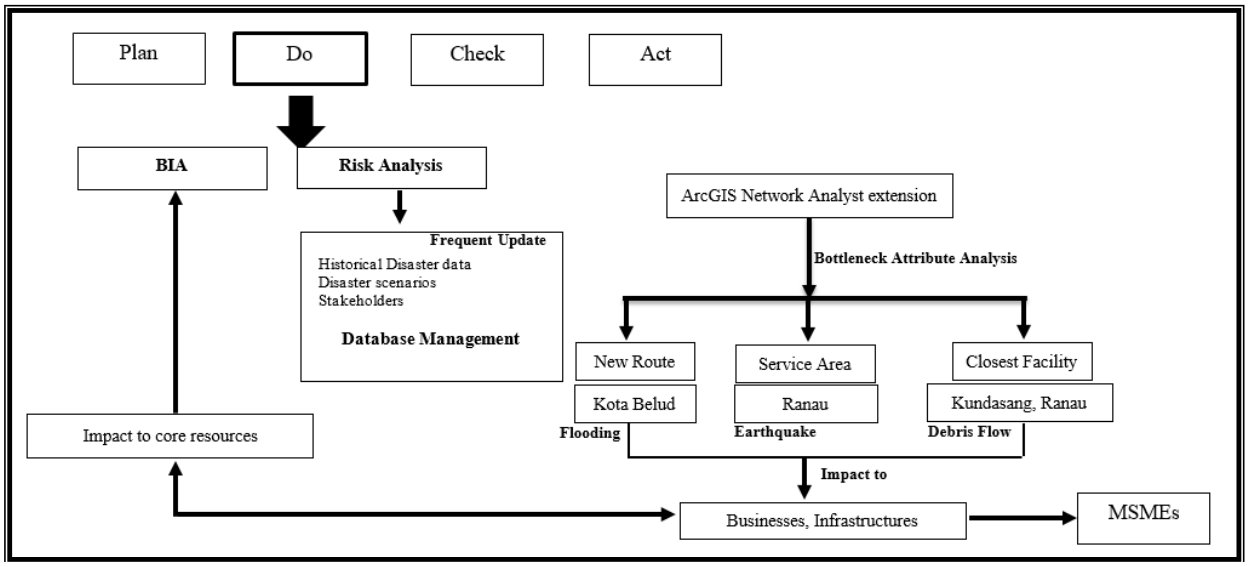

Figure 5. Detailed workflow for data methodology applied in this study.

3. Result and Discussion

3.1 The Impact of Covid 19 and Post Pandemic Era on MSME Sector in Sabah

Sabah has been significantly impacted by the COVID-19 epidemic in both an economic and social sense. The state's economy's main driver, the tourist industry, has been particularly heavily ruined. Compared to the previous year, Sabah saw a more than 70% decrease in visitor arrivals in 2020. This has had an impact on other areas of the economy, including job losses and firm closures. The pandemic has also affected Sabah's social climate. The limitations on mobility and social interaction have contributed to isolation and loneliness and negatively impacted mental health. Inequalities already in place have been made worse by the epidemic, with the poorest and most marginalized communities being disproportionately impacted. However, there are some positive signs in the post-pandemic era. The tourist industry is gradually making a recovery, and Sabah's prospects are once again looking bright. The state government is also making investments in infrastructure improvement and the fight against poverty, which will assist Sabah residents find work and lead better lives. The tourist industry: With a 15% GDP share, the tourism industry significantly contributes to Sabah's economy. Compared to the previous year, Sabah saw a more than 70% decrease in visitor arrivals in 2020. This has had an impact on other areas of the economy, including job losses and firm closures. The pandemic's societal effects have also been seen in Sabah. The limitations on mobility and social interaction have contributed to isolation and loneliness and negatively impacted mental health. Inequalities already in place have been made worse by the epidemic, with the poorest and most marginalized communities being disproportionately impacted.

MSMEs may lack the resources necessary to recover from a significant disaster since they are more susceptible to interruptions than bigger companies. A BCP is a strategy that describes how a company will go on with operations in the event of a disruption. The strategy should outline how to spot risks, how to reduce them, and how to resume business as usual following a disruption. There are several approaches to developing a BCP, but there are some fundamental measures that all MSMEs ought to do. These actions comprise:

i. Identifying hazards is the first step in preventing disruptions to your business. Natural catastrophes, power outages, cyberattacks, and employee strikes might all fall under this category.
ii. Risk mitigation: After identifying the risks, you must create plans to reduce them. This might entail using backup generators, cloud storage, or cyber insurance, among other things.
iii. Restarting business: The last stage is to create policies for restarting operations following an interruption. This could entail devising a strategy for interacting with clients, staff members, and suppliers.
iv. For MSMEs, BCP is a crucial component of risk management. Making a BCP can assist safeguard your company and ensure that it can function even in the case of an emergency.

Therefore, an action was needed for MSMEs to acknowledge the BCP, with the boost of geospatial tools to ensure that they are prepared for any disruption that may come their way and come out with the proposed operational framework as guidelines

3.2 GIS Analysis Results

3.2.1 Kota Belud-Flooding event

Kota Belud district is located downstream closest to Mount Kinabalu, where Kedamaian River flows; as the main source at the water treatment plant for Kota Belud district [31]. After the Earthquake incident in 2015, the river mouth became shallow and it is one of the main reasons for frequent flash floods in the district. In 2017, there was severe flooding at villagers along the Kedamaian River in Kota Belud. This is partly attributed to the post impact of June 2015 Earthquake at Mount Kinabalu in Ranau

[42]. Sometimes, the flood has left Kota Belud cut off by road to small and light vehicles, according to the Fire and Rescue Department of Kota Belud. Only heavy vehicles managed to survive and can use the main roads connecting the town to other states. Normally, when the flood event happens, the simultaneous will follow with the landslides event. This cut off road led to the difficulties for the supplier as well as local businesses to survive through. Some of them sent their local products as stocks to Kota Kinabalu which is the main capital of Sabah. Besides, the impact also includes the local people. As rising water inundated their homes, they needed to move to temporary shelters. Dewan Tun Said Keruak in Kota Belud town is one of the temporary shelters for people affected by flooding. Figure 6 and Figure 7 shows the GIS Analyst result for the new route, which designed to avoid the flooding event and providing with the alternative path for local people daily commute and to find the temporary shelter if the flooding is worsen.

Figure 6. Normal route design using ArcGIS network analyst from Kota Belud hospital to Dewan Masyarakat (community hall) Tun Said Keruak (temporary shelter)

Figure 7. New/alternative route created using GIS network analyst, avoiding a flood event (design as polygon)

Impact of flooding was severe in Kota Belud that led to the installation of an early warning system called SAIFON, installed at main rivers within Kota Belud. This is used to monitor the heavy rains and the rising water level, which at the same time triggered an alert to Civil Defense Members (APM) to be a local leader in helping the migration of affected groups due to flood. Nevertheless, the important part

is to be well-known on the local disaster information or historical data. Since there are not many studies conducted on natural hazard within Kota Belud, and low awareness on the importance of BIA and BCPs among local MSMEs, this study can be one of preparatory study for the area itself.

3.2.2 Kundasang - Earthquake event

When the issue of COVID-19 is rising worldwide, there is a study conducted by Silalahi et al. [22] to help the local government to find a solution in searching the accessibility to referral hospitals. The important spatial data would be the road network, the length of the roads, the road IDs and also the estimation time that can be calculated. Kundasang is selected rather than focusing on Kota Kinabalu, because the aftershocks effect from the Earthquake of Mount Kinabalu from 2015 is still haunting the local communities and indirectly affecting the MSMEs. Most of them are also still recovering and starting to develop back their work routines as farmers, the mount climber (Malim Gunung), and owner of homestays. After five (5) years of the disaster event, the tourism sector just started to breathe out with the opening of Kinabalu Park, the Tagal fish system back to normal with less stressed fishes, and Poring Hot Water Spring is served with clean water and hot temperature to pleasure the visitors. Figure 8 shows the New Closest Facility buffer zones from the epicenter of the Earthquake. Epicenter (Latitude: 5.981438, Longitude = 116.526255) is set in the main incident place. Epicenter here is described as the Earthquake event that occurred in 2015.

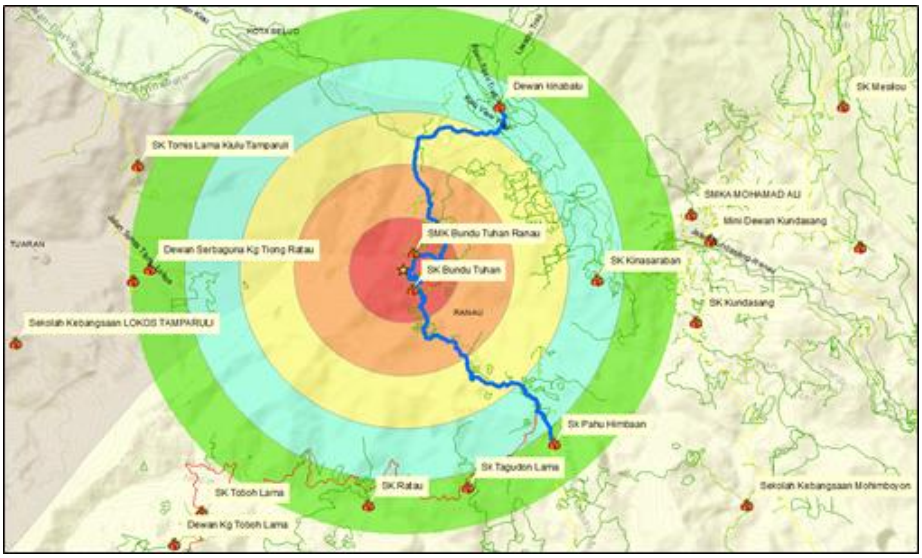

Figure 8. Closest facility buffering zone from the incident point

In the case of Kundasang, MSMEs group coming from farmers and homestay owners, therefore, it impossible to shift their business, other than bring along the important or emergency kit of their business documentation (here is why they need to prepare themselves with proper BCPs, even though their business were small and not well established). Figure 9 shows the output for closest facilities using the indicators set within the analysis.

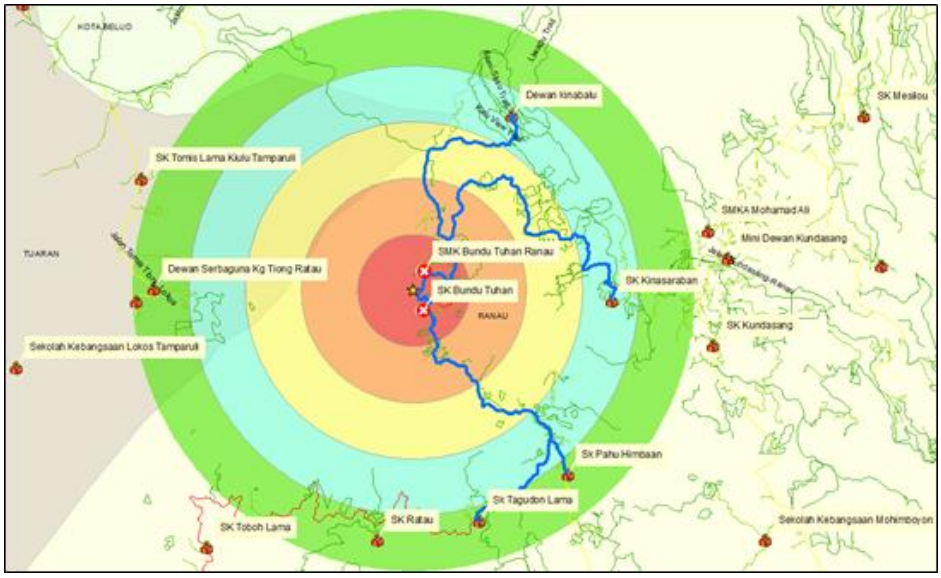

Figure 9. Output of routes in case of earthquake event

From the GIS network analysis results, it is necessary to implement a conceptual framework, called Disaster-based BCP (DBCP). All the results should be assimilated into one framework, which works as the operational or technical framework that serves the bottom to top order of management. This operational framework development was illustrated in detail in the next section.

3.3 Proposed DBCP Framework

The main indicators in the DBCP framework (Figure 10) include the environment (disaster-prone areas), the society (affected local MSMEs) and the economy (local businesses) circle. The role of indicators as being discussed in Table 2 is to guide in decision making through selection on the most appropriate paths or actions to be taken. Phase I suggested indicators are dynamic/fluid in nature so it can be molded to respond appropriately to the local and current conditions of local MSMEs. The affected local MSMEs state and readiness involves the concept of self-assessment by the local disaster agencies on the current state of local MSMEs resilience during the pre-engagement sessions, pre-determined local context, and site-specific indicators. Phase II for the DBCP framework, involves the implementation stage. This is located under the "Do" cycle which can be interpreted as in line with Priority 3 and Priority 4 of SFDRR 2015-2030. This phase embedded geospatial technologies in one of the important key players in BCP documentation, which is the BIA. Within the BIA, there is an assessment regarding the risk analysis and examination. There are Check (for phase III) and Act (for phase IV) that share Priority 2, which is strengthening disaster risk governance to manage disaster risk. Both Check and Act focused on local disaster management which is in line with strengthening the disaster risk governance. Under the Check stage, the monitoring and measurement of the DBCP is significant. It needs to be done on a regular basis to improve the DBCP framework. There is also analysis, and evaluation that is highly dependent on the site-specific and dynamic nature. Internal audit by the internal management team also included in reviewing and improvement to all measures needed in the DBCP framework.

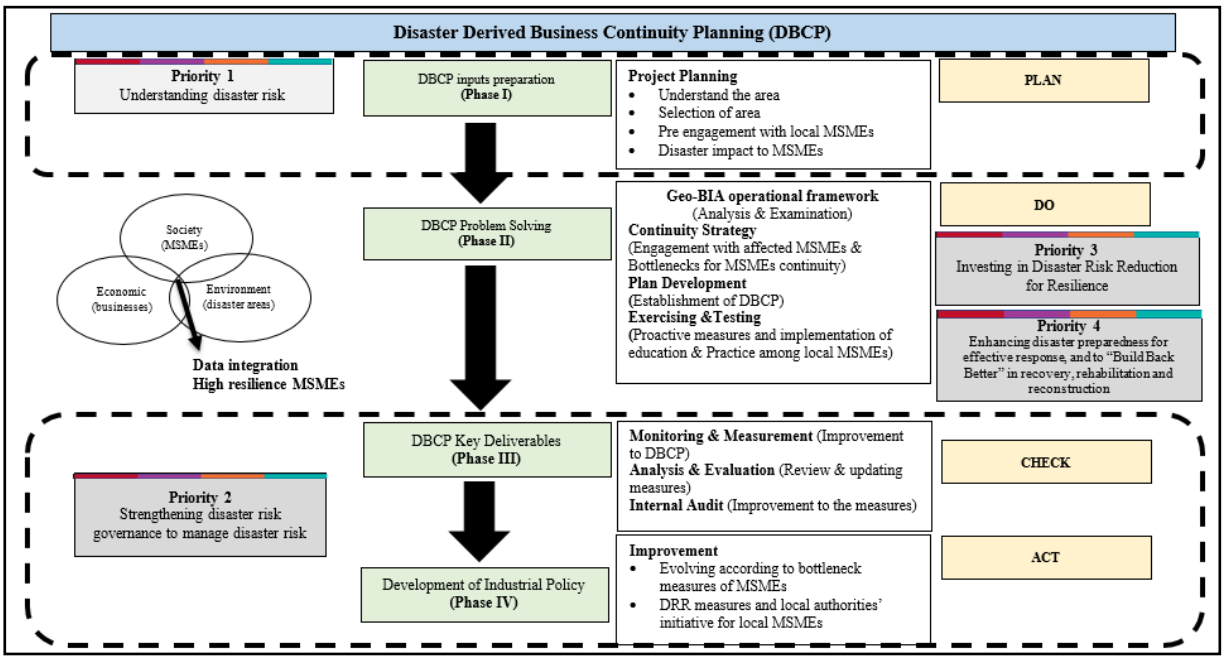

Figure 10. DBCP Framework designed

As for the Act stage, it is closely related to the development of industrial policy. Hereby, the improvement evolved according to bottlenecks for local businesses to MSMEs and also included the DRR measures and local authorities' initiatives for development of local businesses within the disaster-prone areas. Therefore, this novelty method that elevates BIA and risk analysis within the BCP documentation, is one of the dynamic features that could always be upgraded, depending on the site-specific situation, as stated within DBCP framework design.

4. Conclusion

The DBCP framework for MSMEs, especially for those who live in disaster-prone areas and rural communities, can be practiced by local disaster managers and committees in building up a resilient community, including the local MSMEs, thus answering the objective and aim for this study, which to enhance the resilience of MSMEs and facilitate their recovery, for the case of post pandemic era. They will acknowledge the flexibility of the framework, especially when they are exposed to the geospatial data on site. Since this study, focusing on the bottom to top approach, means that the local MSMEs should play an active role in understanding the DBCP framework. The DBCP framework developed in this study was beneficial as future preferences to other researchers for them to refer to the BCP development based on ISO 22301:2019. Moreover, the flexibility within the framework also can be used as a guidance for researchers, to develop more extensive geospatial data analyses, preferences to disaster-prone areas, not only limited to local MSMEs, but also to the community and individual livelihood.

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