



Faculty of Economics and Business

**Assessing the Interplay between Economic Vulnerability and Health
Resilience: A Multidimensional Analysis of Malaysia**

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Assessing the Interplay between Economic Vulnerability and Health
Resilience: A Multidimensional Analysis of Malaysia

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DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. Except where due acknowledgements have been made, the work is that of the author alone. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.



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ABSTRACT

Following periods of economic growth, nations often encounter various challenges, as evidenced by the diverse crises affecting Malaysia's economy. In this context, addressing economic vulnerability and health resilience is crucial for ensuring that government policies are effectively aligned to enhance societal well-being. However, these concepts are inherently abstract and difficult to measure objectively. This study aims to address this gap by first constructing indexes for economic vulnerability and health resilience, grounded in the Economic Vulnerability Theory and the Social Determinants of Health framework. Subsequently, the study examines the interaction between these two dimensions. In addition to integrating data representing external economic conditions, the study successfully recruited 389 respondents from diverse socioeconomic backgrounds. Across three versions of the economic vulnerability and health resilience indexes, findings indicate that Malaysian society exhibits moderate levels of both economic vulnerability and health resilience. Moreover, results suggest that higher-income groups demonstrate greater economic vulnerability and health resilience. Additionally, indicators of economic vulnerability appear to influence the overall health resilience of Malaysian society. Ultimately, the computed indexes and their subsequent analysis provide a valuable benchmark for policymakers. By leveraging these findings, policymakers can refine existing strategies to better address societal needs, promote long-term sustainability, and enhance overall well-being.

Keywords: Economic vulnerability, health resilience, index computation, Malaysia

Menilai Interaksi antara Kerentanan Ekonomi dan Ketahanan Kesehatan: Analisis Berbilang Dimensi di Malaysia

ABSTRAK

Selepas tempoh pertumbuhan ekonomi, negara-negara sering menghadapi pelbagai cabaran, seperti yang dibuktikan oleh krisis-krisis yang mempengaruhi ekonomi Malaysia. Dalam konteks ini, kerentanan ekonomi dan ketahanan kesihatan adalah penting untuk memastikan bahawa dasar-dasar kerajaan selaras dengan efektif untuk meningkatkan kesejahteraan masyarakat. Walau bagaimanapun, konsep-konsep ini adalah abstrak secara semula jadi dan sukar diukur secara objektif. Kajian ini bertujuan untuk mengatasi jurang ini dengan pertamanya membina indeks untuk kerentanan ekonomi dan ketahanan kesihatan, yang berakar pada Teori Kerentanan Ekonomi dan kerangka Penentu Sosial Kesihatan. Seterusnya, kajian ini meneliti interaksi antara dua dimensi ini. Selain mengintegrasikan data yang mewakili keadaan ekonomi luaran, kajian ini berjaya merekrut 389 responden berlatar belakang pelbagai sosioekonomi. Melalui tiga versi indeks kerentanan ekonomi dan ketahanan kesihatan, dapatan menunjukkan bahawa masyarakat Malaysia menunjukkan tahap kerentanan ekonomi dan ketahanan kesihatan yang sederhana. Tambahan pula, keputusan menunjukkan bahawa kumpulan berpendapatan tinggi menunjukkan kerentanan ekonomi dan ketahanan kesihatan yang lebih besar. Selain itu, penunjuk kerentanan ekonomi nampaknya mempengaruhi ketahanan kesihatan keseluruhan masyarakat Malaysia. Konklusinya, indeks dibina dan analisis ini menyediakan penanda aras yang berharga untuk pembuat dasar. Dengan dapatan ini, pembuat dasar dapat menyempurnakan strategi yang ada untuk menangani keperluan masyarakat, demi kelestarian jangka panjang, dan meningkatkan kesejahteraan keseluruhan.

Kata kunci: *Kerentanan Ekonomi, Ketahanan Kesihatan, Pembinaan Indeks, Malaysia*

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
COVID-19	Coronavirus Disease 2019
DHS	Demographic and Health Survey
EFA	Exploratory Factor Analysis
EVI	Economic Vulnerability Index
EVT	Economic Vulnerability Theory
HRI	Health Resilience Index
SDOH	Social Determinants of Health

CHAPTER 1

INTRODUCTION

1.1 Introduction

As the economy of the nation is moving forward, pushed by both internal and external factors, the economic stability and health resilience have become critical determinants of individual and societal well-being. As evident from the past, while economic growth has led to overall improvements in living standards, persistent disparities in income, employment opportunities, and access to healthcare continue to place certain populations at a disadvantage. Economic vulnerability, which refers to the susceptibility of individuals and households to financial insecurity and external economic shocks, remains a pressing concern, particularly in developing and middle-income countries. At the same time, health resilience, the capacity of individuals and communities to adapt to and recover from health adversities, is increasingly recognized as a crucial factor in maintaining long-term well-being. However, the interaction between these two phenomena is often overlooked, despite mounting evidence that economic instability can severely undermine health outcomes.

Malaysia presents a compelling case for examining the relationship between economic vulnerability and health resilience. As a rapidly developing nation, Malaysia has made significant strides in poverty reduction and economic growth. Yet, beneath these national achievements lie persistent socioeconomic inequalities that disproportionately affect lower-income and marginalized groups. Rising living costs, employment precarity, and widening income gaps have left many individuals vulnerable to financial instability, making it difficult to maintain access to essential resources such as healthcare, nutritious

food, and stable housing. These economic insecurities, in turn, impact health resilience, influencing how individuals respond to illnesses, chronic conditions, and mental health challenges. Despite the country's robust public healthcare system, disparities in access and affordability persist, particularly among rural and lower-income populations.

Recently, even though our economy has started to recover from it, it is undeniable that the COVID-19 pandemic served as a stark reminder of the fragile balance between economic security and health resilience. Since then, the lockdowns, job losses, and increased healthcare demands somehow affected vulnerable populations, exposing gaps in Malaysia's social safety nets and healthcare infrastructure. While the government implemented economic stimulus measures and healthcare subsidies to mitigate these challenges, many individuals still struggle with financial hardship and limited healthcare access. These realities underscore the urgent need to assess the structural factors that contribute to economic vulnerability and their implications for health resilience. These dynamics is essential for developing policies that strengthen social protection, improve healthcare accessibility, and enhance overall societal resilience in the face of economic uncertainties.

During Malaysia's Movement Control Orders beginning March 2020, absolute poverty rose from 5.6% (2019) to 8.4% (2020), reflecting widespread income shocks among low-income households (Department of Statistics Malaysia [DOSM], 2021; DOSM, 2020). Constrained liquidity among B40 households coincided with persistent out-of-pocket (OOP) shares of roughly one-third of current health expenditure, so even modest fees deterred care (World Health Organization [WHO], 2023; Ministry of Health Malaysia [MOH], 2023). The NHMS 2019 reported adult diabetes prevalence of 18.3%, with heavier burdens in lower-

income groups (Institute for Public Health [IPH], 2020). In rural Sarawak, longer travel times and fewer specialists compounded these pressures, so income shocks translated into deferred outpatient visits and delayed chronic-disease management (MOH, 2021). Social protection initiatives such as mySalam and PeKa B40 expanded financial coverage for the B40, yet programme uptake and service reach were uneven in remote districts, illustrating a fragility channel where economic shocks feed directly into lost care and reduced health resilience (Ministry of Finance Malaysia, 2020; MOH, 2020).

Despite increasing recognition of these issues, research examining the direct interplay between economic vulnerability and health resilience in Malaysia remains limited. Existing studies tend to focus on either economic hardship or healthcare accessibility in isolation, failing to capture the multifaceted nature of their relationship. Furthermore, little attention has been given to how different socioeconomic groups experience these challenges or how policy interventions can be tailored to address their specific needs. By exploring these intersections, this study aims to fill a critical research gap, providing a multidimensional perspective on economic vulnerability and health resilience. Through an in-depth analysis of socioeconomic trends, healthcare policies, and the lived experiences of vulnerable populations, this research seeks to offer practical recommendations for policymakers, healthcare providers, and social welfare organizations.

1.2 The Concept of Economic Vulnerability

Economic vulnerability is a multidimensional concept that refers to the susceptibility of individuals, households, or economies to economic shocks and financial instability (Briguglio et al., 2009). It extends beyond poverty to encompass a range of structural

weaknesses, exposure to external economic fluctuations, and the capacity to absorb and recover from financial adversities. Economic vulnerability is particularly significant in the context of global economic uncertainty, where individuals and communities face recurrent financial hardships due to factors such as income inequality, unemployment, inflation, and inadequate social protection. With this, it is crucial to understand economic vulnerability which requires an examination of its key determinants and how they manifest across different socio-economic contexts.

One of the primary determinants of economic vulnerability is exposure to certain structural and external factors. Societies with high income disparities often experience persistent economic insecurity among lower-income groups, leading to reduced social mobility and entrenched cycles of poverty (Piketty, 2014). This is particularly evident in developing economies, where wage gaps, limited access to quality education, and an uneven distribution of wealth exacerbate economic precarity. Additionally, unemployment and underemployment significantly contribute to financial instability, as individuals without stable employment often lack access to social security benefits and are more susceptible to economic shocks (International Labour Organization, 2021). Rising inflation and an increasing cost of living further compound economic vulnerability, as households struggle to afford essential goods and services, particularly in regions with weak government intervention mechanisms (Ravallion, 2018).

Another critical dimension of economic vulnerability is financial inclusion, which determines an individual's or household's ability to access and utilize financial services such as banking, credit, and insurance. Limited financial inclusion disproportionately affects

marginalized groups, restricting their capacity to build savings and withstand financial shocks (Demirgüç-Kunt et al., 2018). In many developing economies, financial exclusion remains a persistent challenge, particularly for rural populations and women, who often face barriers such as lack of formal identification, limited financial literacy, and inadequate banking infrastructure (Beck & Demirgüç-Kunt, 2008). Consequently, financial exclusion exacerbates economic vulnerability by reducing the ability of individuals to smooth consumption, invest in productive activities, and mitigate risks associated with economic downturns.

The global perspective on economic vulnerability highlights that both high-income and low-income countries face distinct yet interconnected challenges. In high-income countries, economic vulnerability often manifests in the form of job precarity, wage stagnation, and limited access to affordable housing. Many advanced economies have witnessed a rise in the gig economy and non-standard employment arrangements, which, while offering flexibility, have also led to income instability and a lack of social protection for workers (Standing, 2011). Conversely, in low- and middle-income countries (LMICs), financial instability is often exacerbated by weak institutional frameworks, inadequate healthcare infrastructure, and a high prevalence of informal employment (World Bank, 2020). Nonetheless, the COVID-19 pandemic further underscored the fragility of economic resilience, disproportionately affecting vulnerable populations and exposing the inadequacies of social protection systems worldwide (International Monetary Fund, 2021). The pandemic-induced economic downturn led to widespread job losses, income reductions, and increased reliance on government aid, which in many cases proved insufficient to mitigate financial distress (Baldwin & Weder di Mauro, 2020).

Given these global trends, it is crucial to examine economic vulnerability within the Malaysian context, where rapid economic growth coexists with persistent income disparities and financial instability among certain population segments. In detail, Malaysia's economic performance is influenced by factors such as regional disparities, ethnic income gaps, and reliance on export-driven industries that are susceptible to global economic shifts (Bank Negara Malaysia, 2021). While the nation has made significant strides in poverty reduction, pockets of economic insecurity remain, particularly among the B40 income group (the bottom 40% of income earners), who face challenges related to employment instability, rising living costs, and limited access to social protection (Khazanah Research Institute, 2018). Not to forget, the pandemic further highlighted the vulnerability of informal workers, daily wage earners, and small business owners, many of whom experienced severe income shocks due to movement restrictions and economic slowdowns (Jomo, 2021). Therefore, addressing economic vulnerability in Malaysia requires targeted policy interventions, including strengthening social safety nets, enhancing financial inclusion, and fostering sustainable economic growth that prioritizes equitable wealth distribution. Without comprehensive measures to address these challenges, economic vulnerability may continue to undermine the well-being of affected populations and hinder long-term economic resilience.

1.3 Defining Health Resilience

Health resilience refers to the ability of individuals, communities, and healthcare systems to adapt to, withstand, and recover from health-related adversities, including disease outbreaks, environmental hazards, and socioeconomic stressors. It is a dynamic process that integrates biological, psychological, social, and institutional factors to ensure the maintenance of well-

being despite external challenges (World Health Organization, 2018). The concept of health resilience is particularly relevant in the face of increasing public health crises, economic downturns, and the growing burden of non-communicable diseases in both developed and developing nations. As global health challenges continue to evolve, understanding the determinants and mechanisms of resilience is essential for designing effective public health interventions and strengthening healthcare systems.

According to WHO (2024), there are key factors that could influence health include economic stability, healthcare access, education, social capital, and environment. Economic stability ensures that individuals can afford healthcare services, maintain adequate nutrition, and secure safe living conditions, all of which contribute to better health outcomes (Marmot & Wilkinson, 2006). In contrast, economic instability, characterized by unemployment and financial insecurity, has been linked to higher rates of mental health disorders and chronic diseases, exacerbating health vulnerabilities (Lund et al., 2010). Access to healthcare, including preventive and curative services, is crucial in mitigating health disparities, particularly among economically disadvantaged populations (World Bank, 2021). Countries with universal healthcare systems tend to exhibit higher levels of health resilience, as individuals are less likely to forgo essential treatments due to financial constraints (Reeves et al., 2013). Social capital, which encompasses community support networks, trust, and social cohesion, plays a critical role in enhancing psychological resilience and overall well-being (Kawachi & Berkman, 2000). High levels of social support have been associated with lower stress levels, improved mental health, and better recovery from illnesses (Cohen & Wills, 1985). Additionally, education and health literacy empower individuals to make informed health decisions, reducing the risk of preventable diseases and improving adaptive

capacity in the face of health challenges (Nutbeam, 2008). Higher health literacy has been linked to improved self-care behaviors, medication adherence, and overall engagement with healthcare services (Berkman et al., 2011).

Institutional factors, such as public health policies and crisis preparedness, also play a significant role in fostering health resilience. Government interventions that promote equitable healthcare access, emergency response systems, and vaccination programs can significantly reduce the impact of health crises (Blanchet et al., 2017). The COVID-19 pandemic underscored the importance of resilient healthcare systems, as nations with robust public health infrastructures were better equipped to manage the crisis and mitigate excess mortality (Haldane et al., 2021). In contrast, health systems with pre-existing resource limitations experienced significant strain, leading to increased morbidity and mortality rates. In short, health resilience is a multifaceted concept that extends beyond individual well-being to encompass community and systemic factors. Strengthening health resilience requires a holistic approach that integrates economic stability, healthcare access, social capital, education, and institutional support. As global health threats continue to emerge, fostering resilience at all levels, individual, community, and healthcare system, is essential for ensuring sustainable health outcomes and reducing the burden of preventable diseases.

1.4 Economic Performance of Malaysia during Crises

In a nation, the economic performance is always the concern as it is the fundamental towards a sustainable development. Malaysia is a Southeast Asia country that has experienced significant economic growth and development over the past few decades. This situation could be reflected by the linear trend presented in Figure 1, which presents the Real Gross

Domestic Product (GDP) in Malaysia from 1970 to 2021. On top of this, the country's economic performance from 1970 to 2022 has been characterized by various stages of growth, challenges, and reforms. Along the growth, the past crises that tackled the nations caused the country and the society fall into vulnerability. This is because the past crises as threat exposed the country to a risk for being vulnerable at certain extend which takes time to recover from the vulnerability and economic knockout.

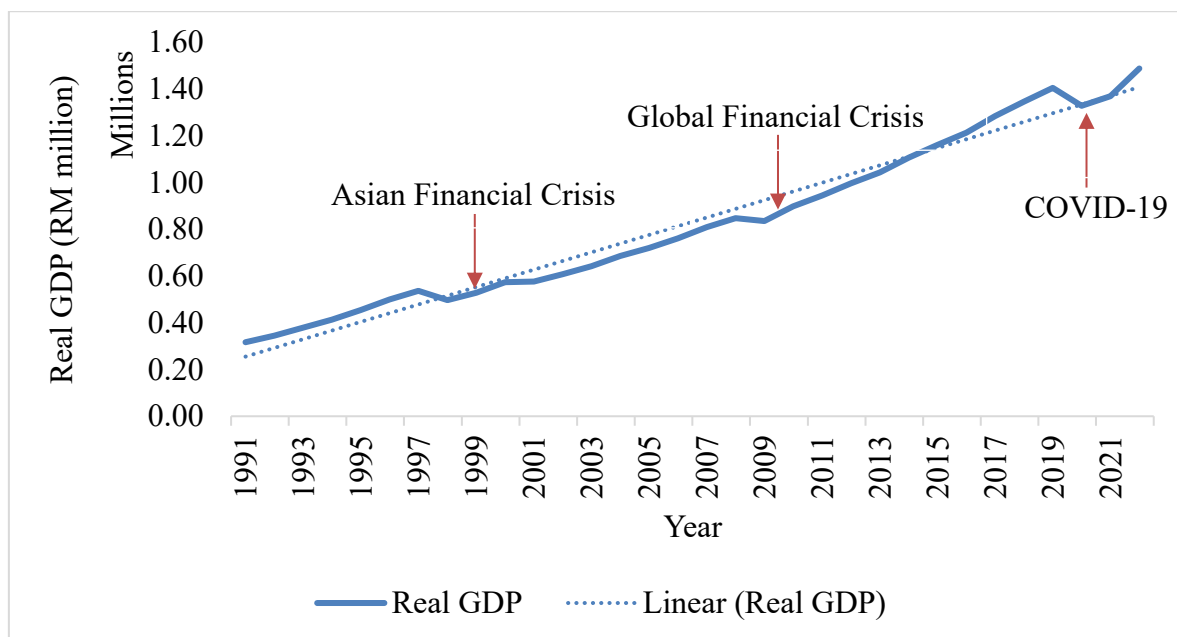


Figure 1.1: Real GDP of Malaysia (1991 – 2021)

Source: CEIC Data, (2023).

From the visualisation in Figure 1.1, it shows that the economic performance fall into recession due to the arrival of the crises namely Asian Financial Crisis in 1998, Global Financial Crisis in 2008 and the COVID-19 that happened few years back. The Asian Financial Crisis was a regional financial crisis that began in Thailand and quickly spread to other countries in Southeast Asia, including Malaysia. The crisis was triggered by a combination of factors, including high levels of debt, currency speculation, and weak

financial systems (Ariff & Abubakar, 1998). In Malaysia, the crisis led to a sharp decline in the value of the Malaysian ringgit and a contraction in the country's GDP, evident by the sudden fall of GDP in year 1998.

The global financial crisis in 2008 that originated in the United States (US) was due to excessive banks' lending, especially in housing loans, which were repackaged and sold to investors. When the property bubble burst, it triggered a domino effect that resulted in the US banking system being crippled, causing some banks to liquidate. Malaysia, a trade-dependent country, was severely impacted by the crisis through its trade and investments. The government responded with a series of measures aimed to stabilize the economy, including capital controls, fiscal stimulus packages, and reforms that intended to strengthen the financial system. However, the crisis had a lasting impact on Malaysia's economy, as it highlighted weaknesses in the country's financial system and exposed the risks associated with high levels of debt and currency speculation.

1.5 The Link Between Economic Vulnerability and Health Resilience

Moving on, the relationship between economic vulnerability and health resilience could somehow be observed domestically and globally. Economic hardship directly influences health outcomes by limiting access to essential healthcare services, increasing the prevalence of mental health disorders, and exacerbating disease burdens among low-income populations (World Health Organization, 2020). Individuals experiencing financial instability often face significant barriers to healthcare access, including high out-of-pocket expenses, inadequate health insurance coverage, and geographic disparities in medical services. These constraints contribute to delayed diagnoses, reduced treatment adherence, and higher morbidity and

mortality rates (Kaiser Family Foundation, 2019). Economic vulnerability also exacerbates the social determinants of health, such as poor living conditions, inadequate nutrition, and increased exposure to environmental hazards, all of which contribute to adverse health outcomes (Marmot et al., 2012).

Beyond physical health, economic vulnerability has profound implications for mental well-being. Financial stress, job insecurity, and housing instability have been linked to increased rates of anxiety, depression, and psychological distress (Lund et al., 2010). Studies indicate that individuals with lower socioeconomic status are more likely to experience chronic stressors, which can trigger physiological responses that negatively impact long-term health (Sapolsky, 2004). The lack of financial security has been associated with heightened allostatic load, a measure of cumulative physiological wear and tear due to chronic stress, which increases susceptibility to cardiovascular diseases, diabetes, and other chronic illnesses (McEwen, 1998). In LMICs, where social protection mechanisms are often limited, the intersection of economic hardship and poor mental health is particularly pronounced, resulting in significant public health challenges (Patel et al., 2018).

Empirical evidence further highlights the disproportionate impact of economic vulnerability on specific demographic groups, including women, the elderly, and marginalized communities. Women in low-income households often face additional health risks due to limited access to maternal healthcare services and gender-based economic disparities (UN Women, 2021). The economic marginalization of women is further compounded by gender wage gaps and caregiving responsibilities, which limit their access to stable employment and financial resources essential for healthcare (World Bank, 2020).

Older individuals experiencing economic insecurity may struggle to afford medical care, exacerbating age-related health conditions and reducing life expectancy (Organisation for Economic Co-operation and Development, 2019). Furthermore, racial and ethnic minorities in many countries experience systemic barriers to healthcare, including discrimination, language barriers, and lower health literacy, which further widen health disparities (Williams et al., 2019). These findings underscore the need for comprehensive policy interventions that address both economic and health disparities to strengthen overall resilience.

In the Malaysian context, economic vulnerability remains a key determinant of health inequities. Despite advancements in healthcare infrastructure, disparities persist in healthcare accessibility between urban and rural populations, as well as among different income groups (Ministry of Health Malaysia, 2021). The populations with fewer opportunities often face higher transportation costs and longer travel distances to medical facilities, limiting their ability to receive timely care (Ng et al., 2014). Additionally, lower-income groups experience difficulties in affording private healthcare services, leading to overcrowding in public hospitals and prolonged waiting times (Mustapha et al., 2020). The COVID-19 pandemic further exposed these vulnerabilities, as economically disadvantaged communities faced greater challenges in accessing healthcare and maintaining economic stability during lockdown measures (Jomo, 2021). Addressing these disparities requires an integrated approach that considers the economic determinants of health and implements targeted policies to enhance resilience among vulnerable communities. Expanding universal healthcare coverage, investing in rural health infrastructure, and strengthening social protection programs are crucial steps toward mitigating the adverse effects of economic vulnerability on health resilience in Malaysia.

Malaysia-specific indicators reinforce this linkage. Absolute poverty increased from 5.6% (2019) to 8.4% (2020) with the pandemic shock, before easing thereafter (Department of Statistics Malaysia [DOSM], 2020, 2021). Adult diabetes prevalence reached 18.3% in NHMS 2019, with higher burdens among lower-income households and rural residents (Institute for Public Health [IPH], 2020). Financial protection remains partial: out-of-pocket (OOP) spending is roughly one-third of current health expenditure, a burden that disproportionately affects B40 households when incomes fall (World Health Organization [WHO], 2023; Ministry of Health Malaysia [MOH], 2023). Together, these indicators show how economic sensitivity (to income/price shocks) and adaptive capacity (to access/finance care) jointly shape health resilience, especially for B40 and rural communities such as those in Sarawak.

1.6 The Needs to Address Economic Vulnerability and Enhancing Health Resilience

The Malaysian government has implemented various policies and initiatives aimed at reducing economic vulnerability and enhancing health resilience, with a focus on social protection, economic stimulus measures, and healthcare reforms. These policies are designed to address structural inequalities, promote economic stability, and improve healthcare accessibility, particularly for disadvantaged populations. However, despite these initiatives, socioeconomic disparities persist, necessitating continuous evaluation and improvement of policy frameworks to ensure inclusivity and sustainability in economic and health resilience strategies.

One of the key policy responses to economic vulnerability is the introduction of social safety nets, such as the Bantuan Keluarga Malaysia (BKM) and EPF i-Sinar

withdrawal scheme, which provide financial assistance to low-income households and individuals facing economic hardship (Ministry of Finance Malaysia, 2022). These programs serve as crucial support mechanisms in alleviating short-term financial distress and preventing households from falling deeper into poverty. Additionally, the Minimum Wage Order has been periodically revised to ensure that workers receive fair compensation, thereby reducing income disparities and improving financial security for low-income earners. However, challenges remain in ensuring that these policies effectively reach all vulnerable groups, particularly informal workers who may not be covered by formal social protection mechanisms (Khazanah Research Institute, 2020). The informal sector, which constitutes a significant portion of Malaysia's workforce, continues to experience income insecurity and limited access to employment benefits, underscoring the need for comprehensive labor policies that extend protection to gig economy workers and self-employed individuals (International Labour Organization, 2021).

In the healthcare sector, Malaysia has made significant progress in expanding access to affordable medical services through programs such as Skim Peduli Kesihatan untuk Kumpulan B40 (PeKa B40) and mySalam, which provide free health screenings and insurance coverage for lower-income groups (Ministry of Health Malaysia, 2021). These initiatives have helped mitigate financial barriers to healthcare access, but concerns remain regarding the sustainability and adequacy of funding for these programs. Moreover, disparities in healthcare service delivery persist, particularly in rural areas where medical facilities and specialized care remain limited (Mustapha et al., 2020). The shortage of healthcare professionals and medical infrastructure in rural and underserved regions further

exacerbates inequalities in health outcomes, highlighting the need for targeted healthcare investments to bridge these gaps (World Bank, 2021).

While Malaysia's policy responses have been instrumental in addressing economic vulnerability and strengthening health resilience, further efforts are needed to enhance the effectiveness and inclusivity of these initiatives. To strengthen labor market policies for better job security, expanding healthcare funding to ensure long-term sustainability, and implementing targeted interventions for marginalized communities, are essential in ensuring long-term economic and health resilience for all Malaysians. Moreover, the integration of digital health solutions and telemedicine could play a crucial role in improving healthcare accessibility, particularly in remote regions (Mahmood et al., 2021). To achieve a more equitable and resilient society, a multi-sectoral approach that involves collaboration between the government, private sector, and civil society is necessary to address the root causes of economic and health disparities in Malaysia.

1.7 Problem Statement

Since 2020, COVID-19 exposed the fragility of both economic and health systems worldwide, highlighting how financial instability and healthcare limitations are deeply interconnected. Many countries, including Malaysia, experienced simultaneous economic downturns and healthcare crises, with businesses shutting down, unemployment rising, and hospitals under strain. In Malaysia, absolute poverty rose from 5.6% (2019) to 8.4% (2020) as the pandemic shock hit household incomes (Department of Statistics Malaysia [DOSM], 2020, 2021). Health services faced surges in demand and deferred care consistent with health-system stress (Haldane et al., 2021). The economic collapse forced many individuals,

especially in vulnerable income groups (B40), into financial distress, limiting their ability to afford healthcare when they needed it most. This past pandemic demonstrated that a country's ability to recover is not solely dependent on economic strength but also on the resilience of its healthcare system and population. Without a strong foundation in both areas, recovery becomes uneven, with some groups rebounding quickly while others suffer long-term setbacks.

From the past literature, economic vulnerability has traditionally been measured using financial indicators such as GDP fluctuations, unemployment rates, and inflation, while health resilience is often studied separately through healthcare capacity and disease burden. This fragmented approach fails to capture the real impact of crises, where economic and health resilience are closely linked. For instance, financial instability can lead to stress-related illnesses, reduced healthcare access, and delayed medical treatments, worsening overall societal well-being. In Malaysia, out-of-pocket (OOP) health spending remains roughly one-third of current health expenditure, magnifying financial barriers during income shocks (World Health Organization [WHO], 2023; Ministry of Health Malaysia [MOH], 2023). Similarly, non-communicable diseases are more prevalent in lower-income groups, the NHMS 2019 reported adult diabetes prevalence of 18.3% with a clear income gradient, so the health impact of economic shocks is unequally distributed (Institute for Public Health [IPH], 2020). Taken together, these patterns illustrate a dual burden on low-income households, where income loss and health stress reinforce one another and slow recovery disproportionately for the B40.

Similarly, poor health resilience can prolong economic recovery, as sick individuals are less productive and healthcare costs rise. In Malaysia's rural and remote areas, including parts of Sarawak, long travel times, limited specialist availability, and uneven service distribution heighten the risk that income shocks translate into deferred outpatient visits and delayed chronic-disease management (MOH, 2021; World Bank, 2021). While national initiatives such as PeKa B40 and mySalam expanded financial protection for the B40, programme coverage and uptake were not uniform across geographies, leaving pockets of unmet need and exposing a health-system fragility channel (MOH, 2020; Ministry of Finance Malaysia, 2020). The disparity in access to preventive measures and timely care created a cycle where the poor experienced worse health outcomes, reinforcing their economic struggles and prolonging recovery time.

The absence of an integrated measure that captures both economic vulnerability and health resilience at the household level makes it difficult to assess societal preparedness for future crises and to target policy effectively. Existing tools point to a scale and content mismatch: the UN Economic Vulnerability Index (EVI) is national-level and omits subnational health-resilience dynamics; the CDC Social Vulnerability Index (SVI) and the UK Index of Multiple Deprivation (IMD) quantify area-level socioeconomic risk but do not integrate household-level health resilience; and the Global Health Security Index (GHSI) assesses national preparedness rather than the income–health interface (Committee for Development Policy, 2021; Centers for Disease Control and Prevention [CDC], 2022; Ministry of Housing, Communities & Local Government [MHCLG], 2019; Nuclear Threat Initiative, Johns Hopkins Center for Health Security, & Economist Impact, 2021). Moreover, core constructs at the heart of resilience analysis remain under-operationalized for Malaysia.

By adopting the IPCC framing, sensitivity denotes the degree to which households are affected by shocks (e.g., income and price shocks), while adaptive capacity denotes the ability to adjust, cope, or recover (e.g., financial protection, access to care); these need to be measured jointly and stratified by income groups (B40/M40/T20) and urban–rural status (Intergovernmental Panel on Climate Change [IPCC], 2014).

Therefore, there is an urgent need for a Malaysia-tailored, integrated Economic Vulnerability–Health Resilience (EV-HR) index that: (i) identifies domains capturing sensitivity and adaptive capacity; (ii) constructs an economic vulnerability index and a health-resilience index at the household level; (iii) stratifies results by income group and urban–rural residence to make disparities explicit; and (iv) examines how sensitivity and adaptive capacity jointly predict health resilience. In a heterogeneous state such as Sarawak, geography and service distribution are likely to modify vulnerability–resilience relationships, making a state-level pilot both policy-relevant and methodologically informative for scaling. These objectives directly address the measurement gap and enable policy-relevant targeting when economic and health stressors coincide, complementing existing macro- and meso-level tools and enhancing Malaysia’s capacity for evidence-based, equity-focused crisis preparedness and recovery.

1.8 Research Questions

The research questions of the study are as below:

- i. What are the critical domains of economic vulnerability and health resilience?
- ii. How can an economic vulnerability index be computed for Malaysia?
- iii. How can a health resilience index be developed for Malaysia?

- iv. What are the disparities in economic vulnerability and health resilience across different income levels?
- v. What is the relationship between sensitivity, adaptive capacity, and health resilience?

1.9 Objectives of the Study

1.9.1 General Objective

The general objective of this study is to assess the interplay between economic vulnerability and health resilience in Malaysia.

1.9.2 Specific Objectives

The specific objectives of this study are as follows:

- i. to identify the critical domains of economic vulnerability and health resilience.
- ii. to compute an economic vulnerability index for the case of Malaysia.
- iii. to develop an index of health resilience for Malaysia.
- iv. to quantify disparities in the Economic Vulnerability (EV) and Health Resilience (HR) indices across household income groups (B40, M40, T20).
- v. to estimate how household-level sensitivity and adaptive capacity jointly predict health resilience.

1.10 Significance of the Study

This study provides valuable insights for government agencies and policymakers in formulating effective strategies to reduce economic vulnerability and enhance health resilience. By adopting a multidimensional approach, the study offers an empirical basis for identifying the most pressing socio-economic challenges faced by different segments of

society. The Economic Vulnerability Index (EVI) developed in this research serves as a critical tool for policy decision-making, enabling authorities to determine which dimensions require immediate intervention based on their severity. Policymakers can leverage these findings to design targeted measures that promote economic stability, social protection, and equitable healthcare access, ensuring that resources are allocated efficiently to address systemic weaknesses. Furthermore, by examining the intricate relationship between economic vulnerability and health resilience, this study enables the government to develop policies that enhance long-term socio-economic stability and foster a more inclusive and resilient society. Through evidence-based policy interventions, the research contributes to the broader goal of reducing economic disparities, strengthening institutional frameworks, and promoting sustainable national development in Malaysia.

Beyond its policy implications, this study plays a crucial role in developing a comprehensive vulnerability-resilience monitoring and evaluation framework for national progress assessment. The constructed vulnerability indicator facilitates continuous monitoring of exposure risks and adaptive capacities, offering authorities a systematic approach to evaluating the effectiveness of resilience-building initiatives. By tracking changes in vulnerability levels over time, policymakers can assess the success of implemented policies and identify areas requiring further intervention. This framework not only aids in crisis preparedness and disaster risk reduction but also ensures that vulnerable populations receive adequate support during economic downturns. Additionally, the study provides a basis for international comparisons, allowing Malaysia to benchmark its resilience strategies against global best practices. Strengthening the country's adaptive capacity is critical for safeguarding public welfare, fostering economic recovery, and achieving long-

term societal resilience, particularly in the context of global uncertainties and economic recessions.

Lastly, this study contributes to the national agenda on sustainable development by aligning its findings with the Sustainable Development Goals (SDGs). Economic vulnerability and health resilience are fundamental components of sustainable growth, as they influence the overall well-being, equity, and stability of the nation. By addressing structural weaknesses and identifying adaptive strategies, the research supports Malaysia's commitment to achieving inclusive economic growth, poverty reduction, and enhanced healthcare accessibility. Moreover, the study equips governmental and non-governmental organizations with the necessary data to design evidence-based interventions that improve living standards and enhance societal resilience. The findings will also serve as a reference for scholars, researchers, and development practitioners in exploring holistic approaches to social protection and economic stability. Ultimately, by strengthening resilience at both the individual and societal levels, this research contributes to a more equitable and sustainable future, ensuring that Malaysia remains adaptable in the face of economic and health-related uncertainties.

1.11 Scope of the Study

This study assesses the interplay between economic vulnerability and health resilience using Sarawak as a state-level case study. The geographic coverage is Sarawak only (East Malaysia); the study does not include all Malaysian states. The target population is adult residents aged 18 years and above who are working during the study period, preferably those with an income source that contributes to their household resources. Analyses cover both

urban and rural localities as defined by official classifications and are stratified by income group using the B40/M40/T20 thresholds applied in Malaysia during the period under study. The unit of analysis is the individual adult, with linked household characteristics incorporated where available. As for structural exposure measurement, the time frame for measurement is from 2019 to 2023. Sarawak's large land area, substantial rural–urban spread, and ethnic diversity provide a stringent feasibility test for constructing and validating an integrated Economic Vulnerability–Health Resilience (EV–HR) framework. However, service delivery models, settlement patterns, and labour-market structures differ from many Peninsular states; therefore, external validity to Malaysia as a whole is analytical rather than statistical. To support cautious generalization, results are stratified by income group (B40/M40/T20) and urban residence, and mechanisms are made explicit.

1.12 Chapter Remarks

This chapter established why a joint reading of economic vulnerability and health resilience is necessary for Malaysia and why Sarawak's working-adult population offers a demanding yet policy-relevant test bed. Beyond introducing concepts, the chapter argued a measurement gap: existing tools either treat economic hardship and health capacity separately or operate at scales that obscure household-level heterogeneity. It therefore justified a Malaysia-tailored EV–HR framework, clarified scope (Sarawak; adults aged ≥ 18 who are working; urban – rural coverage; B40/M40/T20 stratification), and articulated research questions and objectives aligned to the study's analytic strategy.

Critically, the choices made here involve trade-offs. Concentrating on Sarawak strengthens contextual insight but limits statistical generalizability to Peninsular Malaysia; the chapter acknowledges this and commits to transparent stratification (by income group and urban–rural status) and to explicit mechanism testing (sensitivity to shocks; adaptive capacity via financial protection and access) rather than broad claims. Adopting the IPCC framing of sensitivity and adaptive capacity clarifies constructs, yet alternative resilience framings (e.g., systems-governance or social capital) might emphasize different levers; this study’s lens is declared so its implications can be interpreted appropriately. Potential sources of bias, the healthy-worker effect, uneven coverage of remote communities, and limits of self-reported data, are flagged upfront to avoid over-attribution of effects to income or place. Finally, the chapter positions the research as decision-oriented: if income-linked sensitivity and constrained adaptive capacity are found to predict lower health resilience, the EV–HR index can inform targeting (e.g., B40 households in rural districts); if not, the findings would challenge prevailing assumptions and redirect attention to alternative determinants.

On this basis, Chapter 2 will interrogate the literature to justify indicator selection and operational definitions for EV, HR, sensitivity, and adaptive capacity. Chapter 3 will detail data sources, variable construction, normalization and weighting choices, and validation/diagnostics (including variance checks for ANOVA and multicollinearity, interaction specification, and robustness tests for regression). Chapter 4 will present disparities and modelling results with income- and place-stratified estimates, sensitivity analyses, and limitations. Chapter 5 will synthesize implications for Malaysian policy and outline a replication pathway in a Peninsular state to assess transportability.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter discusses about the past literature reviews that related to the study. Throughout the developmental process of a nation, the threats that occur left effect on the economic growth, tremendously affecting the household and bringing them into vulnerability. Different researchers often assess vulnerability suffered by the society during the occurrence of a hazard. This chapter first establishes core theoretical foundations by clarifying the constructs of economic vulnerability and resilience (Section 2.2), then reviews the social determinants of health as the basis for health resilience (Section 2.3). Next, it synthesizes empirical work on economic vulnerability (Section 2.4) and health resilience (Section 2.5), comparing indicators, levels of analysis, and methods across studies. Throughout, the review highlights how exposure, sensitivity, and adaptive capacity have been operationalized in prior work. The chapter closes with an integrated synthesis that identifies the specific gaps this study addresses and explains how those insights inform the construction of the Economic Vulnerability–Health Resilience (EV–HR) index used in this thesis (Section 2.6).

2.2 Economic Vulnerability Theory

Economic vulnerability is a key concept in both economic and social sciences, describing how exposed an economy, group, or individual is to external shocks and their ability to manage and recover from them. It reflects structural weaknesses that stem from issues like income inequality, unstable labor markets, inflation, and inadequate social protection (Briguglio et al., 2009). These challenges are especially severe in developing nations, where

limited resources, weak institutions, and economic volatility deepen financial insecurity, particularly for marginalized communities (World Bank, 2021). Understanding economic vulnerability is essential for policymakers and researchers, as it helps pinpoint the factors that make certain economies or groups more prone to financial instability. This knowledge, in turn, enables the development of targeted policies aimed at strengthening resilience.

Expanding on this idea, economic vulnerability theory explains why some economies or social groups are hit harder by financial shocks than others. It suggests that vulnerability results from both inherent structural factors and the resilience mechanisms that determine an entity's ability to withstand economic turmoil. Unlike poverty, which represents a present state of deprivation, vulnerability signifies the risk of slipping into economic distress due to unexpected shocks (Chambers, 1989). Since vulnerability and resilience are interconnected yet distinct, evaluating both provides a more comprehensive view of economic stability. This review delves into the theoretical foundations of economic vulnerability, examining its core components, the distinction between vulnerability and resilience, and the role of policy interventions in mitigating risk.

Broadly speaking, economic vulnerability refers to how much an economy is at risk from external shocks such as financial crises, trade disruptions, fluctuating commodity prices, or natural disasters (Briguglio et al., 2009). It consists of two primary aspects: exposure to shocks and the ability to cope with them (resilience). Exposure reflects an economy's built-in susceptibility to adverse events, while coping ability pertains to how well it can absorb, manage, and recover from economic shocks through effective policies and institutions. Briguglio et al. (2009) argue that exposure to external shocks is largely structural

and deeply embedded, making it difficult to alter through policy interventions. Certain economies, especially small developing nations, are naturally more vulnerable due to their dependence on foreign trade, lack of economic diversification, and geographical disadvantages. On the other hand, economic resilience can be fostered through strategic policies that improve macroeconomic stability, governance, and social protection systems. The relationship between vulnerability and resilience highlights the critical role of policy responses in minimizing the negative impact of economic shocks.

Economic vulnerability is primarily shaped by inherent structural factors that make some economies more susceptible to external risks. Three key contributors to economic vulnerability are economic openness, export concentration, and reliance on strategic imports. First, economic openness refers to how much a country depends on international trade. While global trade can drive growth, it also makes economies more vulnerable to external shocks such as financial crises, supply chain disruptions, and trade restrictions (Briguglio, 1995). Nations heavily dependent on international markets face heightened instability when global demand fluctuates.

Second, export concentration significantly influences economic vulnerability. Countries that rely heavily on a single export commodity are more exposed to market volatility. For instance, nations that primarily export oil, minerals, or agricultural goods face economic instability when commodity prices drop (Easterly & Kraay, 2000). Dependence on a limited range of industries reduces a country's ability to cushion itself against financial downturns. Lastly, reliance on strategic imports further increases vulnerability. Countries that depend on imports for essential goods like food, energy, and medicine are at risk when

global supply chains face disruptions (Guillaumont, 2009). Rising import costs or shortages of crucial supplies can severely impact economic stability, especially in nations with limited domestic production. These structural vulnerabilities emphasize the need for proactive policies that reduce dependency on volatile sectors, diversify trade, and strengthen local industries to build resilience.

On the other hand, adaptive capacity refers to how well an economy can absorb, adjust to, and recover from external shocks (Briguglio et al., 2009). Unlike inherent vulnerability, resilience is shaped by policy choices and can be strengthened through good governance, institutional frameworks, and strategic economic planning. Four major factors contribute to economic resilience: macroeconomic stability, market efficiency, political governance, and social development. Macroeconomic stability, characterized by low inflation, fiscal responsibility, and balanced trade, helps economies withstand financial crises and maintain investor confidence (IMF, 2020). Countries with sound fiscal policies and responsible debt management are less likely to suffer from prolonged recessions.

Market efficiency is another crucial component of resilience, as it ensures that labor and capital markets can adapt to shifting economic conditions (Acemoglu & Robinson, 2012). Well-developed financial systems enable businesses to access credit and recover more quickly from downturns. Political governance also plays a vital role, governments with strong institutions, transparency, and effective policies tend to handle economic crises more successfully (Rodrik, 1999). In contrast, poor governance, corruption, and mismanagement make economic shocks more damaging and prolong recovery efforts. Finally, social development, particularly in areas like education, healthcare, and social security, enhances

human capital and provides safety nets for vulnerable groups (Sen, 1999). Societies that invest in social infrastructure tend to be more resilient to economic hardships, as they ensure the well-being and productivity of their workforce.

Although economic vulnerability and poverty are often linked, they are distinct concepts. Chambers (1989) differentiates between them by emphasizing that vulnerability is marked by instability, exposure to risks, and uncertainty, whereas poverty is a current state of economic deprivation. Vulnerability highlights the risk of falling into financial distress due to unforeseen events, whereas poverty describes an ongoing condition of hardship. This distinction is critical because not all vulnerable individuals or economies are currently poor, but without adequate resilience, they can become impoverished when crises occur. For instance, middle-income economies may face temporary vulnerability due to economic shocks, but well-designed policies can prevent them from slipping into long-term poverty (Naudé et al., 2009).

Economic Vulnerability Theory provides a framework for assessing risk exposure and formulating proactive policy measures to build resilience. Vulnerability assessments have been widely applied in analyzing small island developing states (SIDS), emerging markets, and climate change adaptation. Policymakers rely on these assessments to identify structural weaknesses and implement reforms that promote economic diversification, improve governance, and strengthen financial stability (Briguglio, 1995). By measuring both vulnerability and resilience, governments can prioritize critical policy areas requiring immediate attention, ensuring sustainable economic growth and stability. Developing early

warning systems, social protection programs, and trade diversification strategies are essential steps in reducing economic vulnerability and strengthening national resilience.

Recognizing that vulnerability and resilience are two sides of the same coin, Briguglio et al. (2009) introduced the vulnerability-resilience framework, illustrated in Figure 2.1. They argue that risk is directly linked to both vulnerability and resilience. Vulnerability arises from structural factors such as economic openness, export concentration, and reliance on strategic imports, which make economies more susceptible to external shocks. Resilience, on the other hand, is shaped by factors like macroeconomic stability, market efficiency, strong governance, and social development, which help absorb, manage, and recover from economic setbacks. The subtraction symbol in front of coping ability in the framework highlights that as resilience increases, overall risk decreases.

Table 2.1: Exposure vs Resilience

Dimension	Exposure	Resilience
Concise definition	Structural susceptibility to exogenous shocks (e.g., trade concentration, import dependence, price volatility); the “hazard context” (Briguglio et al., 2009).	Capacity to absorb, adapt, and recover so that net risk falls and outcomes return toward baseline (WHO, 2008; Solar & Irwin, 2010).
Typical indicators in prior work	Openness index; Herfindahl export concentration; reliance on strategic imports; geographic/remoteness indices.	Macro: social protection coverage, governance; Micro: education, insurance/savings, healthcare access, social capital.
Time horizon	Pre-shock risk profile and shock occurrence.	During/after shock: absorption, adaptation, recovery trajectory.

Economic vulnerability (EV) theory distinguishes structural exposure from policy-malleable resilience, with sensitivity and adaptive capacity mediating how shocks translate into outcomes. Prior EV indices are largely macro-structural (exposure, macro coping capacity) and rarely couple person-level sensitivity/adaptive capacity with health consequences. For an EV–HR index, we separate (i) contextual exposure (state-level) from (ii) individual/household capacities (education, savings, insurance, access to care) that mediate realized impacts (Briguglio, 1995; Briguglio et al., 2009; Guillaumont, 2004, 2013).

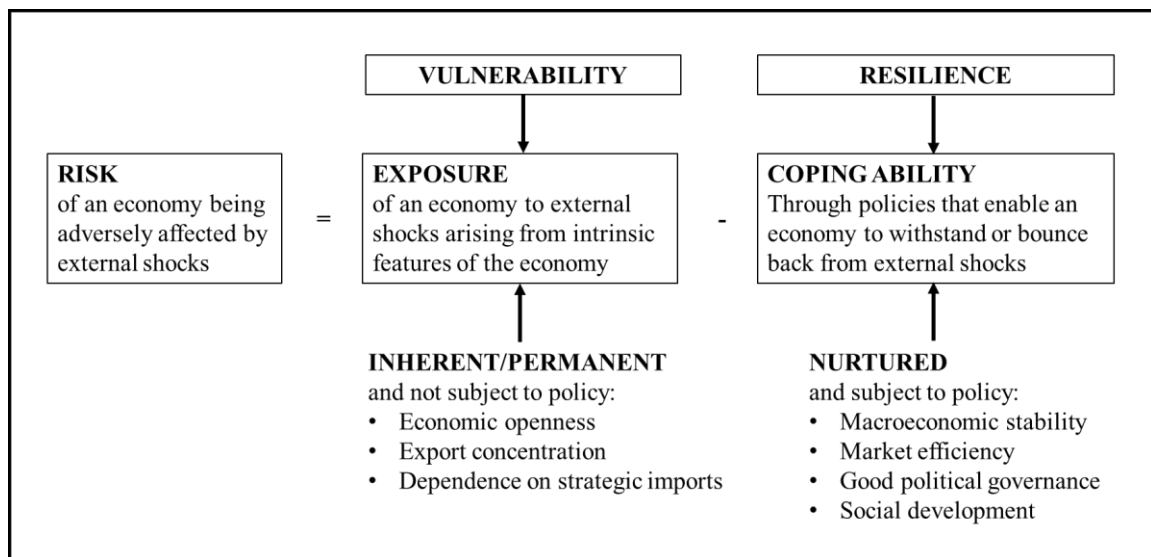


Figure 2.1: Economic Vulnerability Framework

Source: Briguglio et al. (2009).

2.3 Social Determinants of Health as Fundamental of Health Resilience

The understanding that social and economic factors influence health outcomes has its roots in early sociological and economic theories. In the 19th century, Rudolf Virchow (1848) argued that social injustice, poverty, and poor living conditions were fundamental drivers of disease. Around the same time, Karl Marx (1867) emphasized that economic structures determine access to essential resources, including healthcare and nutrition. These early

insights laid the groundwork for modern theories on the social determinants of health. Building on these historical perspectives, the World Health Organization (WHO) formalized the SDH framework in 2008, incorporating a multidisciplinary approach that links health policy, governance, and economic systems to population health outcomes (WHO, 2008). Solar and Irwin (2010) later refined this model, categorizing SDH into structural and intermediary determinants and highlighting the need for systemic interventions to reduce health disparities. Today, the WHO's SDH framework plays a crucial role in shaping global public health strategies, guiding policies aimed at reducing health inequities through socio-economic reforms, improved healthcare access, and community-driven initiatives.

The Social Determinants of Health Framework identifies five key factors that influence health outcomes. One of the most significant is economic stability, as financial security directly impacts an individual's ability to afford healthcare, access nutritious food, and maintain stable housing (Braveman et al., 2011). Individuals and families experiencing poverty, unemployment, or income instability are at a higher risk of chronic illnesses, mental health conditions, and reduced life expectancy (Wilkinson & Pickett, 2009). When economic conditions are stable, people can afford preventive healthcare, regular medical check-ups, and healthier living environments. On the other hand, economic insecurity leads to food shortages, stress-related illnesses, and inadequate medical care (Lynch et al., 2004). Research has consistently shown that income inequality is strongly linked to poorer health outcomes, underscoring the need for policies that promote job security, social welfare programs, and fair wages (Marmot, 2015).

In addition, education is a critical determinant of health, shaping individuals' health literacy, employment opportunities, and lifestyle choices. Higher education levels are associated with healthier behaviors, greater use of healthcare services, and improved financial stability (Cutler & Lleras-Muney, 2006). Conversely, individuals with limited education often struggle to understand health information, navigate healthcare systems, and make informed medical decisions. Studies indicate that lower educational attainment is linked to higher rates of chronic disease, obesity, and mental health disorders, largely due to lower incomes, job insecurity, and a lack of health awareness (Freudenberg & Ruglis, 2007). Expanding health education programs, implementing school-based nutrition initiatives, and providing adult learning opportunities are effective strategies for reducing health disparities and encouraging healthier lifestyles.

Access to high-quality, affordable healthcare is another crucial factor influencing health outcomes. Barriers to healthcare access arise from financial constraints, geographic limitations, and systemic inequalities in the healthcare system (Galea et al., 2011). Evidence shows that countries with universal healthcare systems tend to achieve better health outcomes than those relying on market-driven models, highlighting the critical role of government policies in ensuring equitable healthcare distribution (Raphael, 2011). The availability of healthcare services depends on insurance coverage, the number of medical professionals, and the quality of healthcare infrastructure. Marginalized populations, such as low-income and rural communities, often face greater health risks due to delayed or inadequate medical care (Bambra et al., 2010). To address these disparities, policymakers must focus on expanding healthcare coverage, improving medical infrastructure, and eliminating financial barriers to essential services.

The social and community environment also plays a significant role in shaping health outcomes. Supportive social networks, strong family ties, and active community participation contribute to better mental and physical well-being (Kawachi & Berkman, 2001). Studies have shown that individuals with strong social connections experience lower stress levels, better mental health, and improved chronic disease management (Cohen & Wills, 1985). Conversely, those facing social isolation, discrimination, or exposure to violence are more vulnerable to mental health disorders, substance abuse, and stress-related illnesses (Wilkinson & Marmot, 2003). Community-based health interventions, such as peer support groups, mental health awareness campaigns, and programs promoting social inclusion, can help mitigate these risks and foster healthier communities.

The physical environment in which people live, work, and spend their time has a profound impact on their overall health. Factors such as housing quality, air pollution, transportation systems, and access to recreational spaces all contribute to both physical and mental well-being (Diez Roux, 2016). People living in low-income areas are often exposed to environmental hazards like poor air quality, inadequate sanitation, and high crime rates, which elevate their health risks (Galea et al., 2011). Urban planning and housing policies play a critical role in improving public health by promoting safe housing, increasing green spaces, ensuring clean water access, and enhancing public transportation infrastructure. Research shows that investments in better urban planning and environmental protections can lead to significant reductions in chronic disease rates and improvements in mental health (Dannenberg et al., 2011).

In short, the Social Determinants of Health Framework offers a comprehensive and interdisciplinary approach to understanding how economic, social, and environmental factors influence overall health. By categorizing SDH into five core elements, economic stability, education, healthcare access, social/community context, and neighborhood environment, the framework underscores the complex interactions between social structures and individual well-being. This perspective aligns well with the concept of health resilience, as both emphasize the ability of individuals and communities to cope with and recover from health-related challenges. Empirical research continues to reinforce the need for targeted interventions addressing these determinants to reduce health inequities. Strategies such as expanding universal healthcare, reforming education policies, strengthening social support programs, and investing in urban development are all essential to improving public health and fostering long-term societal well-being.

SDH research shows that income and education structure exposure to illness and capacity to recover via access, literacy, and stable environments (WHO, 2008; Solar & Irwin, 2010; Braveman et al., 2011; Marmot, 2015). Yet most studies remain associational and stop short of integrating these determinants into a single, policy-sensitive resilience construct aligned with economic vulnerability. This motivates coupling income-based sensitivity and adaptive capacity (resources/skills/access) in an index that predicts recovery from health shocks among working adults.

2.4 Past Studies that Related to Economic Vulnerability

To measure economic vulnerability at household level, Kochar (1995) investigated the extent to which households in India were vulnerable to idiosyncratic income shocks, particularly in the agricultural sector. In this study, economic vulnerability was assessed by analyzing household responses to crop income fluctuations, including changes in labor market participation, asset liquidation, and reliance on credit markets. The findings suggested that households with better access to labor markets demonstrated greater resilience to income shocks. This could also indicate that their reliance on costly financial adjustments such as selling assets or taking high-interest loans is reduced. Importantly, the study suggested that the labor market integration as a crucial protective mechanism to help the household to fight against the economic vulnerability. In light of these findings, the research advocated for policies aimed at enhancing employment opportunities and improving access to credit for rural households, as it mitigates the negative effects of financial shocks that fall on their household.

From other perspective, Adger (1998) examined the social and economic vulnerability to climate change in Vietnam. Specifically, this study focused on rural agrarian communities undergoing economic transition. Particularly, the economic vulnerability was measured using poverty incidence, income risks associated with extreme climate events, and institutional changes that could affect the resource distribution. The study's results indicated that the economic transition contributed to increased vulnerability. This results could be explained by the decline of collective protection mechanisms and more investment in high-risk sectors such as aquaculture. Other than that, though economic growth evidently contributed to a reduction in overall poverty rates, the structural factors of vulnerability still

persisted. From the researcher, targeted policy interventions to mitigate the effect of climate change is necessary. In other words, the study recommended that the initiatives to promote better environmental management strategies and poverty alleviation should be sustained. This is to ensure while the economy develops, the rural populations do not fall into vulnerability.

Rising from political aspects, Bussiere and Mulder (2000) examined the role of political instability in influencing economic vulnerability, focusing on developing nations. The study measured economic vulnerability using a combination of political risk indicators, economic instability measures, and trade dependency ratios. The analysis indicates that the political instability served as a determinant of economic vulnerability. This is because the political instability disrupted the investment flows, government effectiveness, and lead to higher risk of financial crises. The findings also suggested that those politically unstable countries are more likely to experience greater susceptibility to external shocks. An important implication of this study was that strengthening political stability through governance reforms and institutional development could play a crucial role in mitigating economic vulnerability. Additionally, the solution by fostering the confidence from investors could help to contribute in reducing the susceptibility to risks especially in the politically unstable regions.

Expanding on the theme of economic vulnerability, Adrianto and Matsuda (2002) developed an economic vulnerability to natural disaster index specifically designed for small islands. In terms of the index computation, the assessment of Gross Island Product (GIP) losses due to disasters, complemented by additional indicators such as per capita income

were considered into the development of composite vulnerability indices. This computation enabled the researchers to capture the economic vulnerability incorporating both macroeconomic and individual-level factors. As such, the findings revealed that the smaller islands exhibited higher economic vulnerability due to their reliance on limited industries which leads them to higher geographic exposure to environmental risks. From this, this study emphasized the necessity of implementing disaster risk reduction policies tailored to the unique challenges faced by small island economies. To simplify this, this study encourage the adoption of diversified economic strategies to boost up the production and carefully consider the infrastructure resilience to mitigate the effects of environmental adversities.

Building upon this research, Adrianto and Matsuda (2004) conducted a further evaluation of economic vulnerability in small island regions, differing from the previous, by integrating the sustainability constraints. Similarly, the study employed the computation of composite economic vulnerability index (CEVI) by incorporating the factors such as economic exposure, economic remoteness, and the impact of environmental disasters. With this comprehensive approach, the researchers accounted both geographic and economic limitations faced by small islands into the consideration for economic vulnerability assessment. The findings reinforced the previous conclusions that smaller islands demonstrated higher economic vulnerability as before. However, an interesting observation was that even though the islands presented highly vulnerability, they could still maintain strong economic performance. This indirectly suggest that there is the presence of resilience mechanisms that could be considered in further research. By emphasizing the importance of pragmatic adaptive economic strategies, the small island economies could ensure sustainability and economic stability in long-term.

In a similar vein, Guillaumont (2004) investigated the structural economic vulnerability of low-income countries (LICs). The economic vulnerability was measured by taking agricultural production instability (refer to natural shocks), real export instability (refer to trade shocks), and population size (refer to structural exposure) into computation. This enabled a comprehensive assessment of both external shocks and the internal capacity to withstand the countries. The findings highlighted that LICs were more vulnerable. This is likely due to the dependence on primary commodities and weak financial systems. This situation worsened the economic performance of the nations. Furthermore, the study emphasized that structural vulnerability negatively impacted economic growth and productivity. Therefore, there is a need to reinforce the international cooperation to mitigate these risks. In this regard, global financial institutions and development agencies should collaborate and implement the policies that promote the economic resilience in LICs.

Moving on to the similar focus, Béné (2009) examined the economic vulnerability of small-scale fishing communities. Unlike other studies, this study fills the gap on distinguishing between economic vulnerability and poverty. To achieve this, economic vulnerability in this study was measured using an index that combined income variability, occupational mobility, and exposure to environmental shocks. This approach allowed for a more detailed understanding of the instability that brought by fishing livelihoods instead of merely focus on the simple income-based poverty measures. Interestingly, the findings indicated that even though the fishers were found not the poorest, they remained among the most vulnerable in economic aspect due to their dependence on fish stocks and unaware about the market dynamics. This study clear a misunderstanding that the policies should not just focus on poverty alleviation but also on reducing livelihood risks by improving the

resource management and developing the alternative income opportunities for the fishers. Moreover, the study recommended the implementation of adaptive policies by integrating the environmental sustainability, achieved by the social protection mechanisms to enhance the sustainable economic security of the communities.

Rooted from economic vulnerability, Guillaumont and Guillaumont (2009) explored the relationship between state fragility and economic vulnerability by emphasizing the role of structural economic risks. The economic vulnerability index assessed the exposure to exogenous shocks and structural weaknesses. To show advancement in economic vulnerability study, the study argued that the EVI computed, presented a more stable and reliable measure compared to subjective vulnerability indices developed by the international organizations. In this sense, the findings suggested that the countries that been classified as fragile often grouped as high economic vulnerability. Hence, a key policy implication motivated by this study was that aid allocation strategies should consider structural vulnerability, monitored by the governance indicators to better control fragile states to stabilize. Additionally, the research underscored the need for international assistance based on a country's specific vulnerability profile. As this approach ensures that the aid programs could accurately address the root causes of economic vulnerability of the target nations.

In a different context, Kienberger et al. (2009) developed a spatial model to assess vulnerability to floods from socioeconomics aspect in Austria's Salzach. In this case, the vulnerability was measured using social, economic, physical, and environmental factors to define vulnerability units. With this, it enabled a precise identification of high-risk areas using mapping system. The results indicated that flood vulnerability varied significantly

across regions. Specifically, the system indicates that the areas where lacks economic resources and infrastructure are the most susceptible. From this, it could be said that the spatially vulnerability assessments could help to improve preparedness to face natural disaster through monitoring the performance of the particular areas after the targeted interventions for high-risk regions. Furthermore, the study highlighted the importance of integrating flood risk management with socio-economic planning to enhance resilience at both local and regional levels. This step is to ensure that the mitigation strategies were effectively aligned with the concurrent economic policies for better economic development.

Expanding the scope of economic vulnerability research, Bucks (2011) analyzed economic vulnerability in the U.S. using annual household-level data from 1989 to 2009. In this research, the vulnerability was measured using twelve indicators, including financial constraints, employment risks, and health-related economic shocks, to develop the composite vulnerability index. This time-series index computation approach was able to capture the long-term trends in economic security and more importantly, it can be modified to observe the economic vulnerability from different demographic groups. The index showed that economic vulnerability showed slight decline between 1989 and 2007. In year 2008, the financial crisis further worsen the economic vulnerability, particularly for lower-income households. A key takeaway was that economic vulnerability of a nation was dependent on macroeconomic stability and social safety nets. Hence, there is a need in emphasizing the policy interventions in times of economic downturns. As such, the study also pinpointed the importance of strengthening financial regulations and social welfare programs to provide a more robust safety net to buffer the effect economic crises on nations in future.

In line with this analysis, Anderloni et al. (2012) explored household financial vulnerability in Italy, with the focus on the impact of debt burden and financial distress on the household vulnerability. In this study, financial vulnerability index that assessed debt servicing capacity, unexpected expense management, and income stability was developed. This index could capture both short-term liquidity constraints and long-term financial sustainability. The results indicated that high debt-to-income ratios and impulsive financial behaviors significantly increased household vulnerability, while higher education levels reduced financial fragility. With this study, the importance of promoting responsible financial behaviours and financial literacy to enhance household financial stability were indirectly highlighted. With this, it is strengthened that there should be a regulatory frameworks to prevent over-indebtedness and ensure consumer protection in financial markets, which sustainably to foster a greater economic resilience among households.

To advance, Guillaumont (2013) further evaluated the economic vulnerability of Small Island Developing States (SIDS) and Least Developed Countries (LDCs) using the economic vulnerability index (EVI). Similarly, vulnerability was measured based on exposure to external shocks, structural economic constraints, and resilience factors. The index facilitated cross-country comparisons of vulnerability levels. The results indicated that SIDS and LDCs were highly vulnerable due to their susceptible economic performance and disaster preparedness. In this sense, an important policy recommendation alert that the aid allocation should prioritize vulnerable states and monitoring could be carried out by using EVI as a guiding metric. Furthermore, the study emphasized the importance of integrating climate adaptation strategies into economic development policies to ensure that external assistance mitigates long-term vulnerability rather than serving as a temporary relief

measure. These findings highlight the critical need for a comprehensive development framework that simultaneously addresses the economic, environmental, and social dimensions of vulnerability.

Emmons and Noeth (2013) explored the intersection of economic vulnerability and financial fragility by examining the impact of financial crises on disadvantaged populations. In this context, the economic vulnerability was assessed using household financial indicators, which underscored the disproportionate effects of financial instability on low-income and minority groups. The study's findings revealed that the economically vulnerable households faced higher financial risks during the 2008 financial crisis due to excessive leverage and insufficient liquid assets. Moreover, the research emphasized that enhancing financial literacy and expanding access to stable financial products could mitigate economic vulnerability and help prevent future financial crises. Additionally, the study underscored the critical need for regulatory interventions to protect vulnerable consumers from predatory lending and financial mismanagement, thereby fostering greater financial resilience among disadvantaged groups.

Expanding on the discourse surrounding economic risk assessment, Wang (2013) critically examined the United Nations' Economic Vulnerability Index (EVI) and its effectiveness in quantifying economic risks. The study employed a revised version of the EVI, integrating measures of economic volatility and structural exposure to external shocks. Wang argued that the index's weighting and composition required refinement to enhance its accuracy. The findings indicated that while the EVI served as a valuable tool for identifying vulnerable economies, it did not always correspond with observed patterns of economic

volatility. A key recommendation was to enhance the index by incorporating additional indicators that more effectively capture the dynamic nature of economic vulnerability. Furthermore, the study underscored the necessity of adapting the EVI to contemporary economic challenges, including globalization, financial market fluctuations, and climate change-induced disruptions, to ensure its continued relevance in policy-making.

Similar but a more focus view on rural area, Murphy and Scott (2014) examined household vulnerability in Ireland during the 2008 financial crisis and the subsequent period of austerity. The study utilized a household vulnerability index (HVI), which integrated factors such as income fluctuations, job insecurity, and access to social welfare benefits. This index enables a dynamic assessment of economic resilience of Ireland households over time. The findings revealed that rural households in regions with an oversupply of housing were particularly susceptible to economic hardship due to declining property values and competitive environment in obtaining employment opportunities. Then, the study advocated for regional economic policies that incorporate resilience-enhancing strategies, such as investment in sustainable industries and job retraining initiatives. Furthermore, the research also emphasized the necessity of decentralized policy interventions tailored to the distinct economic characteristics of rural communities, ensuring that support mechanisms effectively address localized vulnerabilities.

Addressing another dimension of economic vulnerability, Sands et al. (2016) investigated the macroeconomic impact of infectious disease crises. The study assessed economic vulnerability by examining the financial losses associated with past epidemics such as GDP contractions and declines in foreign investment. Through integrating these

variables into predictive risk model, the potential impact of future pandemics is estimated. The findings revealed that infectious disease outbreaks significantly disrupted economies, particularly in developing regions. From the researchers, these risks were still frequently underestimated in macroeconomic forecasts. With this, a key insight from the study was that incorporating infectious disease risks into economic forecasting models could enhance preparedness and policy responses, which mitigates the economic damage during future crises. Furthermore, the research emphasized the importance of developing global health security frameworks that integrate economic risk assessments, ensuring that pandemic preparedness strategies are not only health-centered but also economically sustainable.

Shift the focus to China, Huafeng (2016) investigated household vulnerability and economic status during disaster recovery in the aftermath of the Wenchuan earthquake. In this research, the economic vulnerability was assessed using three distinct approaches: vulnerability measured by expected poverty (VEP), household income (VHI), and subjective evaluation (VSE). These complementary methods provided a comprehensive understanding of income stability, poverty risk, and perceived economic security. The findings indicated that households with lower pre-disaster income and weaker social networks experienced prolonged economic vulnerability, whereas those with diversified income sources exhibited faster recovery. The study featured the need for post-disaster policies that not only provide immediate financial assistance but also promote long-term economic resilience to ensure that vulnerable households have sustainable recovery pathways. Additionally, it emphasized the importance of fostering community-driven recovery initiatives and strengthening social capital as key components of disaster resilience, which could accelerate economic stability and enhance long-term household security in disaster-prone regions.

Malakar and Mishra (2017) expanded on the theme of economic vulnerability by developing an index-based methodology to assess socio-economic susceptibility to climate change across cities in India. Their approach utilized composite indices encompassing infrastructure, technology, finance, social structure, and spatial distribution, which facilitated the comparative vulnerability analyses across urban environments. The results revealed that cities in arid and coastal regions exhibited higher vulnerability due to weaker infrastructure and financial instability. This indirectly indicated that the technologically advanced cities demonstrated greater resilience. A key insight was that city-level assessments could enable policymakers to prioritize infrastructure investments and climate adaptation policies tailored to local vulnerabilities. Furthermore, the study highlighted the necessity of integrating climate adaptation strategies into urban planning frameworks to mitigate long-term risks associated with environmental changes.

Building on this discourse, Flatø et al. (2017) examined the economic vulnerability of female-headed households in South Africa, particularly in relation to climate variability. To measure economic vulnerability in this study, an analysis of household income fluctuations caused by rainfall variability, using longitudinal survey data was implemented. This approach isolated the causal effects of climate shocks on economic well-being while accounting for structural gender inequalities. From the analysis, the results indicated that female-headed households were more economically vulnerable to climate variability than their male-headed counterparts. It was primarily due to lower initial earnings and weaker social protection networks. Therefore, this study emphasized the need for targeted interventions to build resilience among female-headed households by enhancing access to financial resources by expanding employment opportunities and implementing a more

reliable adaptive social protection policies. Furthermore, it underscored the importance of addressing gender disparities in economic security and social mobility to create a more inclusive policy framework for climate resilience.

Senapati and Gupta (2017) examined the socio-economic vulnerability of Mumbai's fishing communities, particularly in relation to climate change. Through a multi-criteria analysis based on sustainable livelihood indicators, including income stability, access to resources, and adaptive capacity, economic vulnerability was assessed. This comprehensive approach accounted for both economic and environmental stressors in evaluating livelihood sustainability and resilience. The findings indicated that fishermen in Mumbai's Madh and Worli villages were vulnerable due to limited access to modern fishing technologies and unstable income streams. To improve the well-being of the fishermen, the study recommended targeted policy interventions, such as expanding financial resources and providing training in climate-resilient fishing techniques, to enhance adaptive capacity. Additionally, it emphasized the needs in fostering community-led initiatives and cooperative strategies to strengthen the collective resilience of fishing-dependent populations.

To widen the scope of economic vulnerability research, Mamun et al. (2018) analysed the impact of development programs on household income and economic vulnerability among low-income households in Peninsular Malaysia. Specifically, the economic vulnerability was measured by assessing the relationship between access to microcredit, participation in training programs, and household income stability. To add on, the study examined whether engagement in development initiatives mitigated economic risks for low-income households, offering insights into their effectiveness. The findings

revealed that while access to working capital and long-term participation in development programs contributed to improved household income, the total number of training hours did not have a significant effect. A key implication was that development programs should prioritize practical skill-building and direct financial assistance rather than generalized training to ensure tangible economic benefits. Furthermore, the study recommended improving program accessibility and designing more tailored interventions to maximize their impact on economic security.

In a related study, Mustapa et al. (2018) explored the relationship between economic vulnerability and participation in development programs among low-income households in Malaysia. By examining household income fluctuations, access to microcredit, and engagement with development initiatives, this study provided insights into how financial insecurity influenced participation in social assistance programs, which highlights the barriers to economic empowerment. The findings suggested that households experiencing higher economic vulnerability were less likely to participate in development programs due to financial constraints and risk aversion. The study underscored the need for more accessible and inclusive development initiatives that addressed barriers to participation, ensuring that vulnerable households could fully benefit from financial and skill-building opportunities. Additionally, the findings emphasized the importance of enhancing the affordability and flexibility of these programs to encourage greater involvement among economically disadvantaged populations.

To mention, Aroca-Jiménez et al. (2018) developed a methodology for assessing economic vulnerability to flash floods, focusing on urban areas in Spain. The study

introduced an Integrated Economic Vulnerability Index (IEVI), which combined economic exposure, sensitivity, and resilience factors to provide a holistic assessment of flood-related economic risks. By integrating various socio-economic and infrastructural indicators, this method allowed for a nuanced evaluation of spatial disparities in economic vulnerability. The findings demonstrated significant variability in economic risk, with urban areas exhibiting distinct patterns based on income levels and infrastructure quality. Through this research, the targeted flood risk management strategies could enhance resilience by addressing the most vulnerable regions. Furthermore, the study emphasized the need for integrating economic vulnerability assessments into urban planning and disaster preparedness policies to support proactive mitigation measures as it could serve as early warning systems to minimize the economic impact of flood-related disasters in urban environments.

Through spatial modeling, Bamweyana et al. (2020) assessed socio-economic vulnerability to COVID-19 in the Greater Kampala Metropolitan Area (GKMA). In this sense, economic vulnerability was quantified using spatially driven indicators classified and weighted according to the BBC vulnerability framework, which encompassed exposure, susceptibility, and adaptive capacity. This approach integrated demographic, economic, and social variables to identify high-risk areas. The findings revealed that urban areas characterized by high population density, economic activity hubs, and weak social protection systems exhibited the greatest levels of vulnerability, with almost a quarter of parishes classified as highly vulnerable. A key insight from the study was that spatial modeling serves as a valuable tool for targeted interventions, allowing policymakers to allocate resources efficiently and mitigate economic risks during pandemics. Moreover, the research

emphasized the need to enhance urban resilience through investments in social protection, healthcare accessibility, and economic diversification to reduce vulnerability in future crises.

Similarly, Mikolai et al. (2020) examined the intersection of household-level health and socio-economic vulnerabilities in shaping the impact of the COVID-19 crisis in the UK. Economic vulnerability was measured using principal components analysis of key household-level indicators, including financial insecurity, employment conditions, housing quality, and digital access. This multi-dimensional approach captured the compounding effects of various disadvantages beyond income-based assessments. The findings demonstrated that working-age households were particularly affected by financial and housing vulnerabilities, whereas retirement-age households experienced greater challenges related to health and digital accessibility. The study suggested that economic vulnerability policies should account for the interplay of employment insecurity, digital exclusion, and housing instability, which collectively exacerbate inequalities. Additionally, it underscored the necessity of designing inclusive policy measures that integrate economic, social, and technological dimensions to enhance resilience across diverse demographic groups.

In a related study, Santana et al. (2021) explored the relationship between socio-economic vulnerability and psychological distress during the COVID-19 pandemic in urban slum communities in São Paulo, Brazil. Economic vulnerability was assessed through household income levels, food insecurity, and employment status, providing a holistic perspective on financial instability. Using multivariate regression analysis, the study identified significant associations between economic insecurity and psychological distress, with low-income individuals facing food insecurity experiencing the highest levels of

psychological strain, exacerbated by pandemic-related disruptions. These findings highlighted the need for targeted mental health interventions and social protection programs to support economically vulnerable populations during crises. Furthermore, the study emphasized the role of government-led financial relief programs in mitigating psychological distress by ensuring economic stability for low-income communities.

Extending the discussion on household vulnerability, Noerhidajati et al. (2021) assessed financial vulnerability among Indonesian households using microdata from national household balance sheets. Economic vulnerability was measured through a Financial Vulnerability Index (FVI), which integrated objective indicators, such as income levels and debt ratios, with subjective measures, including self-reported financial distress. This dual approach provided a comprehensive evaluation of financial instability by capturing both quantitative and behavioral dimensions. The findings indicated that household financial vulnerability was influenced not only by income levels but also by financial behaviors, such as spending patterns, debt management strategies, and savings practices. The study underscored the need for improved financial literacy and regulatory policies to mitigate financial vulnerability and prevent future economic crises. Additionally, it advocated for strengthening consumer protection policies and promoting responsible financial planning to enhance household resilience to economic shocks in both the short and long term.

Expanding on the theme of financial constraints, Peng et al. (2021) examined the impact of credit constraints on household economic vulnerability in rural China. Economic vulnerability was assessed using an ordinal variable approach that classified households based on their ability to withstand external financial shocks, incorporating both formal and

informal credit constraints (FCCs and IFCCs). This methodology provided a nuanced analysis of how financial accessibility influences economic resilience. The findings revealed that both FCCs and IFCCs significantly heightened economic vulnerability, with formal credit constraints exerting a greater impact due to stricter lending criteria and collateral requirements. The study suggested that improving financial accessibility, particularly in rural areas, could strengthen household economic resilience by reducing dependence on informal credit and enabling productive investments. Additionally, it emphasized the role of microfinance initiatives and government-backed credit programs in alleviating financial constraints and fostering sustainable economic growth in underserved communities.

At the beginning of the COVID-19 outbreak, Coelho et al. (2020) assessed the mobility, morbidity and social vulnerability in Brazil. In this study, the authors also utilised the probabilistic model with the intention to quantify the spreading probability of COVID-19. For them to observe the social vulnerability in Brazil, different social aspects namely as mortality rate of infants, the life expectancy, GINI index, poverty, education and house conditions are considered and analysed. The results revealed that areas with high risk of COVID-19 are also socially vulnerable, specifically in North and Northeast. The high transmission rate of COVID-19 has severely affected the Brazilians from the social aspects, especially on the aspects of life expectancy and water supply in the house. Surprisingly, the map illustration presented indicated that most of the urban micro-regions are geographically and socially vulnerable compared to the rural areas.

To address the joint impact of different dimensions on public health and health inequalities, Yang and Geng (2022) integrated three dimensions, namely social, economic

and environmental indicators to foresee their impact from the perspective of vulnerability. The researchers categorized the social demographic structure (proxied by ageing and urbanisation ratios) and environmental risk as the sensitivity dimension. The researchers categorized the capacity dimension with ecological capacity, economics capacity, social education level and social governance capacity. The findings from spatial econometric analysis had proven that the urbanisation, education level and the governance capacity had a positive relationship to promote public health and eliminate the health inequalities. By utilising geographical weighted regression, the results implied that vulnerability affected the public health and health inequalities differently across countries.

The occurrence of the COVID-19 pandemic led the society into vulnerable in multidimensional perspective. Specifically, Cross et al. (2022) analysed socio-economic vulnerability in United Kingdom (UK). To address the socio-economic vulnerability, the authors proxied the dimensions that related to labour market and income impacts, financial mitigations as well as financial outcomes. From UK Household Longitudinal Study (UKHLS) COVID-19, a total of 12,466 respondents, aging from 20 to 65 years old, was collected. Furthermore, binary logistic regression was performed to present the dimension of vulnerability in South England, indicating that there was different and inconsistent degree of socio-economic vulnerability among the states in UK. From the statistical results, it provided the readers the concrete evidence of the concentration of vulnerabilities in high-poverty regions of UK, knowing the residents' ability to protect themselves against the economic shocks.

Badawy et al. (2022) further extended the analysis on multidimensional vulnerability by including remoteness, environmental, social, demographic, physical and economic vulnerabilities to assess the degree of vulnerability in lagging regions of Egypt. In addition, the researchers addressed the gap by counting in the adaptivity to construct a reliable vulnerability measure. After collected the data from Central Agency for Public Mobilization and Statistics (CAPMAS), meteorological station in ELKharga city and Environmental Affairs Agency, they computed multidimensional vulnerability index, after standardized the dimensions using min-max approach. From the index computed, Balat was the most vulnerable municipal among the five municipals selected. However, Balat was not the most vulnerable in term of each dimension of vulnerability, but Kharga was the municipal that highly vulnerable in the environmental and economic dimensions. It is probably owing to that the multidimensional vulnerability index included adaptivity into computation procedure.

From another perspective, flood as a hazard also caused the community to be vulnerable. To identify the vulnerability caused by flood in Nepal, Shreevastav et al. (2021) computed the livelihood vulnerability index, consisting of the components of socio-demography, livelihood, social network, financial, physical, access to health facility, food, water resource, availability of forest resource, as well as natural hazard and climate variability. The livelihood vulnerability index computation was based on the idea from Hahn et al. (2009), where the definition of vulnerability was incorporated from Intergovernmental Panel on Climate Change (IPCC). In addition, the weight for each main component was set to be equal. Because of different scale measurement of the components, the authors standardized the components using min-max approach. After the computation of the

livelihood vulnerability index, each of the component was compared by dividing the geographical areas into up-stream (Gopalkulti and South Bagmati), mid-stream (Laxmipur and Manpur) and down-stream (Badarwa). The livelihood vulnerability index indicated that low stream area was the most vulnerable and also with the highest risk toward the flood hazard.

Every household would react differently when a hazard arises and attacked them. In this point, Notenbaert et al. (2012) assessed the vulnerability at household level in Africa, focusing the households in Mabalene district of Gaza province in Mozambique (East Africa). To observe the household-level vulnerability due to climate variability, the authors accounted geographic, demographic, and socioeconomic factors for the vulnerability analysis. Apart from assessing the aspect of vulnerability, the adaptive strategies toward the climate variability were also observed. From the correlation and regression results, only distance to paved road, income diversification and saving (three out of 25 indicators) were found to be statistically significant at both tests, indicating effects on the vulnerability. From the perspective of adaptive strategies, it was found that age of the head households significantly influenced the coping strategies. Reasonably, with more experience, the household would be able to cope the climate variability by taking necessary actions. Other than that, surprisingly, only distance to livestock market (geographic factor) was statistically significant toward all the six adaptive measures.

Additionally, recently, Guragain and Doneys (2022) studied the vulnerability of the household headed by different gender in the areas of Koshi River Basin in Nepal using mixed mode method. Qualitatively, they conducted interviews with key informant, in-depth

interviews with the households and focus group discussions to gather the gender-based information on the households in the areas. Besides, a total of 216 survey are collected from households in Barahakshetra, Mahedranagar, Shripur and Haripur, where the distribution of gender was equal. To assess gender-based vulnerability of the household, the social, physical, economic and environmental dimensions were considered into the computation of vulnerability composite index. In overall, the results indicated that the female-headed households were relatively more vulnerable compared to male-headed households in all the aspects, evident by the weightage average index (WAI) that was utilised to measure the multidimensional vulnerability.

Economic shock could put the households to an unprepared condition, possibly leading the household into indebtedness or financial vulnerability. He and Zhou (2022) employed the data from China Health and Retirement Longitudinal Study (CHARLS) in years 2011, 2013 and 2015, with the total sample household of 14,277, to examine the financial vulnerability of households in the context of income and medical expenses shocks. Unlike some of the past studies that applied financial margin but neglected the allocation of assets, the researchers integrated both measures to define the financial vulnerability in their study. Remarkably, it was found that the households tend to be financially vulnerable when the health status of the household head was getting worse, regardless from urban or rural area for the three years. Other than that, from the results of feasible generalised linear regression analysis, it is evident that the shocks of income and medical expenses were significantly affected financial vulnerability.

COVID-19 is undeniably causing people to suffer from various dimensions. The marginalized populations such as the refugees is at a heightened risk amidst the pandemic. Accordingly, Aung et al. (2022) examined the health-social vulnerability of the refugees in Malaysia. In this study, the authors sampled 283 refugees in identifying the vulnerability aspect because they were one of the marginalized populations. Additionally, they adapted the vulnerability framework which included adaptive capacities to assess the vulnerability caused by COVID-19. In overall, the refugees were found to be moderately vulnerable in terms of social and health perspectives. Specifically, the refugees were vulnerable in the basic needs condition and on the awareness of COVID-19 prevention for health and social aspects respectively. Other than that, the results also indicated that the health access by the refugees, representing the dimension of basic needs condition, was strongly and positively correlated.

Before the emergence of COVID-19 pandemic, in-work poverty also contributed to the vulnerability. Klug et al. (2020) conceptualized the economic vulnerability by integrating the income and the perceived financial strain to overcome the limitation of both measures. Using this concept, the researchers studied the vulnerability at individual level in Germany and how it contributed to the mental health. Prior to analysing the data, a total of 7,107 working adults that participated in German Socio-economic Panel (SOEP) from year 1997 to year 2017 was collected. With the multi-level regression analysis, the results evident that the economic vulnerability contributed to the worser mental health that was parallel with the other researchers. In addition, sense of control was set to be the mediator to examine to relationship between the vulnerability and the mental health, differentiating this study from past studies.

In combating the COVID-19 virus, the society is believed to be vulnerable to certain extent. The national resilience toward the COVID-19 was weak due to the high risk of disease exposure from the results of even though different containment measures were carried out during that period. To have some idea on it, Paul (2021) examined the vulnerability and the resilience level of India by computing the vulnerability index. In this context, the vulnerability index focused on the four main dimensions, namely infrastructure of hospital, demographic background, housing condition and also the health condition which were obtainable from the various database in India. In overall, the vulnerability index was amounted at 0.42, implying a medium level of vulnerability. Additionally, it was discovered that the society in India was highly vulnerable in hospital infrastructure domain. Unexpectedly, the health aspect was found less vulnerable in India contributed the second highest proportion to the overall vulnerability level.

From other perspective, focusing on psychological wellbeing, Zhang et al. (2021) examined the degree of vulnerability and resilience of children (grouped in urban, rural, left-behind and migrated) in China during the outbreak of the COVID-19 pandemic. In this study, the psychological wellbeing acts as the resilience dimension, where the economic and social resources would contribute to the risk and protective factors respectively. From the 10,678 children sampled, the descriptive statistics revealed that the economic status of the family becomes more severe, but the psychological wellbeing among the children shows betterment, showing a better resilience. Surprisingly, the results indicated that the pandemic positively affected the children's psychological wellbeing, evident from the regression analysis. Besides that, although family economic resources shown decrement across all

categories, the relationship between the parent and the children improved during COVID-19 pandemic.

By focusing the impact on the students at university level, Le Vigouroux et al. (2021) examined the psychological vulnerability on university students in France due to the advent of COVID-19. To frame the vulnerability from the dimension of psychology, the authors took hassle, the symptoms of mental illness, emotions, coping strategies with COVID-19 confinement and situational factors into account. In this study, 1,297 valid respondents were recruited, aged from 17 to 75 years old. Through correlation analysis, the results revealed that hassle was positively correlated with the respondents' belief on compromised future prospects on job due to the COVID-19 lockdown, indicating that the students were somewhat vulnerable from the perspective of psychology and worrying about their future. Other than that, the results also showed that the coping strategies toward COVID-19 lockdown served as a mediator on the relationship between the respondents' emotion and one of the mental illness symptoms, depression.

During the lockdown period, it is undeniable that the containment measure colossally impacted the society in terms of employment and income source. Through purposive sampling techniques, Kesar et al. (2021) collected samples of 4,942 workers in informal sectors from rural and urban areas, who belong to the vulnerable households, to assess the impact of lockdown during the pandemic period. In this study, the sampled vulnerable households included individuals or family members who suffered from employment loss and income shock during the lockdown period. The results revealed that the containment measure implemented during that period negatively influenced the vulnerable households in

terms of their living condition and the food security, evident by that majority of the sampled household experienced reduction in term of food intake and insufficient income source to cope with the living expenses. From logistic regression results, the urban migrant workers were more likely to experience employment loss and earning loss, indicating that they were experiencing higher level of economic vulnerability.

Empirical work splits between macro/meso composite indices and household-level studies. Small-island and LIC studies consistently show high structural exposure (e.g., openness, remoteness, commodity dependence) and document that this raises vulnerability and depresses growth, yet some small islands still perform well, signalling latent resilience mechanisms that macro indices do not capture (Adrianto & Matsuda, 2004; Guillaumont, 2004) . At the household level, Indian rural data show that labour-market integration buffers income shocks, reducing reliance on costly coping such as asset sales, while Vietnamese evidence ties institutional change and climate risks to rising vulnerability despite poverty reduction (Kochar, 1995; Adger, 1998) . Sectoral studies (e.g., small-scale fisheries) distinguish vulnerability from poverty: fishers may not be the poorest yet remain highly vulnerable due to income volatility and environmental shocks, implying policy must address livelihood risk, not only poverty gaps (Béné, 2009) . Methodologically, EVI-style tools align with state fragility but face measurement limits (weighting, volatility correspondence), while spatial HVI applications reveal sharp place-based heterogeneity and rural sensitivity during crises (Guillaumont & Guillaumont, 2009; Wang, 2013; Kienberger et al., 2009; Murphy & Scott, 2014) . Crisis-era evidence also shows financial fragility concentrates among low-income households, strengthening the case for financial protection and consumer safeguards as resilience levers (Emmons & Noeth, 2013) . Gap: macro indices capture exposure but

miss person-level sensitivity and coping; micro studies capture fragility but rarely integrate health consequences, there is no Malaysia-specific, household-level EV–HR instrument linking income-based sensitivity and adaptive capacity to resilience outcomes.

2.5 Past Studies that Related to Health Resilience

In early years, Leigh (1983) examined the influence of education on health through both direct and indirect pathways, analyzing key variables such as years of schooling, health behaviors (e.g., smoking, diet, and exercise), and occupational hazards. Health was assessed using self-reported status and epidemiological indicators, while economic factors were controlled to isolate the specific impact of education. The findings revealed that indirect effects, such as education's role in shaping healthier behaviors and facilitating safer job choices, were more significant than direct effects. This underscores the role of education in fostering awareness of health risks and promoting preventive behaviors, ultimately contributing to long-term health resilience. Moreover, the study suggested that education could empower individuals with the ability to critically evaluate health information and make informed decisions, thereby enhancing overall well-being and longevity.

Similarly, Winkleby et al. (1992) investigated the relationship between socioeconomic status (SES) and health, with a particular focus on cardiovascular disease risk factors, including smoking, blood pressure, and cholesterol levels. SES was measured through education, income, and occupation to determine their relative contributions to health disparities. The results demonstrated that individuals from lower SES backgrounds exhibited higher rates of smoking, hypertension, and unfavorable lipid profiles, with education emerging as the most significant predictor of cardiovascular health. These findings suggest

that education not only provided individuals with knowledge about health risks but also enhanced their problem-solving abilities and access to healthcare services, ultimately leading to improved health outcomes. Furthermore, the study highlighted the cumulative impact of education in reducing health inequities by equipping individuals with resources to navigate healthcare systems more effectively and adopt healthier lifestyles over time.

In a related study, Ross and Wu (1995) examined the association between educational attainment and various health outcomes, emphasizing mechanisms such as economic stability, social-psychological resources, and health behaviors. Using national survey data, the researchers measured health outcomes through self-reports and physical functioning assessments. The findings indicated that individuals with higher levels of education experienced greater job security, lower financial hardship, and improved mental health, all of which contributed to more favorable health outcomes. Additionally, the study found that educated individuals engaged in healthier behaviors, such as reduced smoking rates and increased physical activity, further reinforcing the protective effects of education on health. These results supported policy initiatives aimed at promoting education as a crucial determinant of long-term health resilience, highlighting the importance of investing in educational programs to enhance both individual and population-level health outcomes.

Expanding on the theme of health disparities, Harris (2001) evaluated racial and ethnic inequalities in healthcare access, utilization, and health outcomes among adults with Type 2 diabetes in the United States. Key variables included healthcare access, diabetes management behaviors, and clinical outcomes, such as blood glucose and cholesterol levels. The findings revealed that African-American and Mexican-American patients exhibited

lower rates of self-monitoring blood glucose and cholesterol screening compared to Caucasian patients, which contributed to poorer diabetes-related health outcomes. These disparities underscored the necessity of culturally tailored healthcare interventions to improve chronic disease management among minority populations. Furthermore, the study emphasized the role of systemic factors, such as healthcare provider bias and structural barriers, in exacerbating health inequities, thereby advocating for targeted policies aimed at increasing healthcare accessibility for marginalized communities.

Building upon the discussion of socioeconomic disparities, Evans and Kantrowitz (2002) examined how environmental exposures mediated the relationship between SES and health disparities. The researchers analyzed variables such as income level, neighborhood environmental risks, and health outcomes associated with chronic diseases. The study highlighted that lower-income populations experienced significantly higher exposure to pollutants, noise, and substandard housing conditions, all of which contributed to adverse health effects. The results suggested that environmental stressors played a crucial role in amplifying SES-related health disparities, reinforcing the need for interventions aimed at mitigating these risks. Additionally, the findings provided compelling evidence for policymakers to implement targeted environmental health initiatives in low-income communities, thereby reducing exposure to harmful environmental conditions and promoting overall health resilience.

Further extending the discourse on social determinants of health, Hendryx et al. (2002) explored the impact of community social capital on healthcare access across 22 metropolitan areas in the United States. Key variables included levels of social trust, civic

engagement, and managed healthcare penetration, with access measured through self-reported difficulties in obtaining care. The findings indicated that higher levels of social capital within a community were associated with fewer reported barriers to healthcare. This study emphasized the significance of community-based initiatives in strengthening social cohesion and, in turn, improving healthcare accessibility and public health outcomes. Moreover, the research underscored that social capital played a mediating role in reducing health disparities by fostering supportive networks that facilitated healthcare utilization, particularly for vulnerable populations with limited resources.

Furthermore, Godin and Kittel (2004) examined the impact of economic stability and workplace stress on health outcomes, particularly focusing on absenteeism and psychosomatic complaints. The study analyzed variables such as job security, workplace support, and psychological stress, with health measured through self-reported anxiety, depression, and chronic fatigue assessments. The findings indicated that low job control and high overcommitment were significantly correlated with poor health outcomes, demonstrating the profound impact of economic stability on overall well-being. Additionally, the study emphasized that a supportive work environment played a pivotal role in mitigating workplace stress and fostering health resilience. These findings provided important insights for organizational policies, suggesting that efforts to improve job security and workplace conditions could serve as effective strategies in promoting employee health and reducing work-related stress-related illnesses.

Wilson et al. (2004) examined the association between individual perceptions of neighborhood characteristics and health outcomes. Key variables included self-assessed

neighborhood safety, social cohesion, and environmental quality, measured against self-reported health status, chronic conditions, and emotional distress. The results indicated that negative perceptions of the neighborhood environment correlated with poorer self-rated health and increased emotional distress. These findings suggested that improving neighborhood environments and fostering social cohesion could be effective strategies for enhancing community health resilience. Furthermore, the study emphasized that perceptions of neighborhood safety influenced stress levels and mental well-being, underscoring the need for urban planning initiatives that prioritize both physical and social environmental improvements.

Similarly, Fitzpatrick et al. (2004) investigated the self-perceived barriers to healthcare access among elderly Medicare beneficiaries in the United States. Key variables included socioeconomic status, insurance coverage, and psychological and physical barriers, measured through self-administered questionnaires. The study found that older age, low income, lack of supplemental insurance, and female gender were significant predictors of perceived barriers. The results indicated that psychological and financial constraints, rather than race, played a more substantial role in limiting access to care. These findings emphasized the need for policy interventions targeting economic barriers and improving healthcare accessibility for vulnerable elderly populations. Additionally, the research highlighted the importance of expanding supplemental insurance programs and developing outreach initiatives to assist low-income elderly individuals in navigating the healthcare system effectively.

Building on the discussion of social determinants of health, Veenstra et al. (2005) examined the role of social capital in shaping health outcomes across different neighborhoods in Hamilton, Canada. Variables included voluntary association involvement, neighborhood socioeconomic status, and health behaviors, with health measured through self-rated health, chronic disease prevalence, and emotional well-being. Results indicated that social capital positively influenced health but was moderated by neighborhood socioeconomic conditions. The study suggested that social capital initiatives must be tailored to the specific needs of disadvantaged communities to maximize health benefits. Furthermore, the findings underscored the necessity of strengthening community networks and increasing participation in local organizations as means of fostering health resilience.

Likewise, Ziersch et al. (2005) explored the relationship between neighborhood-based social capital and health outcomes in the western suburbs of Adelaide. Key variables included perceptions of the physical environment, neighborhood trust, social connections, and civic engagement, with health measured using the SF-12 physical and mental health scales. The study found that neighborhood safety was positively associated with physical health, while social connections significantly contributed to mental well-being. The findings suggested that fostering social capital at the community level could enhance health resilience, especially in lower-income areas. Additionally, the research emphasized that urban development strategies focusing on improving social infrastructure and community cohesion could further enhance overall health outcomes in disadvantaged neighborhoods.

Expanding on the role of economic factors, Hopkins (2006) examined the impact of economic stability on health status in Indonesia, Malaysia, and Thailand during and after the

1990s financial crisis. The key variables analyzed included real GDP per capita, mortality rates, and government expenditure on healthcare. Health status was measured using mortality rates as a primary indicator, while household income and public sector spending were examined to understand their influence on healthcare access. The study found that economic downturns had measurable effects on public health, particularly in Indonesia and Thailand, where government spending cuts coincided with increased mortality rates. Malaysia, which maintained higher social safety net spending, showed comparatively better health resilience. These findings underscored the importance of government intervention in minimizing the adverse health effects of economic crises. Additionally, the study highlighted the role of international financial assistance in mitigating the impact of economic downturns on healthcare systems and public health.

In a related study, Pearce et al. (2006) assessed the relationship between geographical access to community resources and health outcomes in New Zealand. Variables included proximity to healthcare, education, and recreational facilities, measured using Geographic Information Systems (GIS). Results indicated significant disparities in resource accessibility, particularly between urban and rural areas, affecting residents' ability to engage in health-promoting behaviors. The study underscored the importance of equitable urban planning and policy measures to address health inequalities arising from geographical disparities. Furthermore, the research suggested that targeted infrastructure investments and transportation policies could play a crucial role in bridging the accessibility gap and promoting health equity across diverse populations.

Nonetheless, Parkes and Kearns (2006) examined the relationship between various neighborhood characteristics and health outcomes in Scotland. Key variables included neighborhood social cohesion, environmental quality, and access to health-related services, with health measured through self-reported conditions and behaviors. Results indicated that neighborhood context had a multi-dimensional impact on health, with social capital and service availability playing crucial roles. The findings suggested that urban planning and community development policies should focus on enhancing both social and physical neighborhood environments to improve health resilience. Additionally, the study reinforced the notion that integrating health-promoting strategies into urban development frameworks could significantly contribute to long-term public health improvements, particularly in socioeconomically disadvantaged areas.

Froot and Van Den Brink (2007) assessed the causal relationship between education and health, controlling for unobserved heterogeneity and reporting bias. The research utilized data from the Netherlands, with health measured through self-reported status and objective medical assessments. Results indicated that higher education levels were consistently associated with improved health outcomes, with potential health returns to education ranging from 1.3% to 5.8% of GDP per capita. These findings emphasized the economic and health benefits of investing in education as a long-term health resilience strategy. Furthermore, the study highlighted that education not only provided individuals with better health awareness but also improved their ability to access healthcare services and make informed medical decisions, reinforcing its role as a key determinant of well-being.

In a similar vein, Mohseni and Lindstrom (2007) examined the relationship between institutional trust in the healthcare system and self-rated health in Sweden, considering the role of healthcare access. The study incorporated variables such as institutional trust, generalized trust, economic stress, and healthcare-seeking behavior, measured through a cross-sectional survey of 27,963 respondents. The findings revealed that individuals with lower trust in the healthcare system were more likely to report poor health, a relationship partially mediated by reluctance to seek medical care. These results suggested that strengthening public confidence in healthcare institutions could improve care-seeking behaviors and overall health resilience. Additionally, the research underscored the importance of transparent communication and equitable healthcare access in fostering trust and encouraging positive engagement with health services.

Extending the focus to adolescent health, Viner et al. (2012) explored how social determinants such as national wealth, income inequality, and access to education affected adolescent health and well-being. The research identified structural factors as the strongest determinants of adolescent health, emphasizing how these influences persisted into adulthood. Health outcomes were measured through indicators such as mental health, physical health, and engagement in risky behaviors. The results indicated that higher national wealth and reduced income inequality led to better adolescent health, whereas disparities in education access exacerbated health inequalities. The study further elaborated on how peer relationships, school environments, and family dynamics shaped health behaviors during adolescence. These findings suggested that interventions targeting structural determinants during adolescence could significantly improve lifelong health resilience. Moreover, the

study provided evidence that early-life interventions could mitigate the negative effects of socioeconomic disadvantage, leading to improved long-term health trajectories.

Similarly, German and Latkin (2012) examined the relationship between social stability and health disparities among low-income urban populations. The study analyzed variables such as housing stability, employment, social networks, and incarceration history, with health measured through self-reported chronic illness and mental health status. Results indicated that higher social stability was strongly associated with better health outcomes, lower rates of chronic illness, and reduced mental health issues. The study suggested that comprehensive policies addressing social determinants could break the cycle of disadvantage and improve overall health resilience. Furthermore, the findings emphasized the need for integrated social support programs that provide stable housing, employment opportunities, and mental health services as essential components of reducing health disparities among marginalized groups.

Likewise, Van Der Heide et al. (2013) investigated how health literacy mediated the relationship between education and health outcomes in the Netherlands. Variables included education level, health literacy scores, and self-reported health status, assessed using the Dutch Adult Literacy and Life Skills Survey. Results indicated that health literacy partially mediated the association between education and health, suggesting that lower education levels contributed to poor health outcomes through reduced ability to navigate healthcare systems. These findings highlighted the importance of educational interventions to improve health literacy and reduce health disparities. Additionally, the study stressed that policies aimed at enhancing health literacy should be integrated into formal education systems and

lifelong learning initiatives, ensuring that individuals, regardless of socioeconomic background, could make informed health decisions.

Furthermore, Ward et al. (2013) applied a social determinants framework to analyze vulnerability across six Asia-Pacific countries, Australia, Hong Kong, Japan, South Korea, Taiwan, and Thailand. The research focused on four key determinants: social cohesion, social inclusion, social empowerment, and socioeconomic security. Data from national surveys were analyzed using logistic regression to identify predictors of vulnerability. The study found that low income was a consistent predictor of low social cohesion and social inclusion across all countries. Additionally, poor subjective health was linked to low socioeconomic security in Japan, South Korea, and Thailand. These results highlighted the necessity of policy interventions aimed at improving social determinants to enhance health resilience among vulnerable populations. Moreover, the study emphasized the potential for cross-national policy learning, where best practices from high-performing nations could be adapted to strengthen social protection mechanisms in lower-performing countries.

Besides, Short and Mollborn (2015) examined the influence of social determinants on health behaviors and how structural inequalities shaped health outcomes. The research analyzed variables such as health behaviors (e.g., smoking, diet, physical activity), socioeconomic status, and social environments, emphasizing the interaction between individual choices and systemic constraints. The findings suggested that health behaviors were deeply embedded within social and economic contexts, with upstream factors such as education, labor market conditions, and institutional policies playing a pivotal role. The study elaborated on how emerging research integrated biosocial models to better understand

health behavior dynamics. These insights supported the argument that interventions should go beyond individual responsibility and address broader structural determinants. Additionally, the research advocated for a multidimensional approach to health promotion, incorporating policy changes, social reforms, and targeted community programs to create environments conducive to healthier lifestyles.

Wheaton et al. (2015) examined how neighborhood characteristics influenced health and well-being in Toronto, focusing on socioeconomic position, environmental conditions, and social networks. The study analyzed variables such as economic deprivation, crime rates, access to healthcare, and self-reported health status. The results indicated that neighborhood-level stressors, including economic inequality and limited healthcare access, were significant predictors of mental and physical health disparities. Furthermore, the study highlighted the role of social cohesion in mitigating negative health outcomes, suggesting that strong community networks could buffer against adverse neighborhood effects. The findings emphasized the importance of urban planning and policy interventions in fostering health resilience by addressing structural inequalities and enhancing access to essential services.

In a similar vein, Brunello et al. (2016) examined the causal relationship between education and health, particularly focusing on how health behaviors mediated this relationship. The study employed instrumental variables derived from compulsory schooling reforms and analyzed data across multiple European countries. Key health behaviors examined included smoking, drinking, and physical activity. Results suggested that education significantly improved health outcomes, with health behaviors accounting for 23-45% of the overall effect. This finding underscored the importance of education in shaping

long-term health trajectories by influencing lifestyle choices and decision-making abilities. Moreover, the research indicated that education not only promoted healthier behaviors but also improved individuals' capacity to navigate healthcare systems, further reinforcing the link between education and overall well-being.

Building upon the intersection of economic and environmental factors, Raffin and Seegmuller (2017) analyzed the relationship between environmental pollution, economic stability, and public health. The study employed an economic model integrating pollution levels, healthcare expenditures, and longevity as key variables. Health outcomes were measured using life expectancy and mortality rates. The findings revealed that pollution negatively affected longevity, but appropriate fiscal policies, such as increased public health spending, could mitigate these effects. Additionally, the study highlighted the disproportionate impact of pollution on lower-income populations, emphasizing the necessity for targeted environmental regulations. These findings underscored the need for comprehensive policy approaches that balance economic growth with sustainable public health investments to enhance long-term health resilience.

Expanding on the role of education in health outcomes, Raghupathi and Raghupathi (2020) examined the relationship between education and health across 26 OECD countries over a 20-year period. Variables included tertiary education rates, life expectancy, infant mortality, and healthcare access. The study found that higher educational attainment was strongly associated with better health indicators, particularly in reducing premature mortality and improving child vaccination rates. Furthermore, the research emphasized that education policies played a crucial role in addressing health disparities by equipping individuals with

the knowledge and resources necessary for proactive health management. These findings reinforced the argument that investments in education could yield substantial health benefits at both individual and population levels, contributing to long-term health resilience.

Further highlighting the impact of social determinants on marginalized populations, Jarrett et al. (2021) investigated the effects of the COVID-19 pandemic on transgender and nonbinary individuals, focusing on healthcare access, mental health, and economic stability. The analysis included cross-sectional data from 76 countries, with variables such as gender-affirming care access, employment status, and mental health indicators. Results revealed that reduced access to gender-affirming resources significantly increased depression, anxiety, and suicidal ideation. The study also identified economic insecurity as a key driver of mental health deterioration during the pandemic. These findings underscored the importance of inclusive health policies and economic support systems in promoting health resilience among marginalized communities, highlighting the necessity for targeted interventions that address both medical and socioeconomic barriers.

Lastly, Budd et al. (2025) investigated the impact of social determinants on COVID-19 testing and vaccination attitudes among Latinx populations in Oregon. Key variables included economic insecurity, healthcare access, education, and discrimination, with multilevel modeling used to assess their influence on health behaviors. The results indicated that pandemic vulnerability, economic insecurity, and discrimination were strongly associated with testing hesitancy, while education was linked to vaccine hesitancy. Additionally, English proficiency and parental nativity moderated these relationships, further illustrating the complexity of social determinants in shaping health behaviors. These

findings emphasized the need for culturally responsive health interventions to address disparities in pandemic responses and vaccine uptake. Moreover, the study suggested that multilingual outreach programs and community-based health initiatives could be instrumental in improving healthcare engagement within Latinx communities.

Across SDH studies, income, education, and access to care consistently predict health risks and recovery, with financial, geographic, and systemic barriers widening disparities, especially for low-income and rural groups (Galea et al., 2011; Raphael, 2011; Bambra et al., 2010) . Social ties buffer stress and improve mental and chronic-disease outcomes, while neighbourhood conditions (deprivation, safety, services) shape both mental and physical health, implying resilience is partly relational and place-based (Kawachi & Berkman, 2001; Cohen & Wills, 1985; Wilkinson & Marmot, 2003; Wheaton et al., 2015) . Health literacy mediates the education–health link, underscoring the role of capability in resilience, and Asia-Pacific evidence identifies low income as a cross-national predictor of low cohesion and inclusion, classic sensitivity channels (Van der Heide et al., 2013; Ward et al., 2013) . Studies also show health behaviours are embedded in structural constraints, implying that interventions must go beyond individual choice to address upstream determinants; urban-planning investments reduce chronic disease and improve mental health, practical resilience levers (Short & Mollborn, 2015; Dannenberg et al., 2011; Diez Roux, 2016) . Gap: much of this literature is associational and descriptive; few studies build a composite, household-level capacity measure that jointly operationalizes sensitivity (income-linked disparities) and adaptive capacity (education, financial protection, access) to predict health resilience within Malaysia, precisely what your EV–HR index is designed to deliver.

2.6 Research Gaps

The literature shows that vulnerability and resilience are jointly shaped by exposure to shocks, the sensitivity of households to those shocks, and the adaptive capacities that enable coping and recovery. Economic vulnerability theory clarifies how structural exposure and policy-malleable resilience interact, while the social determinants of health (SDH) specify how income, education, and access to care pattern health risks and recovery trajectories across populations (Briguglio et al., 2009; WHO, 2008; Solar & Irwin, 2010; Braveman et al., 2011; Marmot, 2015). Taken together, these strands imply that resilience should be understood as the outcome of sensitivity and capacity operating within a given exposure context.

Despite this conceptual convergence, the empirical literatures remain largely bifurcated. Economic vulnerability indices are predominantly macro-structural and seldom incorporate individual or household measures of sensitivity and adaptive capacity linked to concrete health consequences. Conversely, SDH studies typically demonstrate associations between socioeconomic conditions and health but rarely translate these into composite, policy-sensitive tools that predict recovery under economic stress. In Malaysia, and particularly in Sarawak, there is no validated, household-level index that integrates economic vulnerability and health resilience for working adults. This absence limits precise diagnosis of who is most at risk when economic shocks and health stressors coincide, and it constrains the targeting of interventions.

This study responds by developing an integrated Economic Vulnerability–Health Resilience (EV–HR) index calibrated to Sarawak’s working-adult population. The index

operationalizes sensitivity through income-linked disparities and labour-market fragility, and adaptive capacity through education, financial protection (savings/insurance), and access to care, with health resilience defined as the capacity to maintain or return to baseline health and functioning despite shocks. By stratifying results across B40/M40/T20 and urban–rural groups and by testing joint and differential associations in a transparent analytical framework, the index is designed to be both explanatory and actionable in the Malaysian context. The design implications specified here guide the data choices, measurement, and validation procedures in Chapter 3.

Table 2.2: Literature-Gap Matrix

Strand	Typical variables	Method tendency	Malaysia coverage	Gap vs. this study
EV indices	Openness, export concentration, import reliance, governance	Composite macro indices	National/macro	No person-level sensitivity/adaptive capacity or health recovery (Briguglio et al., 2009; Guillaumont, 2013)
SDH	Income, education, access, neighborhood	Regression / associational	Mixed	Rarely integrated into a resilience index aligned with EV structures (WHO, 2008; Solar & Irwin, 2010)
Malaysia/Sarawak	Income–health gradients, access barriers	Descriptive; case studies	Partial	No integrated EV–HR tool for working adults; no mapping of sensitivity/adaptive capacity to recoveries

2.7 Chapter Remarks

The literature review begins by highlighting the concept of economic vulnerability, defining it as the susceptibility of individuals, households, and communities to economic shocks and stresses. The review highlights the multidimensionality of economic vulnerability, encompassing other possible key determinants of vulnerability, such as social, psychological, financial and health vulnerability. Next, the review explores the concept of health resilience, which is defined as the ability of individuals, communities, and health systems to adapt and recover from health shocks and stresses. Finally, the literature review provides a summary of existing empirical studies on the relationship between economic vulnerability and health resilience in Malaysia, highlighting the need for further research to fully understand the dynamics of this relationship and inform policy and practice. In overall, the literature review provides a comprehensive overview of the concepts of economic vulnerability and health resilience and their interplay.

CHAPTER 3

METHODOLOGY

3.1 Introduction

In this chapter, the research design and the methods utilized to achieve the research objectives will be discussed. Firstly, after reviewing on the past studies, a conceptual framework will be presented. The next section will focus on the detail on the research designs, namely the population, sampling techniques, and pilot testing. Section 3.4 and section 3.5 focuses on the description on data analysis and also the index computation procedure that to be conducted to answer the specific objectives mentioned previously. In Section 3.6, it will be the summary of the chapter that sums up the write-up of Chapter 3.

3.2 Theoretical Basis and Conceptual Framework

The conceptual framework treats economic vulnerability as the interplay of exposure, sensitivity, and adaptive capacity and places health resilience as the downstream capacity to withstand and recover from shocks. In this study, exposure is theorized as an exogenous context that shapes the opportunity set in which households operate (e.g., macro shocks, price volatility, remoteness), while sensitivity and adaptive capacity are proximate household attributes that determine how a given shock translates into realized losses or recovery. In this sense, exposure elevates the likelihood or magnitude of shocks, sensitivity transmits those shocks into welfare impacts (e.g., through low income/unstable jobs), and adaptive capacity buffers those impacts through resources and skills (e.g., education, savings/insurance, access to care) .

Owing to that the exposure is largely structural, the present study model it as contextual at the state level for Sarawak, using it to characterize the risk environment rather than as a household regressor; by contrast, sensitivity and adaptive capacity are household-level attributes that vary meaningfully across individuals and income groups and therefore enter the person-level EV–HR indices and models as explanatory dimensions . The outcome construct, health resilience, is defined as the retained ability to maintain or return to baseline health and functioning despite shocks; in our empirical work it is measured at the individual/household level to align with the determinants the theory highlights. Two types of latent structure follow from the theory.

Therefore, to achieve the general objective of this study, specifically to assess the interplay between economic vulnerability and health resilience, a conceptual framework that rooted from the theories discussed in the previous chapter is presented. The study brings in the necessary components that shape economic vulnerability and health resilience. Firstly, economic vulnerability as a multidimensional construct influenced by three key factors: exposure, sensitivity, and adaptive capacity. Exposure refers to the extent to which individuals or communities are subjected to economic shocks, such as job losses, inflation, or financial crises. Sensitivity reflects the degree to which these economic disruptions impact well-being, depending on factors such as income levels, financial security, and dependency on unstable economic sectors. Lastly, adaptive capacity denotes the ability to mitigate or recover from economic stress through mechanisms like social safety nets, education, and skill development. Understanding the interaction between these elements is essential for designing policies that reduce economic vulnerability, enhance resilience, and promote long-term economic stability, particularly for marginalized or at-risk populations.

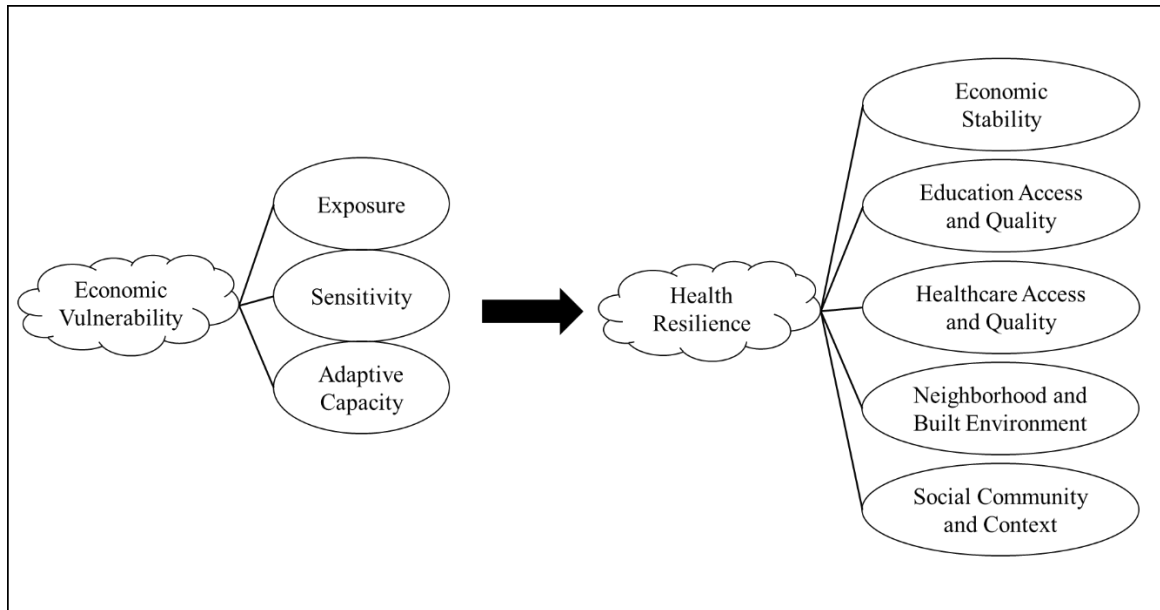


Figure 3.1: Conceptual Framework of the Study

From the other side, health resilience integrates economic stability, education access, healthcare quality, neighbourhood environment, and social community context provides a comprehensive approach to understanding resilience. Economic stability is a critical determinant of an individual's and a community's capacity to withstand economic shocks and uncertainties. Factors such as employment opportunities, income levels, and economic vulnerability influence financial security and access to essential services. Similarly, education access and quality play a fundamental role in shaping long-term economic and social mobility, as higher education levels correlate with improved employment prospects, better health outcomes, and increased civic engagement. Without equitable access to education, individuals may struggle to break the cycle of poverty, further exacerbating economic disparities and limiting adaptive capacity in the face of external challenges.

Healthcare access and quality significantly contribute to health resilience, influencing both individual and community well-being. A robust healthcare system ensures

timely medical interventions, preventive care, and equitable distribution of health resources, which are essential for mitigating the impact of diseases and improving life expectancy. However, disparities in healthcare access, often linked to socioeconomic status and geographic location, create barriers that disproportionately affect marginalized communities. In conjunction with healthcare, the neighbourhood and built environment also shape health outcomes. Access to clean water, air quality, safe housing, and recreational spaces fosters overall well-being, while urban planning and infrastructure development can either reinforce or alleviate systemic inequalities. A well-developed built environment enhances social cohesion, reduces exposure to environmental hazards, and supports a healthier lifestyle, ultimately contributing to resilience.

The role of social community and context further reinforces the ability of individuals and groups to adapt to economic and environmental changes. Strong social networks and community engagement facilitate resource-sharing, emotional support, and collective problem-solving, which are essential during crises. Societies with high levels of social trust and civic participation exhibit greater adaptive capacity, as they can mobilize resources and implement community-driven solutions more effectively. Economic vulnerability, in contrast, undermines resilience by increasing dependence on external assistance and limiting opportunities for upward mobility. Thus, a holistic approach that integrates economic, educational, healthcare, environmental, and social dimensions is crucial for fostering resilience and reducing disparities.

Table 3.1: Measurement of Economic Vulnerability Indicators

Component	Measurement	Source
Exposure	Exposure to fluctuations in international trade and financial flows	Data obtained from DOSM (2024). Computed by authors.
	Exposure to fluctuations in export earnings	Data obtained from DOSM (2024). Computed by authors.
	Exposure to fluctuations in strategic import prices	Data obtained from DOSM (2024). Computed by authors.
External Sensitivity	Access to basic amenities	DOSM (2024).
	Percent of population that is very old or very young	DOSM (2024).
Economic Sensitivity	Economic condition	Obtained from survey.
	Employment status	Obtained from survey.
	Market forces	Obtained from survey.
Environmental Sensitivity	Natural disasters	Obtained from survey.
Health Threat Sensitivity	Health crises	Obtained from survey.
Social Sensitivity	Social and political factors	Obtained from survey.
	Education and skills	Obtained from survey.
	Social support systems	Obtained from survey.
Economic Status	Availability of savings	Obtained from survey.
	Availability of liquid assets	Obtained from survey.
	Availability of productive assets	Obtained from survey.
Food Security	Food security	Obtained from survey.
Psychological Adaptive Capacity	Resilience	Obtained from survey.

To measure economic vulnerability, the assessment of various socio-economic and environmental factors is essential. In this regard, exposure is analysed by examining fluctuations in international trade and financial flows, variations in export earnings, and changes in strategic import prices as suggested by United Nations (2024). Specifically,

exposure to international trade and financial fluctuations is measured by calculating the proportion of the top three export categories in total exports of goods and services. Additionally, exposure to variations in export earnings is assessed using the standard deviation of the difference between annual export revenue and its 20-year trend. Furthermore, exposure to fluctuations in strategic import prices is determined by computing the five-year average of the ratio of food and fuel imports to final consumption expenditure. Collectively, these indicators provide a comprehensive understanding of a region's or economy's susceptibility to external economic shocks.

In contrast, external sensitivity is influenced by access to basic services and the demographic composition of a population, particularly the proportion of individuals who are either very young or elderly, as these groups tend to be more vulnerable to adverse conditions. Economic sensitivity, on the other hand, is evaluated by examining one's perception on the extent to which economic fluctuations affect employment, market dynamics, and overall economic stability. Similarly, environmental sensitivity is determined by assessing a one's perception on sensitivity to natural disasters, which can have severe consequences for communities and infrastructure. In addition, health threat sensitivity is measured by analyzing the extent to which a society is susceptible to health crises, as the capacity to respond to public health emergencies is crucial for overall well-being. Moreover, social sensitivity is assessed based on factors such as exposure to socio-political challenges, levels of education and skills, and the strength of social support networks, all of which contribute to a society's adaptability and resilience.

In terms of economic stability, economic status is evaluated based on the availability of financial resources, including savings, liquid assets, and productive assets, which collectively determine financial security and resilience. Meanwhile, food security is assessed by measuring the accessibility and availability of essential nutrition within a community. Finally, resilience is gauged by analysing individuals' internal capacity to endure and recover from economic, social, and environmental shocks. In this regard, The CD-RISC 10 is employed to evaluate participants' resilience levels. The 10-item version retains strong psychometric properties and has been validated across various populations and contexts (Nartova-Bochaver et al., 2021). Each item is scored on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

The assessment of various socio-economic and environmental factors is essential for understanding the well-being and resilience of individuals and communities. Economic Strain is measured by The 13-item Family Economic Strain Scale (FESS) was designed to assess economic strain in both single- and two-parent households. Initially, the scale comprised 25 items, with 13 adapted from prior research and 12 newly developed for this study. A pilot study was conducted with participants from single-mother, single-father, and two-parent families. The FESS demonstrated strong reliability and was validated through hypothesis testing, establishing its effectiveness in examining perceived economic strain within family dynamics (Hilton & Devall, 1997). Items 1 through 12 are rated on a 5-point Likert scale, ranging from 1 (never) to 5 (almost always), while Item 13 is rated on a similar 5-point scale, ranging from 1 (far below average) to 5 (far above average).

Table 3.2: Measurement of Health Resilience Indicators

Component	Measurement	Source
Economic Strain	Economic Strain	Obtained from survey.
Education and Occupational Complexity	Occupational complexity	Obtained from survey.
	Education attainment	Obtained from survey.
Health Care Access and Quality	Number of beds	DOSM (2024).
	Crude death rate	DOSM (2024).
	Number of health workers	DOSM (2024).
	% of government expenditure on health to GDP	DOSM (2024).
	Life expectancy	DOSM (2024).
	Health care access	Obtained from survey.
Perceived environmental impact	NBE1a: Containment concentration – PM10	DOSM (2024).
	NBE1b: Containment concentration – Nitrogen Oxide	DOSM (2024).
	NBE1c: Containment concentration – Oxide	DOSM (2024).
	NBE1d: Containment concentration – PM2.5	DOSM (2024).
	NBE2: Crime rate	DOSM (2024).
	NBE9: Perceived environmental impact	Obtained from survey.
Distance to Essential Services	Distance from home to market	Obtained from survey.
	Distance from home to public means of transport	Obtained from survey.
	Distance to nearest school	Obtained from survey.
	Distance to nearest hospital	Obtained from survey.
Emotional Connectedness	Loneliness	Obtained from survey.
Social Connectedness		
Social Support	Social Support	Obtained from survey.
Social Acceptance	Discrimination	Obtained from survey.

Similarly, education and occupational complexity is evaluated through occupational complexity and educational attainment, which determine individuals' access to job opportunities and their ability to adapt to evolving labor market demands. In this study, occupational codes were assigned according to the 2000 Dictionary of Occupational Titles (DOT) classification system. The classification of work complexity is based on a defined set of skills essential for each occupation, representing the degree of difficulty in managing data, interpersonal interactions, and physical objects. This scoring system allows for the quantification of job task complexity, where lower scores correspond to higher levels of complexity.

Health care access and quality is assessed using multiple indicators, including the number of hospital beds, the crude death rate, the number of health workers, and the percentage of government expenditure on health relative to GDP. Additionally, life expectancy and access to healthcare services are crucial determinants of the overall health status of a population. In this study, access to healthcare was assessed using a scale adapted from the Demographic and Health Survey (DHS) project, which identifies multiple barriers that individuals face when seeking medical services. The scale encompasses three key dimensions: cultural barriers, resource-related barriers, and physical accessibility constraints. Higher scores on this scale indicate greater difficulties in accessing healthcare services. The healthcare access scale derived from the DHS accounts for these factors by incorporating self-reported survey responses that measure the extent to which individuals perceive these barriers in their healthcare-seeking journey. This approach aligns with previous research that has validated similar multi-dimensional frameworks for assessing healthcare accessibility (Penchansky & Thomas, 1981; Ensor & Cooper, 2004).

Perceived environmental impact is evaluated through various environmental and social indicators. The concentration of environmental contaminants such as PM10, Nitrogen Oxide, Ozone, and PM2.5 is measured to assess air quality and pollution levels. Additionally, crime rate and perceived environmental impact further contribute to understanding how environmental and social conditions affect individuals' quality of life and sense of security. Other than that, distance to essential services is an important factor in determining accessibility to fundamental needs. This component is measured by the distance from home to the market, public transportation, the nearest school, and the nearest hospital. The ease of access to these services significantly impacts individuals' daily lives, particularly in terms of time and financial costs associated with transportation.

Emotional and social connectedness is assessed through loneliness as an indicator of emotional connectedness, reflecting individuals' sense of belonging and emotional support within their communities. This variable is measured by the UCLA Loneliness Scale (ULS) is a widely used self-report measure designed to assess subjective feelings of loneliness and social isolation. It was originally developed by Russell, Peplau, and Ferguson (1978) and has undergone multiple revisions to improve its psychometric properties. Respondents rate items on a 4-point Likert scale ranging from "Never" to "Often", with higher scores indicating greater loneliness. The scale's validity and reliability have been extensively examined across different populations. Studies have confirmed that the this scale demonstrates strong internal consistency, with Cronbach's alpha values typically ranging from 0.89 to 0.94, suggesting excellent reliability (Russell, 1996; Lasgaard, 2007).

Social support is measured directly through the availability of social support networks, which play a vital role in fostering mental and emotional well-being. In this sense, F-SozU K-6 is utilized as it is a brief assessment tool designed to measure perceived social support across various cultural contexts and populations. It was initially validated through research involving participants from the United States, Germany, Russia, and China, demonstrating strong psychometric properties, including high reliability and a unidimensional structure. This scale consists of six items that assess individuals' general perception of social support from multiple sources, such as family, friends, neighbors, and significant others, capturing emotional, instrumental, and social integration aspects of support. Due to its efficiency and comprehensive nature, the scale is well-suited for large-scale surveys, offering a reliable and concise method for evaluating perceived social support (Lin et al., 2018). Each item is rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Lastly, social acceptance is determined by the absence of discrimination, which influences social cohesion and inclusivity within a society. Discrimination was measured using validated self-report scales assessing perceived unfair treatment across various life domains. The framework follows Williams et al. (1997), which examines racial disparities in health linked to socioeconomic status, stress, and discrimination. Respondents rated the frequency and severity of discrimination in daily interactions. To ensure validity and reliability, Krieger et al. (2005) developed a self-report measure distinguishing major life events (e.g., job denial) from everyday discrimination (e.g., disrespect), showing high reliability ($\alpha = 0.75\text{--}0.86$) and predictive validity in health research. Taylor et al. (2004) validated the Detroit Area Study Discrimination Scale (DASDS) in older African

Americans, confirming strong reliability ($\alpha = 0.88$) and links to psychological stress. This study integrates these measures, capturing both acute and chronic discrimination experiences using Likert-scale responses ranging from “Never” to “Often”.

3.3 Research Design

3.3.1 Population and Samples

This study will be conducted by implementing primary quantitative approach to achieve the research objectives. Besides, the data will be obtained through the questionnaire that developed based on the conceptual framework of this study. According to Department of Statistics Malaysia (2022b), the population of the Malaysia in 2022 fourth quarter was approximately 33 million, where the population is divided in 57.8% of Malay, 22.7% of Chinese, 12.2% of Bumiputera, 6.6% of Indian and 0.7% belongs to others. To reach the target respondents, the sampling method used in this research is through non-probability sampling. To be specific, the quota sampling is utilised to reach the required sample sizes needed before the data analysis and reach the representativeness of the population in Malaysia. Cochran (1977) developed a formula to calculate the minimum number of samples required in research. Nevertheless, there are few elements that should be emphasized on. Firstly, the margin of error and the level of significance (α). In this case, the probability to select the sample is set at 0.5. With these two elements, the result is computable. In short, approximately 384 respondents are needed in this research. The formula of Cochran’s sample size is as follow:

$$n = p(1 - p) \left(\frac{Z}{e} \right)^2 \quad \text{Equation 3.1}$$

Where,

n is the number of sample size,

p is the proportion that belongs to the specific category,

Z is the level of significance, and

e stands for the required margin of error.

$$n = 0.5(1 - 0.5) \left(\frac{1.96}{0.05} \right)^2$$

$$n \approx 384$$

3.3.2 Research Instrument

To accomplish the data collection effectively towards the success of this research, the questionnaire will be constructed to get required information that related to economic vulnerability and community resilience with health. In this questionnaire, it will be divided into 10 sections. With the assistance of the questionnaire, the collected data will be utilised to compute the vulnerability and resilience indexed as drafted by the conceptual framework in previous section. Additionally, the different point of Likert scales will be included in the questionnaire, allowing the respondents to choose the option according to their context among different level of scales. In this research, 4-point, 5-point, and 7-point Likert scales are prepared in the questionnaire, referring to the validated instruments and its scoring rules.

3.3.3 Pilot Testing

Prior to the actual data collection and data, a pilot testing will be conducted as a preliminary step to identify the potential issues to be resolved. A pilot testing requires a small number of samples which with a minimal need of time and cost to be executed. The results from the

pilot testing enables the researcher to investigate the feasibility in terms of the variables and any other amendments towards a comprehensive questionnaire design to achieve the research objectives of the study. Tailored to the present study, a pilot survey ($n \approx 30$) was collected to assess clarity, timing, and psychometrics of multi-item scales (CD-RISC-10; FESS; UCLA Loneliness; F-SozU K-6; discrimination measures). We will compute Cronbach's α for each multi-item construct (acceptable greater than 0.70). Cognitive debriefing will be used to resolve wording or cultural issues (including BM – EN translation checks). Where $\alpha < 0.70$, rewording or dropping items were considered, documenting all changes. Pilot reliability tables will be reported in below (by construct and subscale).

Table 3.3: Reliability Test of Pilot Results ($n = 30$)

Components	Cronbach's Alpha	Number of Items
Social Sensitivity	0.98	15
Economic Sensitivity	0.97	15
Environment Sensitivity	0.97	6
Health Threat Sensitivity	0.99	6
Food Security	0.93	9
Resilience	0.96	10
Economic Strain	0.94	13
Social Acceptance	0.94	9
Perceived Environmental Impact	0.95	10
Health Care Access	0.89	7
Social Support	0.88	6
Social Connectedness	0.86	4
Emotional Connectedness	0.77	2

A pilot survey ($n = 30$) was administered to assess item clarity, timing, and internal consistency of all multi-item constructs. For each scale we computed Cronbach's alpha (α) and screened corrected item–total correlations and inter-item correlations to identify weak or redundant items. Following standard criteria, reliability was judged acceptable at $\alpha \geq 0.70$, good at $\alpha \geq 0.80$, and excellent at $\alpha \geq 0.90$; very high $\alpha \geq (\approx .95 - 1.00)$ was

flagged for potential item redundancy. Table 3.3 reports the pilot coefficients. All constructs met or exceeded the acceptable threshold ($\alpha \geq 0.70$). Eleven of thirteen scales showed good – excellent reliability ($\alpha = 0.86 - 0.99$). The highest coefficients were for Health Threat Sensitivity ($\alpha = 0.99$), Social Sensitivity ($\alpha = 0.98$), Economic Sensitivity ($\alpha = 0.97$), Environment Sensitivity ($\alpha = 0.97$) and Resilience ($\alpha = 0.96$), indicating very strong internal consistency. Food Security ($\alpha = 0.93$), Economic Strain ($\alpha = 0.94$), Social Acceptance ($\alpha = 0.94$), Perceived Environmental Impact ($\alpha = 0.95$), Health Care Access ($\alpha = 0.89$), Social Support ($\alpha = 0.88$) and Social Connectedness ($\alpha = 0.86$) also performed well. Emotional Connectedness ($\alpha = 0.77$) met the acceptable threshold for a brief scale.

3.3.4 Data Collection Procedure

First and foremost, the constructed questionnaire will undergo pilot testing to check for the potential issues. To collect at least 384 respondents, the questionnaire will be disseminated to the potential respondents in Malaysia through online and offline. In addition, the questionnaires in English version will be translated into Malay version, allowing the participants to choose their preference language to answer the survey. Then, the respondents will firstly be asked their permission before they answer the survey. After that, if the respondents could not understand or need clarification on certain questions, a brief explanation will be given. The surveys returned will be checked to ensure the answers given by the respondents are filled rationally without any missing response. If these cases happened, the particular surveys will be omitted from being analysed.

3.4 Data Analysis

3.4.1 Descriptive Analysis

Descriptive statistical analysis is a procedure to describe the data for a better understanding to the reader. This procedure is an initial step for directing the next analysis. It gives reader a thought of the circulation of the data. Other than that, the description helps to eliminate the outlier before the statistical analysis. This procedure further empowered to distinguish relationship among factors for the direction of further measurable examinations. To accomplish the descriptive analysis, a frequency analysis is conducted. The numbering of data enables the researcher to see the trend and compare among the variables. An effective frequency analysis could help to target the relevant objects for policy implementation. The analyses are in tabulation, numbering and figuration which are in graphical investigation.

3.4.2 Factor Analysis

Next, factor analysis is a procedure that is utilized to lessen a big number of variables into a lesser quantity of variables. This method extricates most extreme basic change from all factors and places them into a typical score. The index generated from this test enables a further analysis later. This technique is crucial as it additionally accepts a few suppositions. In this case, the assumptions are there is direct relationship, without multicollinearity issue, it incorporates significant factors into investigation, and there is genuine connection among factors constantly. A few techniques are accessible, yet head segment examination is utilized most ordinarily.

3.4.3 Analysis of Variance (ANOVA)

Analysis of Variance (ANOVA) is a statistical technique used to compare means across multiple groups to determine whether significant differences exist (Fisher, 1925). It is particularly valuable in both experimental and observational studies where researchers seek to examine how categorical independent variables influence a continuous dependent variable. ANOVA relies on several key assumptions, including normality (data should be normally distributed), homogeneity of variances (variability should be similar across groups), and independence of observations (Montgomery, 2019). At its core, ANOVA works by partitioning the total variance in the data into two components: within-group variance (differences within each group) and between-group variance (differences among group means). The test statistic, known as the F-statistic, is calculated as the ratio of these variances. A significant F-test suggests that at least one group mean differs from the others (Kirk, 2012). If this occurs, researchers often use post hoc tests such as Tukey's Honest Significant Difference (HSD) or Bonferroni correction to pinpoint specific group differences (Field, 2018). ANOVA has several extensions to accommodate different research designs. One-way ANOVA is used when there is a single independent variable, while two-way ANOVA allows for the analysis of two independent variables simultaneously. In cases where the same subjects are measured multiple times, repeated measures ANOVA is employed (Tabachnick & Fidell, 2019). This statistical method is widely utilized across various fields, including social sciences, medicine, and business analytics, offering a powerful framework for hypothesis testing and data-driven decision-making in empirical research.

3.4.4 Multiple Regression Analysis

Multiple regression analysis is an advanced statistical technique used to examine the relationship between a dependent variable and multiple independent variables. It extends simple linear regression by incorporating multiple predictors, allowing researchers to assess the combined and individual effects of independent variables on the outcome variable (Montgomery et al., 2021). This method is widely applied in various disciplines, including economics, social sciences, healthcare, and engineering, to develop predictive models and test hypotheses. For MRA to produce reliable results, several fundamental assumptions must be met. These include linearity, which assumes a straight-line relationship between independent and dependent variables, and independence of residuals, meaning that errors should not be correlated. Additionally, homoscedasticity, or constant variance of residuals, and normality of residuals are necessary conditions (Kutner et al., 2005). A key issue in MRA is multicollinearity, where independent variables exhibit strong correlations with one another, leading to unstable and unreliable coefficient estimates.

The significance of individual predictors in MRA is tested using t-tests, while the overall model fit is evaluated using R-squared (R^2) and Adjusted R-squared. The R^2 value represents the proportion of variance in the dependent variable explained by the independent variables. However, since adding more predictors artificially inflates R^2 , researchers use Adjusted R^2 , which accounts for the number of predictors in the model (Fox, 2016). A significant F-test indicates that at least one independent variable has a meaningful impact on the dependent variable. Model diagnostics are critical to ensuring the validity of MRA. Residual analysis is performed to check for nonlinearity, heteroscedasticity, and violations of normality assumptions. Scatterplots of residuals against predicted values, normal

probability plots, help detect potential issues (Hair et al., 2018). Addressing these concerns ensures that the model produces reliable and interpretable results.

3.5 Index Computation Procedure

In each domain to assess the degree of vulnerability, the present study will deal with various data sets of varying dimensions, and each component is made up of several dimensions. Additionally, each dimension is measured using different measurement scale and units, depending on the nature of the indicators. Realising this issue, the present study applies data standardization by using minimum-maximum approach. The equations below indicate the procedure to normalize or standardize the indicators. Equations 3.2 and 3.3 are employed with positive and negative variables respectively.

$$Index_{S_w} = \frac{S_w - S_{min}}{S_{max} - S_{min}} \quad \text{Equation 3.2}$$

$$Index_{SW} = 1 - \frac{S_w - S_{min}}{S_{max} - S_{min}} \quad \text{Equation 3.3}$$

where,

S_w stands for data of a variable in average for a ward,

S_{min} stands for the minimum value of the data, and

S_{max} stands for the maximum value of the data.

To calculate the indexes, the bottom-up approach will be used to examine the aggregation of different indicators into sub-dimensions, sub-dimensions into dimensions, and dimensions into the overall index, using both arithmetic mean and geometric mean approaches. The arithmetic mean is calculated by adding the group of numbers and then

dividing the total by the number of counts in the series. The geometric mean is an average that reveals the centre tendency of a group of numbers by multiplying their values together. The following is the equation that shows how the general mean is defined:

$$\mu_{\alpha}(x) = \begin{cases} \left(\frac{(x_1)^{\alpha} + (x_2)^{\alpha} + \dots + (x_n)^{\alpha}}{n} \right)^{1/\alpha} & \alpha \neq 0 \\ (x_1 \times x_2 \times \dots \times x_n)^{1/\alpha} & \alpha = 0 \end{cases} \quad \text{Equation 3.4}$$

According to Equation 3.4, when the α equals to 1, the mean calculated is known as the arithmetic mean because the calculation is performed by doing a simple average, be known as the sum of all the components of the distribution divided by the total number of elements in the distribution. In contrast, the geometric mean is a situation where it takes the n^{th} root of the product of components and $\alpha \neq 0$. In short, geometric mean could be calculated by multiplies the data and find the n^{th} root of the values. The total RHI and EVI are calculated on a 0-to-1 scale, with 0 indicating the least susceptibility and 1 indicating the most vulnerability in Malaysia. Since this index computation pools also the data from secondary sources, the 3-year-average and 5-year-average of the data are considered into the index computation. This is to ensure the robustness of the two indexes computed. Nevertheless, the indexes are also computed solely depending on the cross-sectional data collected from the survey to observe the economic vulnerability and health resilience from the aspect of individuals, serving as a comparison to the other two version of indexes computed.

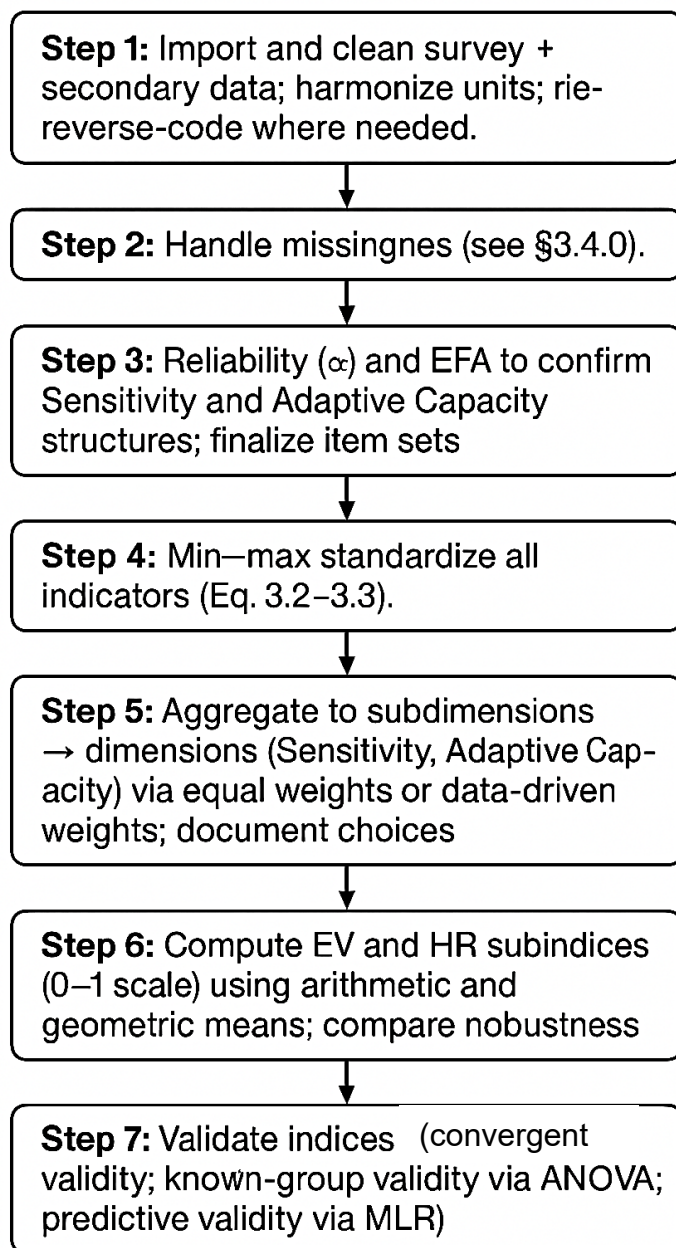


Figure 3.2: Flow Chart of Index Computation Procedure

3.6 Statement of Hypothesis

The statement of hypothesis for this study are as follows:

H₁: There is a significant difference in economic vulnerability across different household income levels.

H₂: There is a significant difference in health resilience across different household income levels.

H₃: Economic sensitivity has a significant relationship with health resilience.

H₄: Environmental sensitivity has a significant relationship with health resilience.

H₅: Health Threat sensitivity has a significant relationship with health resilience.

H₆: Social sensitivity has a significant relationship with health resilience.

H₇: Economic status has a significant relationship with health resilience.

H₈: Food security has a significant relationship with health resilience.

H₉: Psychological adaptive capacity has a significant relationship with health resilience.

3.7 Ethical Considerations

This study rigorously adheres to ethical principles governing research involving human participants, ensuring full compliance with both national and institutional regulations. Prior to commencing the study, ethical approval was obtained from the Human Research Ethics Committee (Non-Medical) at Universiti Malaysia Sarawak (UNIMAS) [Number of Ethics Approval: HREC(NM)/2023 (2)/24] as attached in Appendix, affirming the research's commitment to ethical integrity and the safeguarding of participants' rights and welfare. The approval letter is included in Appendix. All data collected throughout the study will be handled with the highest level of confidentiality and securely stored to prevent unauthorized access. Participants will receive comprehensive information regarding the study's

objectives, methodology, potential risks, and benefits through a thorough informed consent process. Furthermore, the study upholds ethical standards by preventing coercion or undue influence to maintain the integrity of the research.

3.8 Chapter Remarks

In short, the contents of this chapter mostly focused on the research methodology utilised in the present study to assess the interplay between economic vulnerability and health resilience in Malaysia. In this case, questionnaire will be used to obtain the required components of vulnerability and resilience aspects before the data analysis. Using the formula from Cochran (1977), the sample size calculated is set to be 384 respondents. In addition, to affirm the dataset of this study, a pilot testing will first be carried out during the data collection. Accordingly, the respondents will firstly be obtained the consents to participate in this research voluntarily. After the data is collected, the data will be analysed through descriptive analysis, factor analysis, reliability test, ANOVA and also regression analysis. To see the relationship between the vulnerability and resilience, two indexes will be computed through equal weighting scheme and weighted scheme based on the approaches of arithmetic and geometric means. The findings will be further presented and interpreted in the next chapter.

CHAPTER 4

EMPIRICAL RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the analysis and findings of the study to achieve the objective of this research, specifically to assess the interplay between economic vulnerability and health resilience in Malaysia. The findings are derived from data collected from 388 respondents in Sarawak, offering valuable insights into the demographic background of the participants and the factors influencing their economic and health resilience. The chapter begins by outlining the demographic characteristics of the respondents, providing a foundational understanding of the sample population. To properly measure the economic vulnerability and health resilience, this study firstly examines the key indicators contributing to economic vulnerability and health resilience. Next, it discusses the selection of indicators used to assess economic vulnerability and health resilience, followed by a detailed explanation of how the economic vulnerability index and the health resilience index are computed. Subsequently, the data analysis delves into disparities in health resilience and economic vulnerability across different income levels. Finally, it assesses the relationship between sensitivity, adaptive capacity, and health resilience, aiming to offer a comprehensive understanding on the interaction of the factors. The results presented in this chapter serve as the foundation for the discussions and interpretations in the subsequent sections.

4.2 Demographic Background of the Respondents

Understanding the demographic background of a sample provides valuable insights into its composition and diversity. This section explores key demographic variables, including gender, ethnicity, religion, marital status, educational level, employment status, and household income range. By analyzing these factors, we can identify patterns and trends that shape social and economic dynamics. The data will be presented through a combination of charts for visual representation and a summary table for a concise overview. This comprehensive analysis aims to offer a clearer understanding of the demographic characteristics of the given population.

Table 4.1: Summary of Demographic Background of the Respondents

	Frequency	Percent (%)
Gender		
Male	179	46.13
Female	209	53.86
Ethnicity		
Malay	156	40.21
Chinese	104	26.80
Sarawak Indigenous	128	32.99
Religious Belief		
Islam	166	42.78
Christian	151	38.92
Buddhist	64	16.49
Freethinker	7	1.80
Educational Level		
Pre-school education or no formal education	1	0.26
Primary education	4	1.03
Lower secondary education	39	10.05
Upper secondary education	87	22.42
Post-secondary education / pre-university studies	72	18.56
Diploma education	62	15.98
Advanced diploma	14	3.61
First degree	79	20.36
Master's degree	30	7.73
Marital Status		
Single / Never married	197	50.77
Married	179	46.13
Divorced	2	0.52
Widowed	6	1.55
Separated	4	1.03
Employment Status		
Government employee	91	23.45
Private sector (Full-time)	180	46.39
Private sector (Part-time)	20	5.15
Employer	21	5.41
Own account worker	22	5.67
Intern, trainee, or apprentice	3	0.77
Gig worker	12	3.09
Unpaid family worker	1	0.26
Temporary Unemployed	4	1.03
Housewife	13	3.35
Government pensioner	4	1.03
Private pensioner	4	1.03
Student	13	3.35

Table 4.1 continued

Income Group		
Less than RM2,000	20	5.15
RM2,001 – RM3,500	28	7.22
RM3,501 – RM4,850	43	11.08
RM4,851 – RM6,000	76	19.59
RM6,001 – RM8,000	73	18.81
RM8,001 – RM10,960	60	15.46
RM10,961 – RM15,000	50	12.89
RM15,001 – RM20,000	30	7.73
More than RM20,000	8	2.06

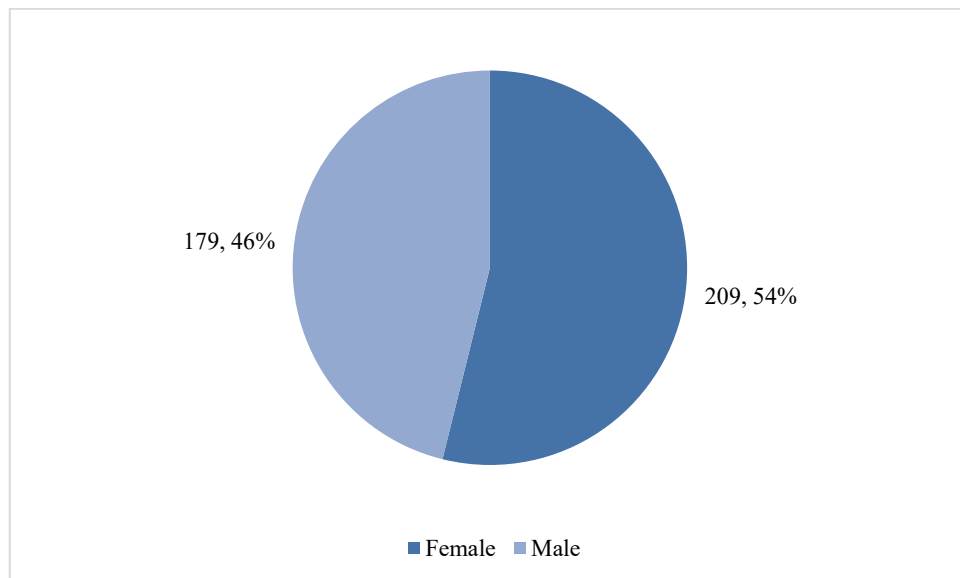


Figure 4.1: Gender Distribution of the Respondents

Source: Author's Own Computation.

From Figure 4.1, it illustrates the gender distribution of a given population, showing that there are 209 females (54%) and 179 males (46%). This indicates that females form the majority, exceeding males by 30 individuals. The relatively balanced distribution suggests a near-equal representation of both genders, with only an 8% difference.

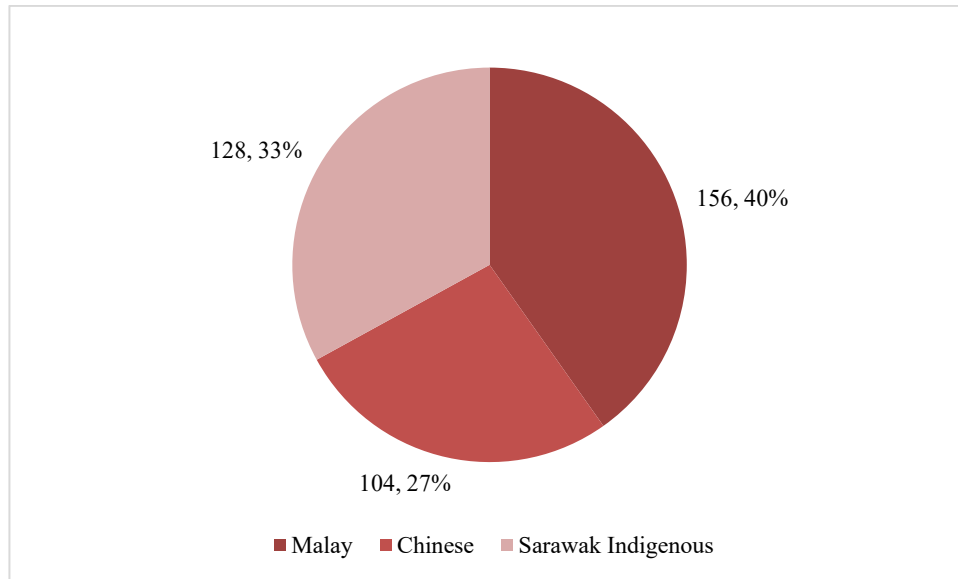


Figure 4.2: Ethnicity Distribution of the Respondents

Source: Author's Own Computation.

Figure 4.2 illustrates the ethnic composition of a given population, showing that Malays make up the largest group with 156 respondents (40%), followed by Sarawak Indigenous people at 128 respondents (33%), and Chinese at 104 respondents (27%). This distribution suggests that while the population is diverse, Malays form the majority, with Sarawak Indigenous and Chinese communities also significantly represented.

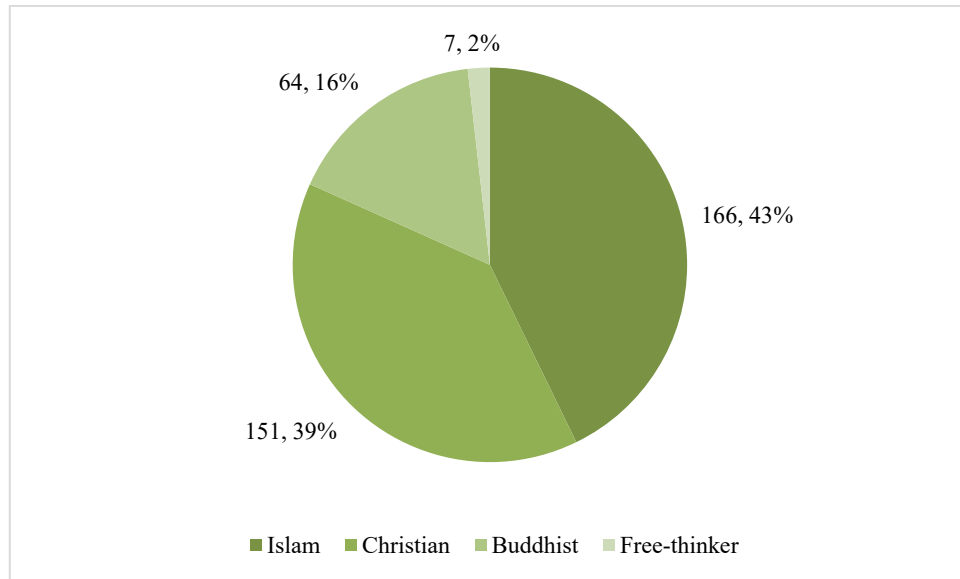


Figure 4.3: Religion Distribution of the Respondents

Source: Author's Own Computation.

Next, the pie chart in Figure 4.3 presents the distribution of religious affiliations among the respondents. The largest group is Islam, comprising 43% (166 respondents), followed closely by Christians at 39% (151 respondents). Buddhists account for 16% (64 respondents), while free-thinkers make up the smallest segment at only 2% (7 respondents). This analysis indicates that Islam and Christianity dominate the religious landscape in this population, with Buddhism representing a smaller yet notable portion. The low percentage of free-thinkers suggests that secular or non-religious individuals are a minority within this demographic.

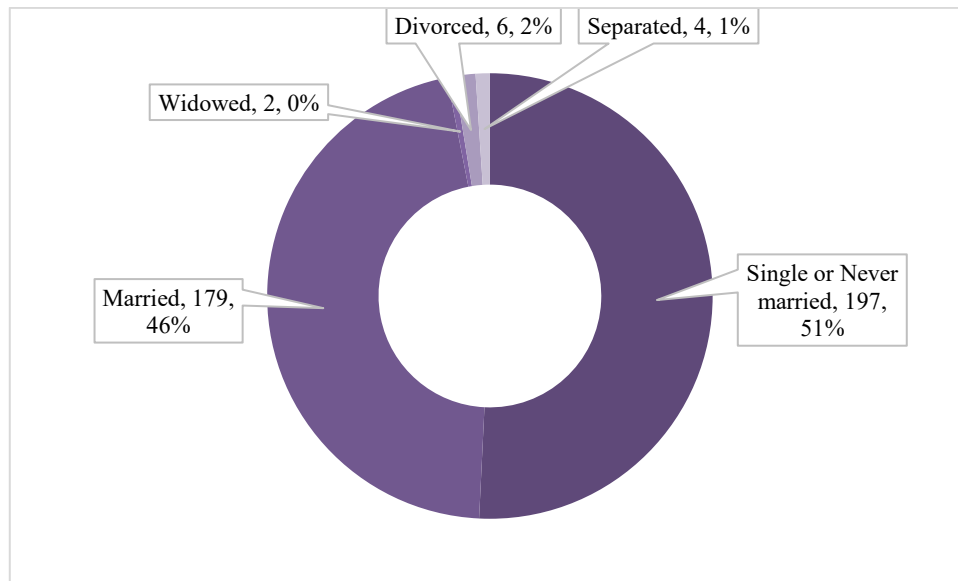


Figure 4.4: Marital Status Distribution of the Respondents

Source: Author's Own Computation.

The distribution by marital status of the respondents is then be represented by the donut chart in Figure 4.4. From the chart, the majority of individuals are either single or have never been married, making up 51% (197 respondents). Married individuals form the second largest group, comprising 46% (179 respondents). The remaining categories, which include divorced (6 respondents, 2%), separated (4 respondents, 1%), and widowed (2 respondents, 0%), represent a very small fraction of the population. This suggests that marriage is prevalent within the group, but there is still a significant portion of individuals who remain single or never marry. The minimal percentages of widowed, divorced, and separated individuals indicate that long-term relationships may be relatively stable.

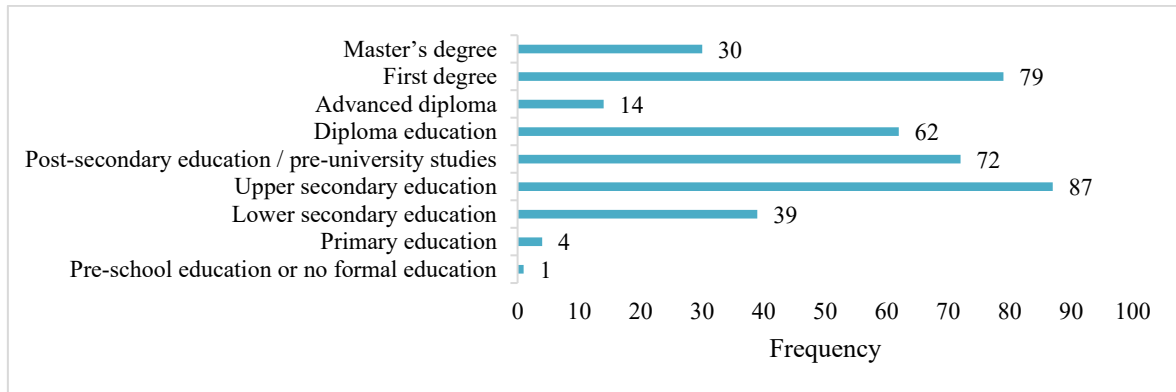


Figure 4.5: Educational Attainment Distribution of the Respondents

Source: Author's Own Computation.

In terms of highest education level achieved, it is then summarized in Figure 4.5. The horizontal bar chart (or Figure 4.5) displays the distribution of educational attainment within a given population. The highest proportion of individuals have completed upper secondary education or its equivalent, totaling 87 individuals. This is followed closely by those with a first degree or equivalent (79 respondents) and post-secondary or pre-university education (72 respondents). Diploma education also has a significant representation with 62 individuals. Lower secondary education accounts for 39 respondents, while a smaller number have attained an advanced diploma (14 respondents) or a master's degree (30 respondents). The lowest levels of education include primary education (4 respondents) and pre-school or no formal education (1 respondent). This suggests that the majority of individuals have at least a secondary or post-secondary level of education, with a relatively smaller proportion reaching higher academic qualifications such as master's degrees.

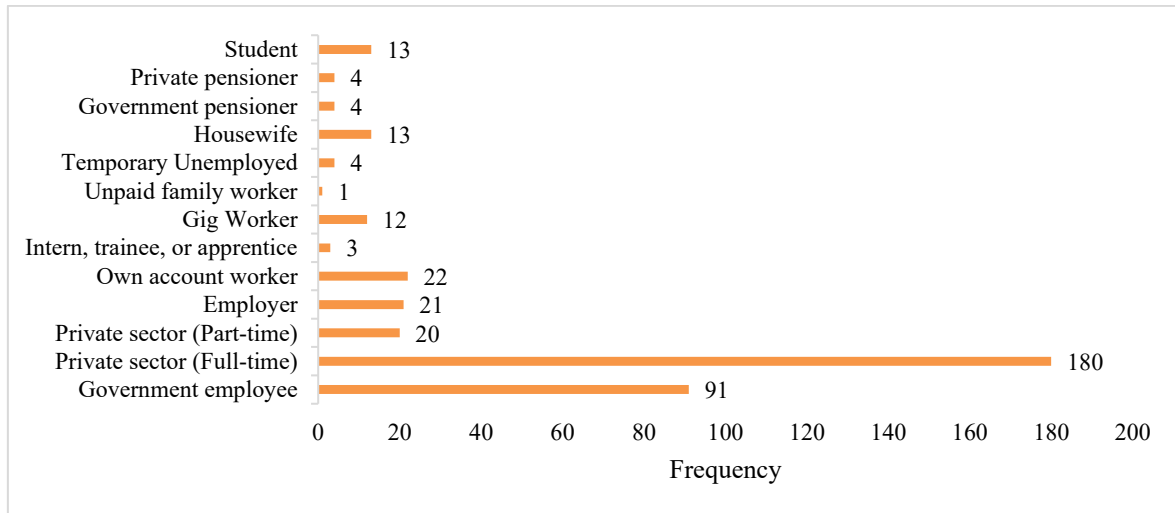


Figure 4.6: Employment Status Distribution of the Respondents

Source: Author's Own Computation.

Meanwhile, the majority are employed in the private sector on a full-time basis, totaling 180 individuals, followed by government employees, accounting for 91 respondents. Other notable employment categories include own-account workers (22 respondents), employers (21 respondents), and part-time private sector employees (20 respondents). A smaller proportion of respondents are engaged in gig work (12 respondents), internships or apprenticeships (3 respondents), and unpaid family work (1 respondent). Additionally, there are 13 students and 13 housewives, while retirees (both private and government pensioners) and temporarily unemployed individuals each make up 4 respondents. The findings indicate that most respondents are employed in formal sectors, with a considerable presence in self-employment and informal employment.

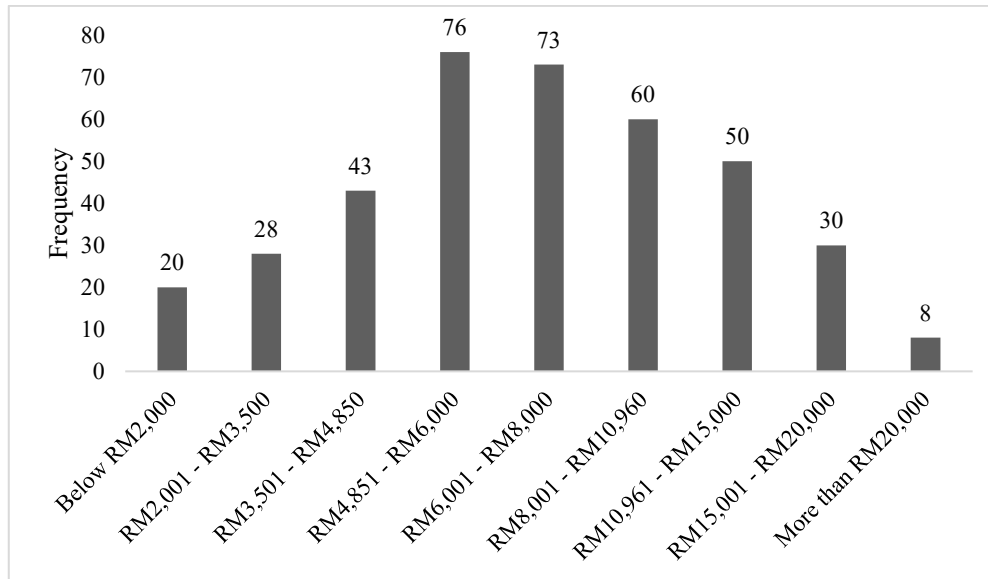


Figure 4.7: Household Income Distribution of the Respondents

Source: Author's Own Computation.

As visualised by Figure 4.7, it illustrates that the household income distribution of the respondents. The majority of households fall within the RM6,001 – RM8,000 income range, with 76 respondents, followed closely by the RM8,001 – RM10,960 range, which accounts for 73 respondents. Other significant income groups include RM10,961 – RM15,000 (60 respondents) and RM15,001 – RM20,000 (50 respondents). Lower income groups, such as those earning below RM2,000 (20 respondents) and RM2,001 – RM3,500 (28 respondents), have relatively fewer respondents. The highest income category, those earning more than RM20,000, comprises only 8 respondents, indicating that high-income earners are a minority. The distribution suggests that most respondents belong to the middle-income bracket, with fewer individuals in the lower and upper-income ranges.

4.3 Indicators Selection for Economic Vulnerability and Health Resilience Indexes

Before computing the economic vulnerability and health resilience indexes, the indicator selection is firstly conducted to ensure that the components could accurately reflect the indexes. To achieve this, factor analysis is performed to regroup and reduce the number of items, ensuring they effectively represent the index components for Malaysia, even when referencing past studies. The results of the factor analysis indicate that the dataset is highly suitable for such an analysis, as evidenced by the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy, which yields a value of 0.95. This value falls within the excellent range, signifying a strong degree of shared variance among the variables and confirming that the dataset is appropriate for factor extraction. Furthermore, Bartlett's Test of Sphericity produces a statistically significant Chi-Square value of 28,005.36 with a p -value of 0.00, thereby rejecting the null hypothesis that the correlation matrix is an identity matrix. This finding establishes that there is sufficient correlation between variables, which supports the suitability of factor analysis as an appropriate statistical technique for this dataset.

In detail, the total variance explained reveals that the first few factors account for a substantial proportion of the variance in the dataset. Specifically, the first factor alone explains 38.69% of the total variance, while the second factor contributes an additional 13.06%, resulting in a cumulative variance of 51.75% explained by these two factors. As additional factors are considered, the cumulative variance increases, with the ninth factor bringing the total explained variance to 70.84%. This suggests that a relatively small number of factors encapsulate a significant portion of the variation in the data, which is an ideal outcome in factor analysis. Moreover, after rotation, the variance is more evenly distributed across the factors, enhancing the interpretability of the results. The rotation sums of squared

loadings indicate that the explained variance is well-balanced among the factors, ensuring that no single factor disproportionately dominates the structure of the dataset.

Table 4.2: Factor Analysis for Economic Vulnerability Indicators Selection

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.95
Approx. Chi-Square	28,005.36
Bartlett's Test of Sphericity	df
	2,211.00
<i>p</i> -value	<i>p</i> < 0.000

Rotated Factor Matrix							
Economic Vulnerability Indicators	Components						
	Social Sensitivity	Economic Sensitivity	Food Security	Resilience	Environment Sensitivity	Health Threat Sensitivity	Economic Status
S_EdS3	0.80						
S_EdS4	0.78						
S_SSS2	0.78						
S_EdS1	0.77						
S_SSS3	0.76						
S_SSS4	0.76						
S_EdS5	0.75						
S_SSS6	0.74						
S_SSS1	0.73						
S_SSS5	0.73						
S_EdS2	0.70						
S_SPF5	0.59						
S_SPF1	0.54						
S_SPF4	0.53						
S_SPF3	0.53						
S_SPF2	0.51						
S_ES2		0.78					
S_ES3		0.76					
S_ES4		0.76					
S_EC5		0.76					
S_ES1		0.76					
S_EC4		0.75					
S_ES5		0.75					

Table 4.2 continued

S_EC1		0.74					
S_EC3		0.74					
S_EC2		0.72					
S_MF1		0.68					
S_MF3		0.66					
S_MF4		0.64					
S_MF5		0.62					
S_MF2		0.59					
FS5			0.89				
FS4			0.88				
FS7			0.87				
FS3			0.86				
FS6			0.83				
FS8			0.82				
FS9			0.81				
FS2			0.81				
FS1			0.70				
R6				0.84			
R5				0.82			
R8				0.80			
R9				0.80			
R4				0.79			
R7				0.78			
R1				0.74			
R3				0.73			
R10				0.71			
R2				0.66			
S_ND4					0.80		
S_ND3					0.77		
S_ND5					0.75		
S_ND6					0.74		
S_ND2					0.73		
S_ND1					0.62		
S_HC2						0.61	
S_HC1						0.58	
S_HC3						0.58	
S_HC4						0.57	
S_HC5						0.57	
S_HC6						0.55	
ALA							0.65
AS							0.64
APA							0.61

The rotated factor matrix, obtained using the Varimax rotation method, provides insight into the strength of the associations between individual variables and the extracted factors. Factor loadings greater than 0.50 are generally considered to be meaningful, as they indicate a strong relationship between the variable and the respective factor. The majority of the variables in the dataset exhibit high loadings on a single factor, thereby supporting the validity of the factor solution. However, some variables display weaker loadings, suggesting that they do not strongly correspond to any one factor. These relatively low values indicate that these variables may not fit well within the extracted factor structure, implying that they either contribute to multiple factors or do not align sufficiently with any single factor.

Upon interpreting the extracted factors, several distinct themes emerge. The first factor appears to represent social sensitivity, encompassing variables related to educational and social aspects that influence individual and community well-being. The second factor, economic sensitivity, captures financial dimensions, including income stability, financial security, and savings. The third factor, food security, comprises variables related to access to and stability of food resources, highlighting the importance of nutrition and sustenance in economic resilience. The fourth factor, resilience, pertains to the capacity of individuals and communities to withstand economic and social adversities. Meanwhile, the fifth factor, environmental sensitivity, reflects concerns about environmental factors and their impact on overall well-being. The sixth factor, health threat sensitivity, encompasses variables associated with vulnerability to health risks, emphasizing the role of health security in economic and social stability. Finally, the seventh factor, economic status, encapsulates aspects of financial independence and resource availability, further reinforcing the significance of economic well-being.

In overall, the results of this factor analysis suggest a well-defined and interpretable structure that successfully identifies key dimensions underlying the dataset. The extracted factors provide meaningful insights into the relationships among the variables, allowing for a comprehensive understanding of the interconnections between social, economic, and environmental factors. However, the presence of variables with weak loadings suggests that some elements may require refinement or reconsideration to enhance the clarity and precision of the factor structure in future studies.

Table 4.3: Factor Analysis for Health Resilience Indicators Selection

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.89
Approx. Chi-Square	17,947.55
Bartlett's Test of Sphericity	df
	2,145.00
<i>p</i> -value	<i>p</i> < 0.000

Rotated Factor Matrix									
Health Resilience Indicators	Components								
	Economic Strain	Social Acceptance	Perceived Environmental Impact	Health Care Access	Social Support	Social Connectedness	Distance to Essential Services	Education and Occupational Complexity	Emotional Connectedness
ES9	0.80								
ES10	0.79								
ES8	0.79								
ES11	0.78								
ES7	0.77								
ES3	0.77								
ES12	0.76								
ES2	0.76								
ES6	0.73								
ES1	0.72								

Table 4.3 continued

ES4	0.71								
ES5	0.69								
SD6		0.88							
SD4		0.87							
SD8		0.87							
SD3		0.86							
SD9		0.86							
SD5		0.86							
SD2		0.84							
SD1		0.82							
SD7		0.80							
ENV4			0.85						
ENV7			0.83						
ENV9			0.83						
ENV5			0.82						
ENV6			0.81						
ENV3			0.80						
ENV10			0.78						
ENV8			0.76						
ENV1			0.76						
ENV2			0.74						
HCA2				0.84					
HCA1				0.83					
HCA3				0.82					
HCA4				0.82					
HCA5				0.75					
HCA8				0.69					
HCA6				0.52					
SS4					0.78				
SS2					0.75				
SS3					0.74				
SS5					0.74				
SS1					0.73				
SS6					0.72				
L5						0.77			
L3						0.76			
L2						0.71			
L4						0.60			
DM							0.75		
DPH							0.72		
DPMT							0.53		
DS							0.51		
OC								0.64	

Table 4.3 continued

Edu								0.60	
L1									0.62
L6									0.60

The results of the factor analysis indicate that the dataset is well-suited for this statistical technique. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy, which is a measure of the proportion of variance among variables that might be common variance, yields a value of 0.89. This value is considered good, suggesting that the dataset contains a sufficient level of interrelated variables to justify factor analysis. Furthermore, Bartlett's Test of Sphericity produces a test statistic of 17,947.55, with a *p*-value of 0.00. This result confirms that the correlation matrix is significantly different from an identity matrix, meaning that there are significant correlations among the variables. Consequently, the results support the appropriateness of conducting factor analysis on this dataset.

An analysis of the total variance explained reveals that the first few factors account for a substantial proportion of variance in the dataset. The first factor alone explains 16.47% of the variance, while the second factor adds 11.55%, leading to a cumulative variance of 28.02% explained by the first two factors. As additional factors are included, the cumulative variance increases, reaching 58.68% with the inclusion of the ninth factor. This suggests that these nine factors sufficiently account for a majority of the variance within the dataset, allowing for a meaningful interpretation of the underlying structure. The rotation sums of squared loadings further indicate a more balanced distribution of variance among the extracted factors, ensuring that no single factor overwhelmingly dominates the model and that the factors remain interpretable.

The rotated factor matrix provides crucial insights into how the variables are associated with specific factors. A factor loading above 0.50 is generally considered to be significant, as it suggests that the variable is meaningfully associated with a given factor. The first factor, which can be interpreted as economic strain, includes strong loadings from variables. These variables are likely indicative of financial difficulties, income constraints, or economic hardships faced by individuals. The second factor, social acceptance, captures dimensions of societal inclusion. This factor may reflect levels of discrimination or perceived social belonging.

The third factor perceived environmental impact indicates that individuals' perceptions of environmental conditions significantly shape their experiences. The fourth factor, health care access suggest that this factor captures the accessibility and availability of healthcare facilities. The fifth factor, social support highlights the presence of emotional and practical support from family and community networks. Further analysis reveals that the sixth factor, social connectedness suggests that this factor represents the extent to which individuals feel connected to others in their community. The seventh factor, Distance to Essential Services incorporates variables measuring proximity to key services. This factor reflects the impact of location and infrastructure on individuals' daily lives. The eighth factor, education and occupational complexity signifies a relationship between educational attainment and the complexity of one's professional role. Lastly, the ninth factor, emotional connectedness suggests an emphasis on emotional bonds and feelings of attachment.

The results of this factor analysis demonstrate a well-defined structure, as seen in the high factor loadings and the relatively even distribution of variance across the factors. The

cumulative variance explained by the model, approximately 59%, is reasonable, though some unexplained variance remains. The application of the Varimax rotation ensures that factors are more clearly distinguishable from one another, which enhances their interpretability. Although the factor structure is robust, future research may consider refining or reassessing certain variables to further improve the clarity and precision of the analysis. Ultimately, the findings provide valuable insights into the multidimensional nature of economic, social, and environmental influences within the dataset.

4.4 Computation of Economic Vulnerability Index

After performing the exploratory factor analysis (EFA), a total of 67 items were grouped into seven components in the initial stage of the analysis. These components were subsequently reviewed and verified by aligning them with established theoretical frameworks and consulting a panel of experts in economic and social resilience. Following this process, this study refined the classification of economic vulnerability indicators into seven distinct components, which are social sensitivity, economic sensitivity, food security, resilience, environmental sensitivity, health threat sensitivity, and economic status. The computation of the three versions of economic vulnerability indexes were conducted using both the arithmetic mean and geometric mean methods. The findings revealed that the values derived from the arithmetic mean approach were consistently higher than those obtained through the geometric mean method. This difference arises from the distinct ways in which each method processes data. The arithmetic mean calculates the average by summing all individual item scores and dividing by the total number of respondents, making it sensitive to extreme values. In contrast, the geometric mean does not rely on summation but instead determines the central tendency by multiplying all individual scores and then distributing

them proportionally while maintaining the overall product. Because of this, the geometric mean inherently assigns greater influence to smaller values and is less susceptible to distortion caused by outliers in skewed datasets (Clark-Carter, 2005). Conversely, the arithmetic mean tends to be disproportionately affected by extreme values and may not accurately represent proportional changes, especially when dealing with ratios and percentages.

Table 4.4: Economic Vulnerability Index Incorporating 3-year Average External Factor

Economic Vulnerability Index (Incorporating 3-year average external factor)			
Arithmetic mean approach		Geometric mean approach	
Component	Score	Component	Score
Exposure	0.534	Exposure	0.433
External Sensitivity	0.539	External Sensitivity	0.524
Economic Sensitivity	0.444	Economic Sensitivity	0.444
Environmental Sensitivity	0.415	Environmental Sensitivity	0.415
Health Threat Sensitivity	0.466	Health Threat Sensitivity	0.466
Social Sensitivity	0.435	Social Sensitivity	0.435
Asset Deficiency	0.629	Asset Deficiency	0.633
Food Insecurity	0.188	Food Insecurity	0.189
Lack of Resilience	0.375	Lack of Resilience	0.376
Overall Economic Vulnerability	0.447	Overall Economic Vulnerability	0.417

The economic vulnerability index, as presented in Table 4.4, incorporates a three-year average of external factors and is analyzed using both the arithmetic mean and geometric mean approaches. These methods provide different perspectives on economic vulnerability by weighing component scores in distinct ways. Under the arithmetic mean approach, the EVI is computed by taking a simple average of all component scores, which assigns equal weight to each factor. Based on this method, exposure has a score of 0.534, indicating a moderate-to-high level of vulnerability due to external factors. Likewise,

external sensitivity is slightly higher at 0.539, suggesting that economic conditions are moderately susceptible to external shocks.

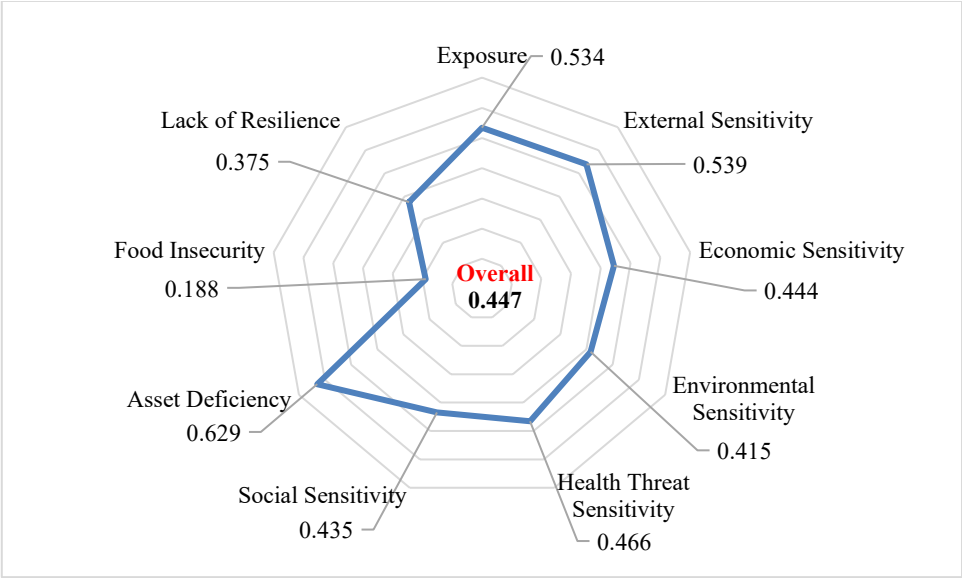


Figure 4.8: Economic Vulnerability Index Incorporating 3-year Average External Factor using Arithmetic Mean

Among all components, asset deficiency registers the highest vulnerability score of 0.629, highlighting significant deficiencies in capital, infrastructure, or financial resources. Conversely, food insecurity exhibits the lowest score at 0.188, implying that it has minimal contribution to economic vulnerability. Other contributing factors, such as economic sensitivity (0.444), environmental sensitivity (0.415), health threat sensitivity (0.466), and social sensitivity (0.435), add to the overall vulnerability but are not as dominant as asset deficiency. Ultimately, the overall economic vulnerability index using this method stands at 0.447, reflecting a moderate level of economic vulnerability.

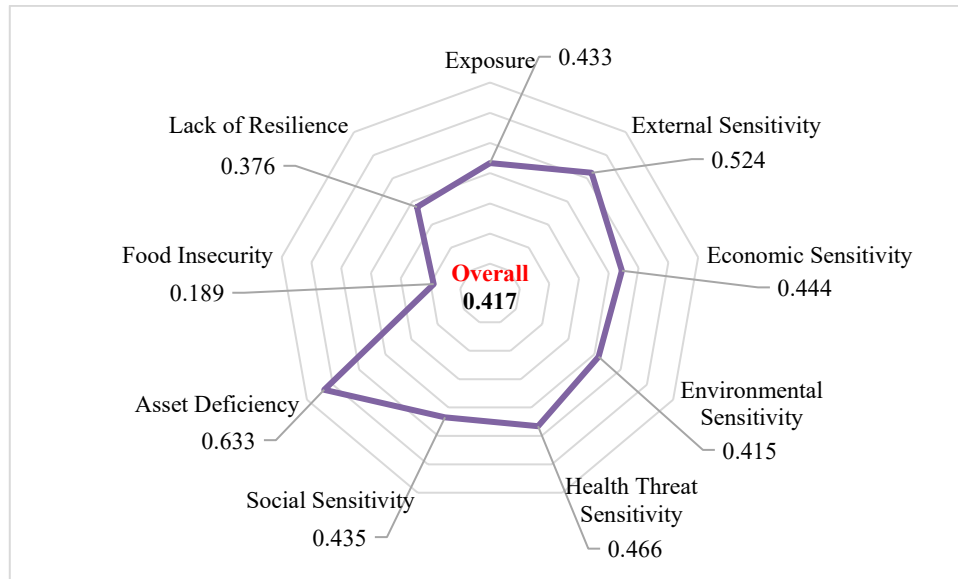


Figure 4.9: Economic Vulnerability Index Incorporating 3-year Average External Factor using Geometric Mean

Taken together, the dominance of asset deficiency (0.629) and the moderate overall EVI (0.447; geometric mean: 0.417) suggest that vulnerability in the sample is rooted less in acute scarcity of essentials and more in structural capital and infrastructure constraints. In the Malaysian context, such constraints align with long-standing urban–rural disparities and uneven capital deepening. For Sarawak specifically, the findings cohere with your earlier account of multicultural, community-anchored resilience practices, which often buffer shocks but do not by themselves close infrastructure and capital gaps. This socio-institutional backdrop helps explain why food insecurity is low (0.188) while asset deficiency remains the binding constraint.

Table 4.5: Economic Vulnerability Index Incorporating 5-year Average External Factor

Economic Vulnerability Index (Incorporating 5-year average external factor)			
Arithmetic mean approach		Geometric mean approach	
Component	Score	Component	Score
Exposure	0.456	Exposure	0.451
External Sensitivity	0.538	External Sensitivity	0.536
Economic Sensitivity	0.444	Economic Sensitivity	0.444
Environmental Sensitivity	0.415	Environmental Sensitivity	0.415
Health Threat Sensitivity	0.466	Health Threat Sensitivity	0.466
Social Sensitivity	0.435	Social Sensitivity	0.435
Asset Deficiency	0.629	Asset Deficiency	0.633
Food Insecurity	0.188	Food Insecurity	0.189
Lack of Resilience	0.375	Lack of Resilience	0.376
Overall Economic Vulnerability	0.439	Overall Economic Vulnerability	0.420

Compared to the three-year average EVI, the exposure score has declined from 0.534 to 0.456 under the arithmetic mean approach, while external sensitivity remains relatively stable at 0.538 (a slight decrease from 0.539). The lower exposure score suggests that longer-term external factors might provide more stability in economic conditions, reducing the overall vulnerability arising from exposure-related shocks. However, external sensitivity continues to indicate a high level of economic dependency on external conditions. As a result, the overall economic vulnerability index slightly decreases to 0.439, compared to 0.447 in the three-year average EVI.

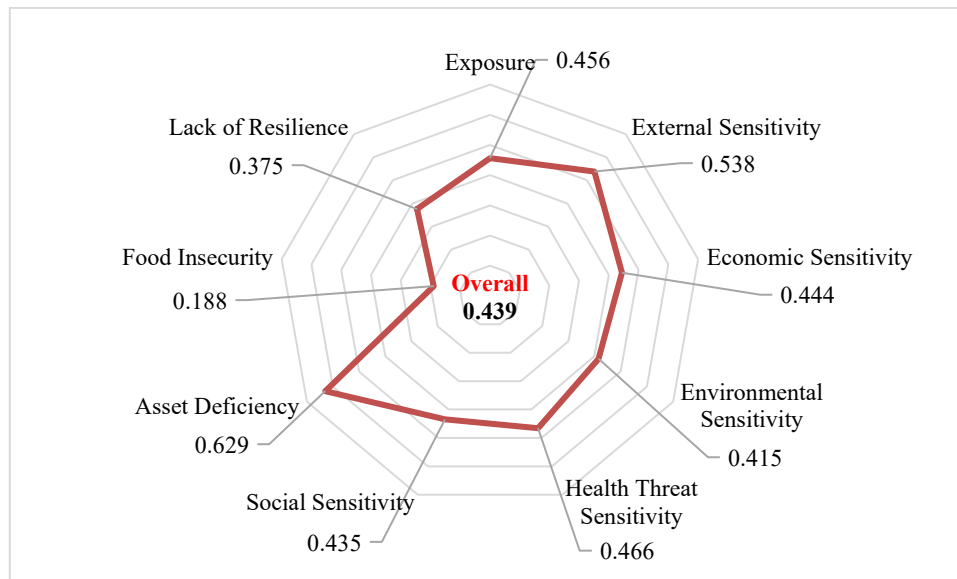


Figure 4.10: Economic Vulnerability Index Incorporating 5-year Average External Factor using Arithmetic Mean

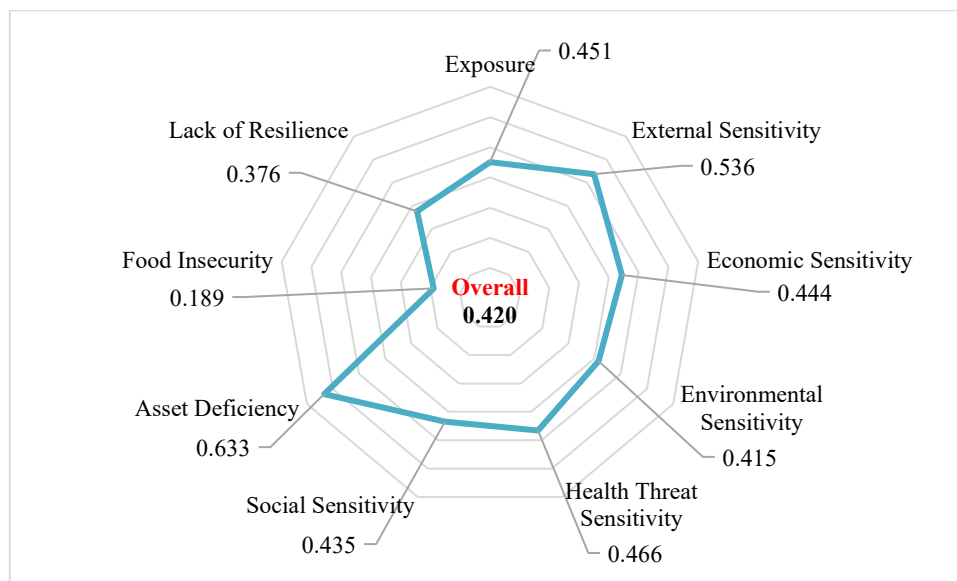


Figure 4.11: Economic Vulnerability Index Incorporating 5-year Average External Factor using Geometric Mean

Similarly, under the geometric mean approach, the exposure score also decreases to 0.451, reinforcing the trend of a more moderated impact of long-term external factors.

Meanwhile, external sensitivity remains high at 0.536, slightly higher than the three-year average (0.524). Due to these changes, the overall economic vulnerability score in the geometric mean approach also inclines slightly to 0.420, compared to 0.417 in the three-year analysis. The increase in vulnerability is primarily attributed to higher external sensitivity values, which indicate that extending the period of analysis leads to a more balanced representation of economic risk. However, asset deficiency remains the dominant contributor to economic vulnerability, and food insecurity remains the least concerning factor, reinforcing the earlier findings. In short, incorporating a five-year average of external factors leads to a slight decrease in overall economic vulnerability under both methods.

Table 4.6: Economic Vulnerability Index Focused on Individual Level

Economic Vulnerability Index (Focused on individual level)			
Arithmetic mean approach		Geometric mean approach	
Component	Score	Component	Score
Economic Sensitivity	0.444	Economic Sensitivity	0.444
Environmental Sensitivity	0.415	Environmental Sensitivity	0.415
Health Threat Sensitivity	0.466	Health Threat Sensitivity	0.466
Social Sensitivity	0.435	Social Sensitivity	0.435
Asset Deficiency	0.629	Asset Deficiency	0.633
Food Insecurity	0.188	Food Insecurity	0.189
Lack of Resilience	0.375	Lack of Resilience	0.376
Overall Economic Vulnerability	0.422	Overall Economic Vulnerability	0.401

The economic vulnerability index is also assessed by focusing solely on individual-level vulnerabilities, thereby excluding external factors such as exposure and external sensitivity from this version of computation. This approach allows for a more precise evaluation of how intrinsic factors contribute to economic vulnerability, independent of external economic shocks, aiming to observe the economic vulnerability from different

perspective. Similar to previous indices, both the arithmetic mean approach and the geometric mean approach are used.

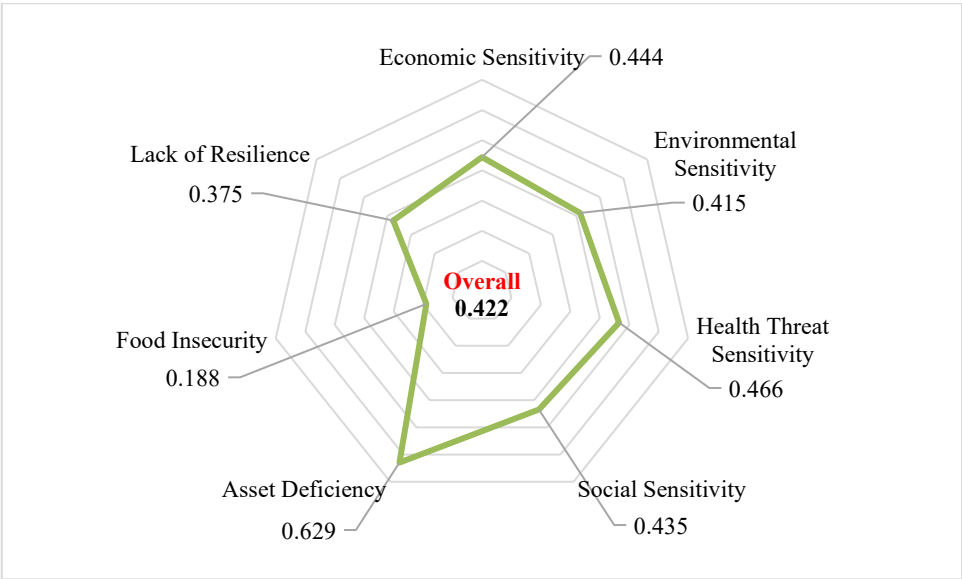


Figure 4.12: Economic Vulnerability Index Focused on Individual Level using Arithmetic Mean

The exclusion of external factors results in a notable decrease in the overall vulnerability index. Under the arithmetic mean approach, the EVI falls from 0.439 (five-year external factor analysis) to 0.422, signifying that external influences play a substantial role in increasing economic vulnerability. Despite this reduction, asset deficiency remains the most critical component (0.629), while food insecurity remains the least impactful factor (0.188). The elimination of exposure and external sensitivity means that economic vulnerability is now primarily driven by internal factors such as sensitivity to economic conditions, social aspects, and health threats.

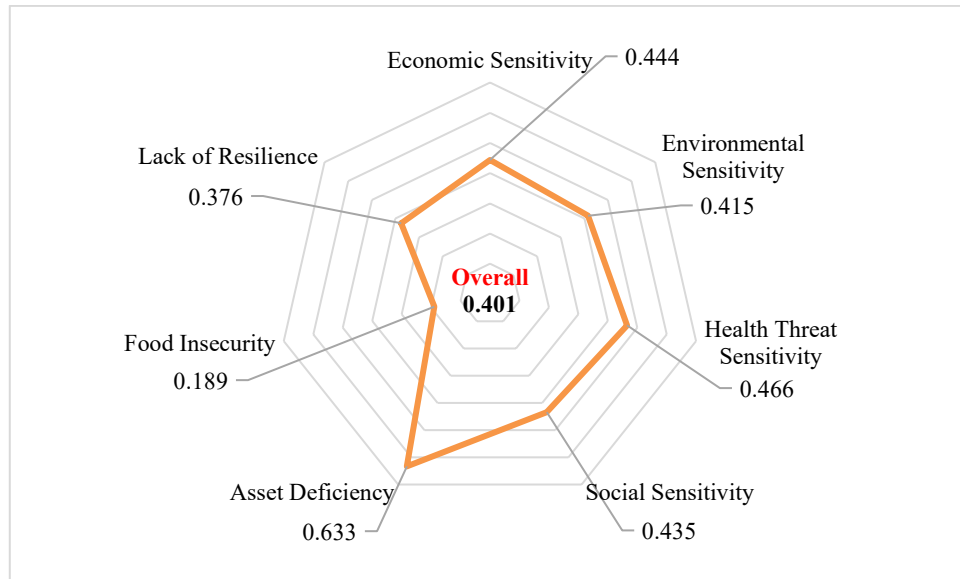


Figure 4.13: Economic Vulnerability Index Focused on Individual Level using Geometric Mean

Similarly, under the geometric mean approach, the EVI further decreases from 0.420 to 0.401, reinforcing the dampening effect of excluding external factors. This suggests that without external economic influences, individual vulnerabilities alone contribute less to economic instability than when combined with external exposure. While the overall vulnerability is lower, the pattern among individual components remains unchanged, with asset deficiency remaining the most concerning factor and food insecurity the least significant. Because external exposures are sizeable in open, trade-oriented economies such as Malaysia, the reduction in EVI once these are removed is informative. It isolates intrinsic (household/community) drivers, chiefly asset deficiency and social/health sensitivities, as the core vulnerability substrate. This interpretation is consistent with an institutional setting where macro shocks amplify but do not originate the vulnerability observed in the sample.

4.5 Discussion on the Economic Vulnerability Index

Following the interpretation of these three indexes, it is crucial to delve deeper into their implications. First, economic exposure refers to the extent to which an economy is vulnerable to external shocks, including fluctuations in global trade, financial markets, and commodity prices. The observation that the three-year average exposure is higher than the five-year average suggests that Malaysia's economic vulnerability has intensified in recent years. This growing susceptibility makes the economy more sensitive to external disruptions such as trade slowdowns, global recessions, and supply chain disturbances (Puah et al., 2020). More importantly, this trend highlights Malaysia's increasing reliance on external economic conditions, thereby amplifying its exposure to market volatility. On a global scale, economic exposure is often seen in open economies that depend heavily on exports and imports. Similarly, Hamdan (2017) notes that Malaysia has long struggled with economic exposure due to its dependence on exports, particularly in key commodities like palm oil, petroleum, and rubber. Historically, Malaysia's economic downturns have coincided with global recessions, such as the 1997 Asian Financial Crisis and the 2008 Global Financial Crisis. More recently, supply chain disruptions caused by the COVID-19 pandemic and geopolitical tensions have further impacted the country's trade performance (Tedong et al., 2022). These developments emphasize the need to enhance economic resilience to better withstand external shocks.

Beyond economic exposure, external sensitivity is another critical factor in assessing an economy's reliance on essential services, demographic composition, and ability to absorb economic shocks. The increasing trend in external sensitivity over the past three years suggests that Malaysia's economy is becoming more dependent on external factors. As noted

by Isia et al. (2023), external exposure can influence various national aspects, such as healthcare access, education quality, and social infrastructure. This trend also reflects demographic shifts, including an aging population and high dependency ratios, which heighten economic vulnerability. Globally, economies with high external sensitivity often face challenges such as large dependent populations and inadequate public services (Wills-Karp, 2024). Likewise, many developing nations struggle with external sensitivity due to limited healthcare access, underdeveloped educational facilities, and persistent social inequalities (Abdullah, 2016). While Malaysia has made significant progress in improving public services, challenges remain in ensuring equal access to quality healthcare and education. Furthermore, the country's large proportion of elderly and young dependents places additional financial pressure on the working-age population. To address external sensitivity, strategic investments in healthcare, education, and social services are essential, as suggested by Daud et al. (2019).

Economic sensitivity, from an individual perspective, reflects how people perceive their financial security in response to economic conditions, market trends, and employment stability. Malaysia's economic sensitivity index score of 0.444 indicates a moderate level of public concern regarding economic fluctuations. This perception is shaped by various factors, including job security, cost of living, and exposure to external economic risks. Economic sensitivity is often associated with financial literacy and savings behavior, with individuals who possess greater financial knowledge typically demonstrating more resilience to economic uncertainty (Jamal et al., 2015). Those working in volatile industries, such as the gig economy, contract-based employment, and small business ownership, tend to experience heightened economic sensitivity due to income instability. The expansion of

digital platforms and freelance work has further contributed to this trend, as workers in these sectors often lack social protections such as fixed salaries, unemployment benefits, or retirement plans (Fong et al., 2015). Additionally, urban households may feel more financially vulnerable due to higher living costs, housing expenses, and debt obligations, even if their employment remains relatively stable. This is further supported by a study from Ramli (2024), which found that lower-income households in Malaysia tend to experience higher levels of financial vulnerability due to limited access to formal savings mechanisms and social safety nets.

Environmental sensitivity, in the context of individual perception, refers to how people assess the impact of environmental changes on their daily lives, well-being, and economic stability. The environmental sensitivity index score of 0.415 suggests that individuals in the region perceive environmental risks as less pressing compared to economic and social concerns. Several factors could contribute to this perception, including lower exposure to severe pollution, limited direct experiences with environmental disasters, and confidence in ongoing conservation efforts (Chin et al., 2017). In this context, individuals who have minimal direct interaction with nature may perceive environmental risks as a secondary concern, even if issues like air pollution or waste management exist (Lo et al., 2015). Since they do not experience the immediate and tangible effects of environmental degradation firsthand, such concerns may seem less urgent compared to pressing issues like economic stability, job security, or healthcare. However, this does not imply that Malaysians are indifferent to environmental issues. Instead, it suggests that their level of sensitivity remains moderate.

Health threat sensitivity is another key dimension of economic vulnerability, measuring the extent to which a population perceives itself as susceptible to health crises. The relatively high score of 0.466 indicates a moderate level of concern regarding health threats. At a global level, economies with high health threat sensitivity often face underdeveloped healthcare systems, a high prevalence of diseases, or limited access to medical facilities. In rapidly developing regions, urban healthcare centers typically benefit from well-equipped hospitals and a higher concentration of medical specialists, whereas rural areas often struggle with shortages of medical facilities and professionals. In many remote areas, heightened sensitivity to health threats is largely driven by the unequal distribution of healthcare services and the prevalence of infectious diseases. In Sarawak, this concern is primarily justified by disparities in healthcare access and the persistence of infectious diseases (Hamdan et al., 2015).

Social sensitivity is a crucial measure of how individuals perceive societal factors as contributors to economic vulnerability. The score of 0.435 indicates a moderate level of social vulnerability, emphasizing the role of social disparities in economic instability. Societies with high social sensitivity often experience significant income inequality, weak social safety nets, and governance challenges. Individuals highly sensitive to social issues may feel financially insecure due to perceived systemic barriers that limit economic opportunities. Furthermore, those who struggle to access essential services, such as healthcare, financial assistance, and job training, are likely to feel more vulnerable during economic downturns, as they lack sufficient safety nets to cushion financial hardships. In Sarawak, social sensitivity is shaped by income disparities, uneven access to quality education, and socio-economic gaps between indigenous and urban populations (Santosa et

al., 2024). Ultimately, heightened social sensitivity can amplify financial insecurity, influencing economic behaviors and long-term stability.

Asset deficiency is another critical factor of economic vulnerability, assessing the extent to which individuals and households lack access to financial, physical, and human capital, thereby increasing their susceptibility to economic shocks. Sarawak's high score of 0.629 suggests that a significant portion of the population faces economic insecurity due to limited asset ownership. According to Idris and Majid (2023), asset poverty is a major driver of economic vulnerability, making financial recovery particularly challenging for affected households. In Malaysia, asset deficiency varies across states and demographic groups. Research by Santosa et al. (2024) found that many households lack savings, have minimal access to formal financial institutions, and primarily rely on subsistence agriculture. This limited access to financial assets and resources exacerbates economic vulnerability. Individuals experiencing asset deficiency often struggle to build wealth or leverage assets for economic growth, ultimately placing them in a more precarious financial position.

Food insecurity, which encompasses food availability, accessibility, and affordability, represents another dimension of economic vulnerability. Sarawak's relatively low score of 0.188 suggests that food security is not a significant economic concern, likely due to the presence of local agricultural production and food assistance programs. Ken (2024) highlights that countries facing severe food shortages often experience widespread malnutrition and humanitarian crises. Fortunately, Malaysia's strong food security performance, as reflected in its high index value, indicates stability in this area. The country benefits from a robust agricultural sector and government intervention programs that

enhance food security. As noted by Esa et al. (2023), Malaysia has consistently invested in key sectors that support food stability, improving its overall food security ranking. Additionally, government measures such as price controls on essential goods and food subsidies have further ensured food accessibility. However, localized food insecurity remains a challenge for low-income households, where high transportation costs and supply limitations drive up food prices. These issues should remain a priority for policymakers to ensure equitable food distribution.

Lastly, resilience in this context refers to the psychological capacity of individuals and communities to adapt to and recover from adverse circumstances, including economic downturns, social disruptions, and environmental crises. Sarawak's resilience score of 0.375 indicates that while vulnerabilities persist, psychological resilience plays a crucial role in mitigating their effects. Individuals with strong psychological resilience tend to engage more actively in education, social support networks, and mental health services, which help them navigate economic challenges (Zailani et al., 2024). In Malaysia, resilience is influenced by cultural values, government support programs, and religious institutions that contribute to social stability. In particular, Sarawak's indigenous communities demonstrate a strong capacity for resilience through communal living, traditional knowledge, and self-sustaining lifestyles (Santosa et al., 2024). These cultural and social structures enable communities to manage economic and environmental challenges more effectively. Despite existing vulnerabilities, the collective strength of these communities plays a significant role in reducing the negative impacts of economic instability and social disruptions.

4.6 Computation of Health Resilience Index

To shape health resilience, the theory of social determinants of health suggested five main factors. However, after conducting the exploratory factor analysis, an initial set of 66 items was analysed, resulting in the identification of nine distinct components that define health resilience. Following this analysis, a total of 56 items were retained after careful review and validation against established theoretical frameworks. Additionally, input from a panel of experts in public health and social resilience was incorporated to ensure the robustness of the factor structure. As a result, this study refined the classification of health resilience indicators into the following nine components: economic strain, social acceptance, perceived environmental impact, health care access, social support, social connectedness, distance to essential services, education and occupational complexity, and emotional connectedness. To further quantify health resilience, three versions of health resilience indices were computed using both the arithmetic mean and geometric mean methods.

Table 4.7: Health Resilience Index Incorporating 3-year Average External Factor

Health Resilience Index (Incorporating 3-year average external factor)			
Arithmetic mean approach		Geometric mean approach	
Component	Score	Component	Score
Economic Strain	0.342	Economic Strain	0.340
Education and Occupational Complexity	0.557	Education and Occupational Complexity	0.556
Health Care Access and Quality	0.603	Health Care Access and Quality	0.553
Perceived Environmental Impact	0.639	Perceived Environmental Impact	0.625
Distance to Essential Services	0.877	Distance to Essential Services	0.877
Emotional Connectedness	0.680	Emotional Connectedness	0.680
Social Connectedness	0.546	Social Connectedness	0.545
Social Support	0.542	Social Support	0.542
Social Acceptance	0.772	Social Acceptance	0.772
Overall Health Resilience	0.617	Overall Health Resilience	0.592

This method indicates an overall health resilience score of 0.617, suggesting above-average resilience when all factors are given equal weight. Among the components, economic strain received the lowest score (0.342), indicating that individuals face significant financial challenges, with lower scores representing greater economic strain. Meanwhile, distance to essential services had the highest score (0.877), indicating excellent proximity to necessary services. Other factors, such as health care access and quality (0.603) and perceived environmental impact (0.639), contribute positively, while social connectedness (0.546) and social support (0.542) reflect moderate resilience.

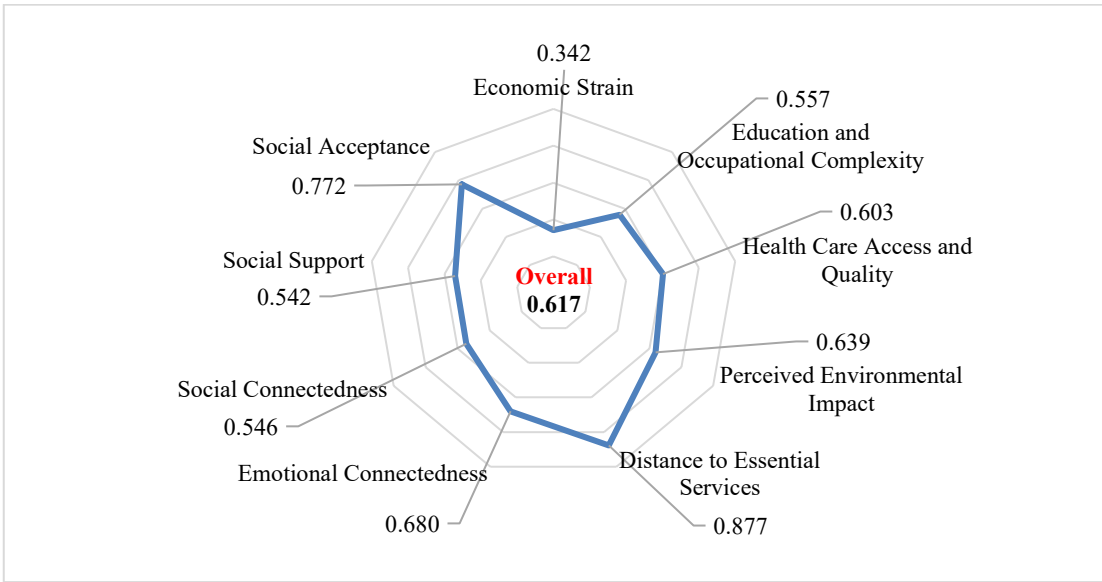


Figure 4.14: Health Resilience Index Incorporating 3-year Average External Factor using Arithmetic Mean

In contrast, the geometric mean, results in a slightly lower overall score of 0.592. This approach provides a more balanced view when there are large variations in individual scores. While most components retain values close to those in the arithmetic mean, some, such as health care access and quality (0.553) and perceived environmental impact (0.625), register slightly lower scores due to the smoothing effect of the geometric mean. However,

key indicators like economic strain (0.340) and distance to essential services (0.877) remain largely unchanged.

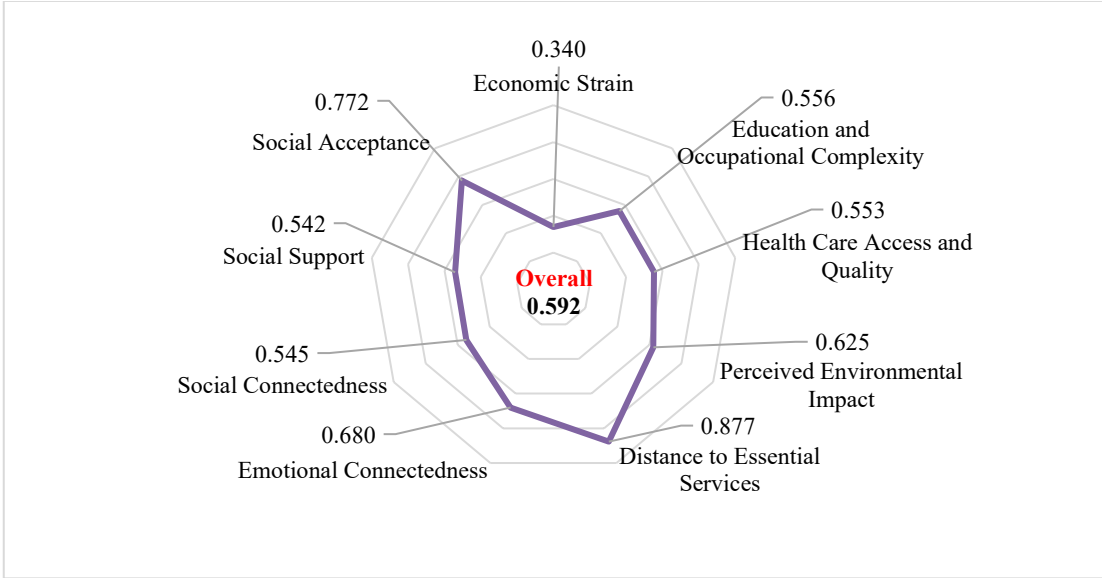


Figure 4.15: Health Resilience Index Incorporating 3-year Average External Factor using Geometric Mean

By comparing both methods, it is evident that the arithmetic mean presents a more optimistic assessment, whereas the geometric mean provides a more conservative estimate, mitigating the impact of extreme values. This distinction is crucial, as the choice of method influences how resilience is interpreted. If policymakers or researchers wish to emphasize the strongest and weakest aspects equally, the arithmetic mean is appropriate. However, if they seek a more tempered and realistic perspective, particularly in the presence of outliers, the geometric mean serves as a more reliable indicator. Ultimately, understanding the implications of each approach allows for a more nuanced interpretation of health resilience and its contributing factors.

Table 4.8: Health Resilience Index Incorporating 5-year Average External Factor

Health Resilience Index (Incorporating 5-year average external factor)			
Arithmetic mean approach		Geometric mean approach	
Component	Score	Component	Score
Economic Strain	0.342	Economic Strain	0.340
Education and Occupational Complexity	0.557	Education and Occupational Complexity	0.556
Health Care Access and Quality	0.597	Health Care Access and Quality	0.593
Perceived Environmental Impact	0.566	Perceived Environmental Impact	0.557
Distance to Essential Services	0.877	Distance to Essential Services	0.877
Emotional Connectedness	0.680	Emotional Connectedness	0.680
Social Connectedness	0.546	Social Connectedness	0.545
Social Support	0.542	Social Support	0.542
Social Acceptance	0.772	Social Acceptance	0.772
Overall Health Resilience	0.609	Overall Health Resilience	0.589

Incorporating a 5-year average perspective, the health resilience index integrates external data for health care access and quality and perceived environmental impact, offering a broader assessment of long-term resilience in the future. When computed using the arithmetic mean, the overall health resilience score slightly declines to 0.609, compared to 0.617 in the 3-year estimate, suggesting that resilience levels may have decreased when considering a longer timeframe. This decline is particularly reflected in the health care access and quality (0.597) and perceived environmental impact (0.566) components, both of which are lower than their 3-year counterparts (0.603 and 0.639, respectively). The drop in perceived environmental impact suggests that individuals perceive environmental conditions as less favourable when examined over a longer period, likely due to the cumulative effect of pollution levels and crime incidence.

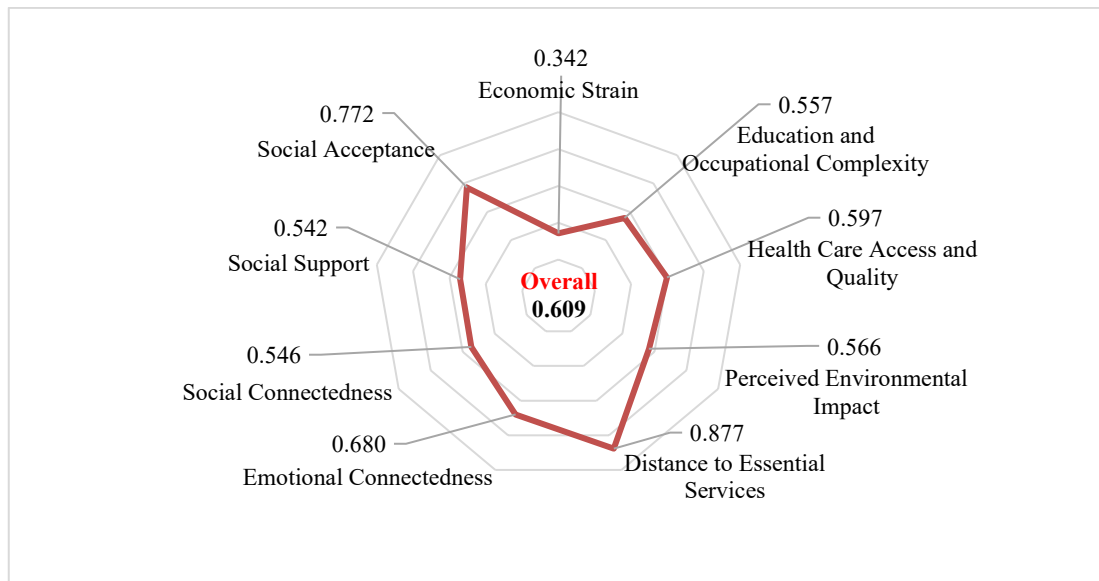


Figure 4.16: Health Resilience Index Incorporating 5-year Average External Factor using Arithmetic Mean

When applying the geometric mean, the overall resilience score further decreases to 0.589, reflecting an even more conservative estimate of resilience. Notably, the health care access and quality (0.593) and perceived environmental impact (0.557) components show additional reductions, reinforcing the notion that these factors have gradually weakened when observed over a longer timeframe. This indicates that while some aspects of resilience, such as accessibility to essential services and community support, remain strong, external stressors, such as healthcare system strain and environmental degradation, have increasingly influenced overall health resilience.

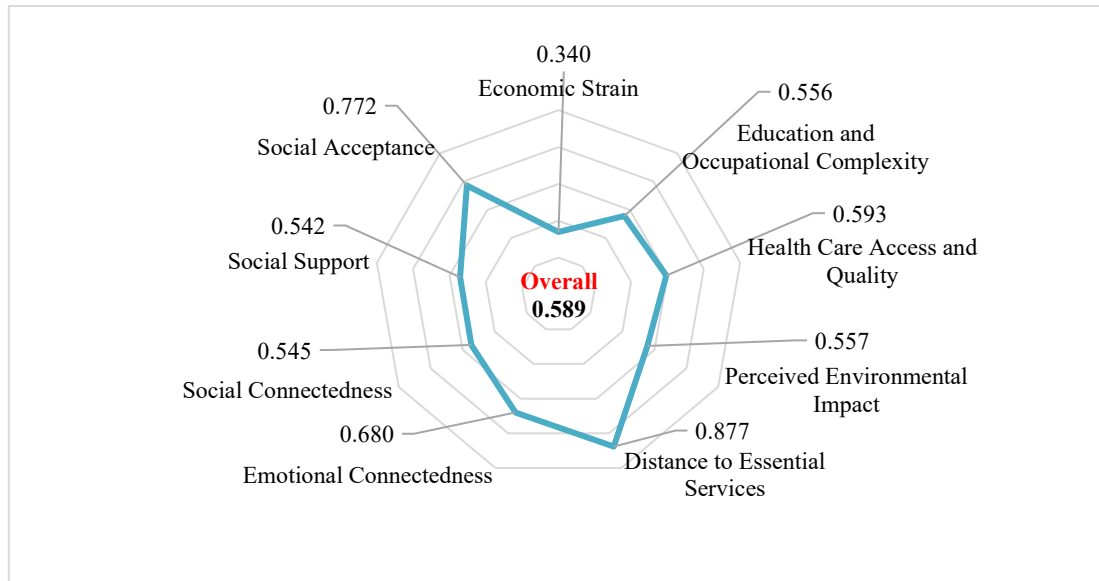


Figure 4.17: Health Resilience Index Incorporating 5-year Average External Factor using Geometric Mean

The comparative analysis between three-year and five-year perspectives underscores the importance of long-term assessments in evaluating resilience. The observed decline in healthcare access and quality, along with the perceived environmental impact, suggests that shorter-term assessments may present an overly optimistic view, whereas longer-term trends reveal underlying and persistent vulnerabilities. These findings emphasize the need for comprehensive and sustained evaluations to capture the full scope of systemic challenges. Without continuous monitoring, policymakers may overlook gradual deteriorations that could compromise overall resilience. Therefore, integrating long-term data into health resilience assessments enables more informed decision-making, allowing for proactive interventions that address structural weaknesses. This underscores the necessity for dynamic policy frameworks that can adapt to emerging threats, ensuring sustainable improvements in healthcare access, environmental management, and overall health resilience.

Table 4.9: Health Resilience Index Focused on Individual Level

Health Resilience Index (Focused on individual level)			
Arithmetic mean approach		Geometric mean approach	
Component	Score	Component	Score
Economic Strain	0.342	Economic Strain	0.340
Education and Occupational Complexity	0.557	Education and Occupational Complexity	0.556
Health Care Access and Quality	0.645	Health Care Access and Quality	0.644
Perceived Environmental Impact	0.581	Perceived Environmental Impact	0.579
Distance to Essential Services	0.877	Distance to Essential Services	0.877
Emotional Connectedness	0.680	Emotional Connectedness	0.680
Social Connectedness	0.546	Social Connectedness	0.545
Social Support	0.542	Social Support	0.542
Social Acceptance	0.772	Social Acceptance	0.772
Overall Health Resilience	0.616	Overall Health Resilience	0.597

Previously, the health resilience of Malaysian is observed by integrating the effect of external factors in term of health care access and environmental indices. This modification allows for an assessment of resilience solely based on socioeconomic and social factors from individual's aspect. Using the arithmetic mean, the overall resilience score stands at 0.616, nearly identical to the original M1 score of 0.617, suggesting that the removed factors had a limited influence on the overall index. However, this does not necessarily imply that healthcare access and environmental conditions are irrelevant; rather, it indicates that the remaining factors, such as economic stability, social cohesion, and proximity to essential services, play a dominant role in shaping health resilience.

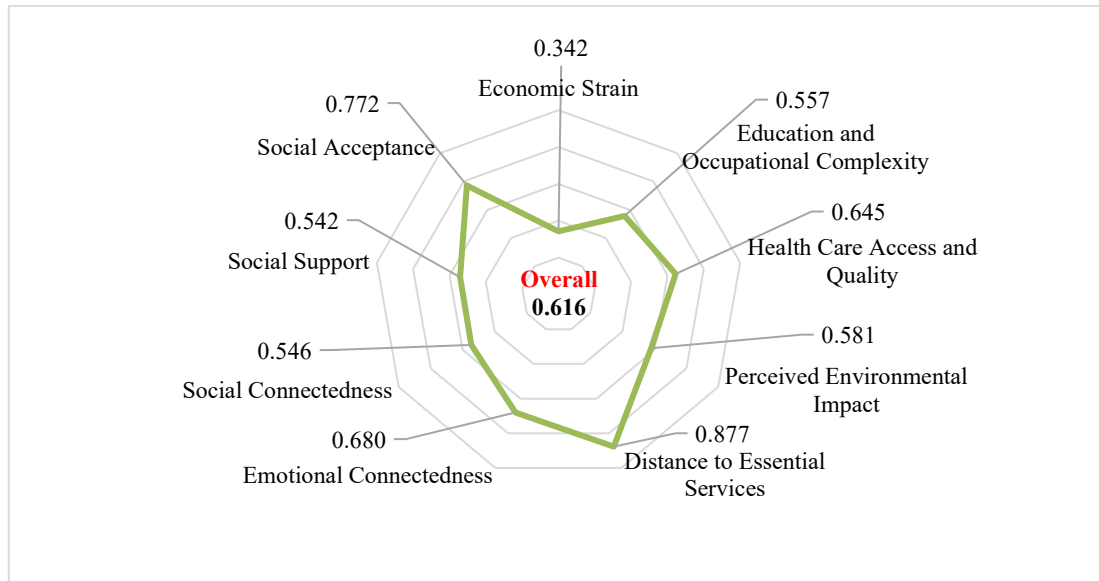


Figure 4.18: Health Resilience Index Focused on Individual Level using Arithmetic Mean

Under the geometric mean, the revised health resilience score is 0.597, mirroring the previous trend where this method provides a slightly lower but more stable estimate. The lack of significant deviation in the overall score further reinforces the notion that while healthcare access and environmental conditions contribute to resilience, their impact may not be as pronounced as other social and economic determinants. Notably, the high score for ‘Distance to Essential Services’ (0.877) indicates good formal proximity to service nodes in the sample, whereas the comparatively lower economic strain underscores persistent affordability frictions. In Malaysia, resilience also derives from social capital, norms of mutual aid, religious organisations, and communal networks, which note for Sarawak’s indigenous communities. These socio-cultural assets plausibly elevate social acceptance and connectedness, complementing formal service proximity in sustaining resilience. Likewise, economic strain (0.342) remains the weakest component, reaffirming that individuals facing economic challenges continue to experience reduced resilience. The key takeaway from this recalculated index is that the overall resilience score remains largely stable despite the

exclusion of external factors from the dimensions of health care access and quality and perceived environmental impact. This suggests that, while these factors are important, they do not singularly determine health resilience levels.

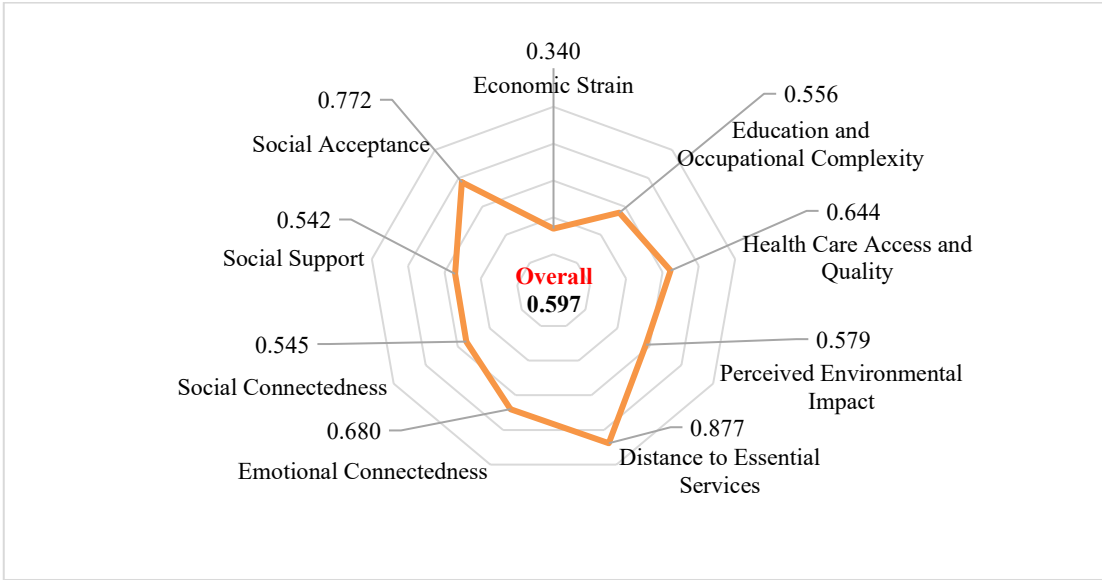


Figure 4.19: Health Resilience Index Focused on Individual Level using Geometric Mean

4.7 Discussion on Health Resilience Index

After interpreting these three different models of health resilience indexes, it is crucial to further clarify Malaysia’s achievements in health resilience. To begin with, a score of 0.342 for the economic strain component suggests that while financial challenges exist, they do not overwhelmingly dictate health resilience in the country. However, financial insecurity still plays a role in increasing stress levels, limiting access to medical care, and reducing overall well-being. More broadly, economic strain is recognized as one of the key social determinants of health. Economic instability, often caused by job loss, underemployment, or stagnating wages, can lead to financial stress, which negatively affects both mental and physical health (Azriddin et al., 2024). As a result, individuals facing financial difficulties

may postpone seeking medical attention, forgo routine check-ups, or opt for cheaper but less nutritious food, all of which contribute to long-term health complications (Hosin et al., 2024). In Malaysia, economic disparities are particularly evident among lower-income groups, who have fewer job opportunities (Mustafa et al., 2025). While economic opportunities are more abundant in urban areas, the high cost of living often offsets these advantages.

Similarly, education and occupational complexity play a crucial role in shaping health resilience by influencing health literacy, job security, and access to healthcare. A score of 0.557 suggests that these factors have a moderate impact in Malaysia. Specifically, education enhances health literacy, allowing individuals to make informed decisions about their well-being (Kamaruddin & Anis, 2024). Furthermore, higher education levels increase job opportunities, leading to greater financial stability and improved access to healthcare services. As noted by Yusof et al. (2024), individuals with higher education are more likely to secure jobs that offer health benefits, sick leave, and safer working conditions. However, educational attainment varies across states and socioeconomic groups. Programs such as Technical and Vocational Education and Training (TVET) aim to equip individuals with relevant employment skills, with the hope that they will secure better job prospects. This aligns with Jackson's (2016) study, which highlights the role of occupational complexity in fostering career development.

Encouragingly, improvements in healthcare access and quality over the past three years signal positive progress in Malaysia's healthcare system. This advancement can be attributed to increased government investment in medical infrastructure, the expansion of

healthcare facilities, and outreach programs targeting remote communities (Kelana & Radzi, 2024). According to Carvalho and Vilaça (2024), healthcare access and quality are essential components of health resilience, as improved medical services facilitate early disease detection and timely treatment. Countries with strong healthcare systems ensure that individuals, regardless of income or location, receive necessary medical care. In Malaysia, initiatives such as the PeKa B40 healthcare scheme provide financial assistance to lower-income groups. Additionally, expanding medical training programs and increasing the number of healthcare professionals have contributed to improved service delivery nationwide. However, in Sarawak, geographical challenges continue to hinder healthcare access (Mazlan & Idrus, 2024).

In parallel, the growing awareness of environmental impact over the past three years suggests increasing concerns about pollution, deforestation, and climate-related issues. Environmental factors directly influence health resilience, as exposure to pollutants, poor air quality, and natural disasters can exacerbate respiratory diseases, cardiovascular conditions, and mental health stress (Baharuddin & Satyanarayana, 2024). Pollution and inadequate sanitation weaken health resilience, while clean air, water, and green spaces promote faster recovery and overall well-being. Air pollution, in particular, remains a leading environmental health risk, with industrial emissions, vehicle pollution, and deforestation contributing to deteriorating air quality (Wong, 2025). Countries with insufficient environmental regulations often experience higher rates of respiratory diseases and declining public health standards. Furthermore, crime rates, often included in environmental impact assessments, can increase mental health stress and weaken social cohesion (Gunawan et al., 2024).

A high score of 0.877 for proximity to essential services suggests that, overall, distance is not a major barrier to health resilience in Malaysia. Nonetheless, geographical remoteness continues to pose challenges in accessing healthcare, education, and emergency services, particularly in rural areas (Marzbali & Hou, 2024). In urban settings, the close proximity of essential services ensures better access to healthcare and government facilities. Well-developed infrastructure, public transportation, and a high concentration of medical centers enable residents to receive timely medical care. More broadly, easy access to hospitals, clinics, schools, and social services enhances quality of life and ensures timely medical interventions. While urban populations generally benefit from good access to essential services, the Malaysian government has introduced mobile clinics, rural health outreach programs, and community-based services to bridge existing gaps (Santini et al., 2025). However, many villages and longhouses still struggle with limited access to essential services.

Emotional connectedness also plays a vital role in shaping health resilience, as reflected in a score of 0.680. Strong relationships within families and communities provide emotional support, helping individuals cope with stress and hardship. Emotional well-being is closely linked to improved mental health, lower anxiety levels, and greater resilience to health challenges (Azmi et al., 2025). Studies have shown that strong social ties enhance overall well-being, reducing the risk of depression and stress-related illnesses. Support from family and friends contributes to faster recovery from illnesses and encourages healthier lifestyle choices, as evidenced by Harith et al.'s (2021) study. In Malaysia, family structures remain strong, with multigenerational households being common. Communal support is deeply ingrained in Malaysian culture, with familial and religious networks providing

psychological comfort. Tye et al. (2017) argue that spiritual and religious guidance further complements emotional support from family and friends. However, urbanization and modernization are gradually weakening traditional family structures, raising concerns about loneliness and reduced emotional support.

Similarly, social connectedness, with a score of 0.546, refers to individuals' ability to form and maintain relationships within their communities and society. While Sarawak has strong social networks, they may not be as deeply integrated as emotional bonds. This suggests that while interaction exists, broader societal engagement could be improved. Globally, social connectedness is associated with better mental and physical health. Strong networks create a sense of belonging, reduce stress, and improve coping mechanisms during crises (Zainal et al., 2024). Conversely, social isolation can lead to mental health problems, lower productivity, and diminished overall well-being.

Lastly, a score of 0.772 indicates that Sarawak enjoys a strong sense of inclusivity and cultural cohesion. Social acceptance, defined as an individual's sense of belonging within a community regardless of ethnicity, background, or social status, positively impacts mental well-being by reducing stress and anxiety related to discrimination. Societies with high social acceptance tend to have lower crime rates, greater social stability, and improved collective well-being (Roslan et al., 2018). Malaysia, as a multicultural nation, generally maintains strong social cohesion. This is supported by government initiatives promoting ethnic harmony and economic equity, which have contributed to a relatively stable and peaceful society (Jamaiudin, 2019). However, occasional tensions arise due to economic disparities and policy-driven ethnic divisions. Nonetheless, national efforts such as the

Rukun Negara and cultural exchange programs aim to foster unity (Dufossé & Tiwari, 2024). Sarawak, in particular, stands out for its unique multiculturalism and interethnic harmony, celebrating diversity through shared festivals and traditions.

4.8 Disparities in Health Resilience and Economic Vulnerability Across Income Levels

Prior the inferential analysis be conducted on the computed economic vulnerability and health resilience indexes, the normality of the indexes is evaluated using both the Kolmogorov-Smirnov (KS) and Shapiro-Wilk (SW) tests to determine whether the data significantly deviated from a normal distribution. The results, as presented in **Table 4.9**, indicate that for all three measures of Economic Vulnerability (M1, M2, M3) and Health Resilience (M1, M2, M3), the KS test yielded non-significant p -values ($p = 0.200$). This suggests that the null hypothesis of normality cannot be rejected, implying that the data for these variables do not show substantial deviations from a normal distribution. Similarly, the Shapiro-Wilk test produced non-significant p -values for all variables ($p > 0.05$), reinforcing the conclusion that the data follow a normal distribution. As both normality tests consistently suggest that the data do not significantly depart from a normal distribution, it can be concluded that the assumption of normality is satisfied for all variables in this study. Hence, the further analysis will be conducted using parametric version of the statistical test.

Table 4.10: Normality Test for Economic Vulnerability and Health Resilience Indexes

Variables	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistics	df	<i>p</i> -value	Statistics	df	<i>p</i> -value
Economic Vulnerability (M1)	0.024	388	0.200	0.996	388	0.338
Economic Vulnerability (M2)	0.025	388	0.200	0.996	388	0.331
Economic Vulnerability (M3)	0.027	388	0.200	0.995	388	0.203
Health Resilience (M1)	0.038	388	0.200	0.996	388	0.533
Health Resilience (M2)	0.025	388	0.200	0.998	388	0.933
Health Resilience (M3)	0.032	388	0.200	0.997	388	0.710

A one-way ANOVA is conducted to examine the differences in economic vulnerability (M1, M2, M3) and health resilience (M1, M2, M3) across three socioeconomic groups classified by income range (B40, M40, and T20). The analysis was supplemented with Levene's test to assess homogeneity of variances and post hoc LSD comparisons to explore significant group differences.

Table 4.11: Disparities in Health Resilience and Economic Vulnerability Across Income Levels

Variables		<i>n</i>	M	SD	Levene test statistics	<i>F</i> -statistics
Economic Vulnerability (M1)	B40	91	0.489	0.112	2.680 [0.070]	4.742 [0.009]
	M40	209	0.517	0.104		
	T20	88	0.538	0.115		
Economic Vulnerability (M2)	B40	91	0.480	0.112	2.730 [0.066]	4.631 [0.010]
	M40	209	0.509	0.104		
	T20	88	0.529	0.115		
Economic Vulnerability (M3)	B40	91	0.476	0.144	2.730 [0.066]	4.631 [0.010]
	M40	209	0.512	0.134		
	T20	88	0.538	0.148		
Health Resilience (M1)	B40	91	0.544	0.060	2.028 [0.133]	4.237 [0.015]
	M40	209	0.569	0.065		
	T20	88	0.563	0.077		
Health Resilience (M2)	B40	91	0.544	0.060	2.172 [0.115]	4.409 [0.013]
	M40	209	0.569	0.065		
	T20	88	0.563	0.077		
Health Resilience (M3)	B40	91	0.596	0.069	1.402 [0.247]	4.075 [0.018]
	M40	209	0.622	0.075		
	T20	88	0.620	0.087		

Notes: The short form *n*, M and SD represents the number of observations, mean and standard deviation respectively. The value in square bracket [] is the *p*-value.

To begin, Levene's test for Economic Vulnerability (M1) was non-significant ($p = 0.070$), indicating that the assumption of homogeneity of variances was met. The ANOVA results revealed a statistically significant difference in Economic Vulnerability (M1) among the three socioeconomic groups, $F(2,385) = 4.742$, $p = 0.009$. Looking at the descriptive statistics, individuals in the T20 group reported the highest economic vulnerability ($M = 0.538$, $SD = 0.115$), followed by those in the M40 group ($M = 0.517$, $SD = 0.104$), while the B40 group demonstrated the lowest level of economic vulnerability ($M = 0.489$, $SD = 0.112$). Further insights from the post hoc LSD comparisons confirmed these patterns. The results indicated that B40 had significantly lower economic vulnerability than both M40 ($p = 0.036$) and T20 ($p = 0.002$). However, the difference between M40 and T20 was not statistically significant ($p = 0.132$), suggesting that the, in this sample, economic vulnerability experienced by the wealthiest individuals (T20) was comparable to that of the middle-income group (M40), yet still significantly higher than that of the lower-income group (B40).

A similar trend was observed in Economic Vulnerability (M2). Levene's test remained non-significant ($p = 0.066$), confirming the assumption of equal variances across groups. The ANOVA results demonstrated a significant difference among the groups, $F(2,385) = 4.631$, $p = 0.010$. The descriptive statistics indicated that, once again, T20 exhibited the highest level of economic vulnerability ($M = 0.529$, $SD = 0.115$), followed by M40 ($M = 0.509$, $SD = 0.104$) and B40 ($M = 0.480$, $SD = 0.112$). Post hoc LSD comparisons reinforced these findings, showing that B40 had significantly lower economic vulnerability than both M40 ($p = 0.036$) and T20 ($p = 0.002$). However, the difference between M40 and T20 was not statistically significant ($p = 0.138$). In this study, these results consistently highlight that economic vulnerability is most pronounced among individuals in the sampled

T20 group, while some of the B40 continues to demonstrate the lowest level of economic vulnerability, with M40 positioned in between.

Likewise, the analysis for Economic Vulnerability (M3) followed the same pattern. Levene's test was once again non-significant ($p = 0.066$), confirming the assumption of homogeneity of variances. The ANOVA results indicated a significant difference across groups, $F(2,385) = 4.631, p = 0.010$. According to the descriptive statistics, the highest level of economic vulnerability was reported by the T20 group ($M = 0.538, SD = 0.148$), followed by M40 ($M = 0.512, SD = 0.134$) and B40 ($M = 0.476, SD = 0.144$). Post hoc LSD comparisons further supported these observations, demonstrating that B40 had significantly lower economic vulnerability than both M40 ($p = 0.038$) and T20 ($p = 0.002$). Meanwhile, the difference between M40 and T20 was not statistically significant ($p = 0.138$), reaffirming that, within this sample, the highest-income individuals (T20) experience notably higher economic vulnerability than those in the B40 group, whereas M40 remains positioned at an intermediate level.

Turning to health resilience, the results for Health Resilience (M1) exhibited a contrasting trend. Levene's test was non-significant ($p = 0.133$), ensuring that the assumption of homogeneity of variances was met. The ANOVA results revealed a significant difference among the groups, $F(2,385) = 4.237, p = 0.015$. In contrast to economic vulnerability, descriptive statistics showed that M40 demonstrated the highest level of health resilience ($M = 0.569, SD = 0.065$), followed by T20 ($M = 0.563, SD = 0.077$), while B40 exhibited the lowest resilience ($M = 0.544, SD = 0.060$). Post hoc LSD comparisons reinforced these findings, showing that B40 had significantly lower resilience than M40 ($p = 0.004$) and

marginally lower resilience than T20 ($p = 0.059$). However, there was no significant difference between M40 and T20 ($p = 0.524$), suggesting that, on average in this sample, individuals in the middle-income (M40) and high-income (T20) groups experience similar levels of health resilience, while those in the B40 group consistently exhibit the lowest resilience.

A similar pattern was evident for Health Resilience (M2), where Levene's test remained non-significant ($p = 0.115$), confirming the assumption of equal variances. The ANOVA results demonstrated a significant main effect, $F(2,385) = 4.409$, $p = 0.013$. As in the previous measure, M40 reported the highest health resilience ($M = 0.569$, $SD = 0.065$), followed by T20 ($M = 0.563$, $SD = 0.077$) and B40 ($M = 0.544$, $SD = 0.060$). Post hoc LSD comparisons revealed a significant difference between B40 and M40 ($p = 0.006$), suggesting that middle-income individuals had considerably higher resilience than those in the lower-income group. Meanwhile, the difference between B40 and T20 approached significance ($p = 0.052$), implying a potential but inconclusive trend, while M40 and T20 did not differ significantly ($p = 0.526$). In this setting, these results suggest that individuals from the middle-income category (M40) demonstrate the highest health resilience, whereas those in the B40 group continue to exhibit the lowest resilience levels.

Lastly, the results for Health Resilience (M3) followed the same pattern. Levene's test was non-significant ($p = 0.247$), indicating that the assumption of homogeneity of variances was satisfied. The ANOVA results showed a significant effect of socioeconomic status, $F(2,385) = 4.075$, $p = 0.018$. Once again, M40 exhibited the highest health resilience ($M = 0.622$, $SD = 0.075$), followed closely by T20 ($M = 0.620$, $SD = 0.087$), while B40

reported the lowest resilience ($M = 0.596$, $SD = 0.069$). Post hoc LSD comparisons confirmed that B40 had significantly lower resilience than both M40 ($p = 0.006$) and T20 ($p = 0.037$). However, no significant difference was observed between M40 and T20 ($p = 0.837$), reinforcing that while middle- and high-income groups in the present study demonstrate similar levels of resilience, the lower-income group experiences significantly lower resilience levels within this sample.

Shedding light from ANOVA results, the component-level mechanisms may help explain these counterintuitive income-gradients. First, EVI's largest lever is asset deficiency; although one might expect T20 to be shielded, one plausible explanation is that higher exposure to market-linked assets and sectoral dependencies could transmit external shocks more directly, consistent with the importance of 'exposure' and 'external sensitivity' in the 3-year EVI (0.534 and 0.539). Second, HRI advantages for M40 over B40/T20 are consistent with a 'sweet spot' of affordability plus dense social support: economic strain is lower than B40, while social connectedness/acceptance remain robust. These are hypotheses consistent with the index architecture and should be read as interpretive mechanisms rather than causal claims.

In this study, the findings reveal a consistent pattern: economic vulnerability is highest among individuals in the T20 group, while health resilience is strongest within the M40 group. Meanwhile, the B40 group in our sample consistently exhibits the lowest levels of health resilience yet experiences the least economic vulnerability. Several interrelated factors may help explain this paradox. Firstly, lifestyle inflation may play a role. As income rises, some individuals tend to adjust their spending habits accordingly, leading to greater

financial commitments such as mortgages, luxury purchases, and education costs. As a result, despite earning high incomes, a subset of individuals in the T20 group may experience financial strain due to reduced liquidity. This aligns with Nawaz and Mujaddad's (2024) study, which found that as people earn more, they often increase their spending on non-essential goods and services, potentially placing financial pressure on themselves. Secondly, higher-risk investment behaviours could further contribute to economic vulnerability (Fatimah et al., 2021). With greater financial capacity, some in the T20 group may engage in volatile investments, including stock markets, real estate, and business ventures, which can lead to financial instability despite substantial earnings.

In contrast, the B40 group, comprising the bottom 40% of income earners, in this sample displays the lowest economic vulnerability despite limited financial resources. This may be partly attributable to a combination of socio-economic safety nets and behavioural adaptations, as highlighted in Koen et al.'s (2017) study. Government assistance programs, such as cash transfers, food subsidies, and healthcare support, may serve as protective mechanisms that help prevent extreme financial distress. Cattaneo et al. (2023) also emphasize that social welfare programs, including food subsidies and direct cash aid, can reduce poverty risks for lower-income populations. Additionally, some individuals in this group may have lower financial expectations and adopt frugal spending habits, which could help shield them from economic shocks. Unlike some T20 households, which may face higher financial obligations, many in the B40 population appear to maintain lower debt and focus primarily on essential expenses, potentially reducing exposure to financial instability. This aligns with Banna et al.'s (2023) research, which found that lower-income households, due to limited financial resources, often prioritize necessities and avoid excessive debt.

The M40 group, representing the middle 40% of income earners, on average in this sample demonstrates the highest levels of health resilience. This may reflect a combination of relatively stable economic conditions, access to healthcare, and more balanced lifestyles. Bakar et al. (2015) argue that Malaysia's emphasis on work-life balance, community cohesion, and family values can enhance health resilience. Compared with some T20 households that may experience high work-related stress and time constraints, individuals in the M40 group may, on average, enjoy a better work-life balance, contributing to improved well-being. Their relatively stable income may allow access to private health insurance, routine medical check-ups, and preventive healthcare measures, such as vaccinations and wellness programs, facilitating early detection and management of chronic illnesses (Diderichsen et al., 2012). Greater financial stability can also enable healthier lifestyle choices, including gym memberships, balanced nutrition, and mental well-being programs, which may contribute to overall health resilience (Fan et al., 2023).

Despite having lower economic vulnerability in this sample, the B40 group may face significant challenges in terms of health resilience. A key contributing factor could be limited access to quality healthcare. Public healthcare services, on which many B40 households rely, are sometimes overcrowded, with long waiting times and constrained resources (Nazroo, 1998). Consequently, individuals in this group may experience delays in receiving medical attention, allowing preventable diseases to progress into more severe conditions. Additionally, the high cost of private healthcare remains beyond the financial reach of many in this group, further restricting access to specialized treatments and essential medications. Otero et al. (2015) highlight that financial insecurity among low-income individuals is closely linked to chronic stress, which can negatively impact health outcomes.

Overall, these interpretations should be read as hypotheses consistent with our empirical patterns rather than as established causal claims.

In this sample, economic vulnerability (EV) differs significantly across income groups, $F(2,385) = 4.742$, $p = 0.009$, with T20 households showing the highest levels, followed by M40 and B40. This pattern highlights the need for policies that enhance household and firm-level financial resilience, consistent with SDG 1 (No Poverty), SDG 8 (Decent Work and Economic Growth), and SDG 13 (Climate Action). Relevant strategies include financial risk-literacy initiatives, portfolio diversification programmes, and wider access to savings and insurance instruments that can buffer shocks. For B40 households, the relatively lower EV observed suggests that maintaining effective social safety nets remains crucial, reinforcing commitments under SDG 1. For M40 households, resilience measures should focus on reducing vulnerabilities linked to upward income mobility, ensuring that economic gains do not increase financial exposure.

Health resilience (HR) also differs significantly, $F(2,385) = 4.237$, $p = 0.015$, with M40 performing on par with or better than T20, and both surpassing B40. Closing the HR gap for B40 households directly supports SDG 3 (Good Health and Well-Being), SDG 10 (Reduced Inequalities), and SDG 11 (Sustainable Cities and Communities). Policy levers include strengthening primary healthcare outreach, expanding mobile health services, improving last-mile transport access, and offering preventive-care subsidies to reduce financial strain. For M40 households, sustaining the combination of stable earnings and reliable healthcare access is important to preserve resilience. For T20 households, emphasis

should be placed on work–life balance and mental health supports, in line with SDG 3, to address emerging resilience challenges linked to lifestyle and occupational pressures.

4.9 Assessing the Relationship Between Sensitivity, Adaptive Capacity, and Health Resilience

Understanding the factors that contribute to individuals' health resilience is essential in public health concern. In light of this, this regression analysis examines the interplay between sensitivity and adaptive capacity which are the components to shape economic vulnerability, as well as health resilience, highlighting how various factors influence individuals' ability to cope with health-related stressors. Sensitivity reflects susceptibility to external pressures, whereas adaptive capacity represents the ability to effectively respond and adapt. By identifying the key determinants that strengthen or weaken health resilience, this study provides valuable insights that can inform evidence-based policies and interventions. With insights from this analysis, it fosters a more resilient and healthier communities amid evolving environmental and socio-economic challenges.

The first regression model (Model 1) examined the relationship between sensitivity, adaptive capacity, and health resilience. The model yielded a correlation coefficient of $R = 0.383$, indicating a moderate positive relationship. The coefficient of determination ($R^2 = 0.147$) suggests that 14.7% of the variance in health resilience is explained by the predictor variables. The adjusted R^2 (0.131) accounts for the number of predictors in the model. The standard error of the estimate (0.063) represents the typical deviation of the predicted health resilience scores from the actual scores. The Durbin-Watson statistic (1.573) suggests no serious autocorrelation issues. The overall model was statistically significant, $F(7, 388) = 9.358, p < 0.05$. Firstly, economic sensitivity is associated with a positive coefficient ($\beta =$

0.120, $p = 0.121$), suggesting that an increase in economic sensitivity is linked to an increase in health resilience. However, this relationship is not statistically significant, indicating that the observed association may have occurred by chance rather than representing a consistent pattern. Similarly, health threat sensitivity ($\beta = -0.024$, $p = 0.784$) and social sensitivity ($\beta = -0.105$, $p = 0.209$) do not exhibit statistically significant relationships with health resilience. The lack of significance suggests that variations in these factors do not reliably predict changes in health resilience.

Table 4.12: Relationship Between Sensitivity, Adaptive Capacity, and Health Resilience

Predictors	Model 1	Model 2	Model 3
Economic Sensitivity	0.120 [0.121]	0.117 [0.129]	0.142* [0.058]
Environmental Sensitivity	-0.160** [0.035]	-0.162** [0.032]	-0.191*** [0.009]
Health Threat Sensitivity	-0.024 [0.784]	-0.025 [0.772]	-0.038 [0.653]
Social Sensitivity	-0.105 [0.209]	-0.103 [0.219]	-0.082 [0.312]
Asset Efficiency	0.182*** [0.001]	0.184*** [0.001]	0.207*** [$p < 0.000$]
Food Security	0.123*** [0.028]	0.125*** [0.025]	0.154*** [0.005]
Psychological Adaptive Capacity	0.141*** [0.006]	0.142*** [0.005]	0.176*** [$p < 0.000$]
<i>R</i>	0.383	0.388	0.448
<i>R</i> ²	0.147	0.151	0.201
Adjusted <i>R</i> ²	0.131	0.135	0.186
Standard Error of the Estimate	0.063	0.063	0.069
Durbin-Watson	1.573	1.584	1.581
<i>F</i> -statistics	9.358	9.649	12.627
Dependent Variable	Health Resilience (M1)	Health Resilience (M2)	Health Resilience (M3)

Notes: The value in square bracket [], indicates the p -value. The asterisks (*, ** and ***) indicate statistical significance at 10%, 5% and 1% respectively.

In contrast, environmental sensitivity ($\beta = -0.160$, $p = 0.035$) demonstrates a statistically significant negative association with health resilience. This finding implies that

as environmental sensitivity increases, health resilience tends to decrease. This relationship may reflect the detrimental effects of environmental stressors on overall health and well-being. Additionally, several factors exhibit statistically significant positive associations with health resilience. Asset efficiency ($\beta = 0.182, p = 0.001$) is positively influencing health resilience, indicating that greater sufficiency in owned assets contributes to improved health resilience. Similarly, food security ($\beta = 0.123, p = 0.028$) is positively associated with health resilience, suggesting that access to adequate food resources plays a crucial role in strengthening individuals' ability to withstand health-related challenges. Moreover, resilience itself is a significant predictor of health resilience ($\beta = 0.141, p = 0.006$). The positive coefficient suggests that as resilience increases, health resilience also improves, emphasizing the critical role of resilience in enhancing individuals' capacity to cope with health-related adversities.

In Model 2, the correlation coefficient increased slightly to $R = 0.388$, with $R^2 = 0.151$, indicating that 15.1% of the variance in health resilience is explained by the model. The adjusted R^2 (0.135) suggests a slight improvement in explanatory power. The standard error of the estimate remained at 0.063, and the Durbin-Watson statistic was 1.584, indicating no serious autocorrelation concerns. The model was statistically significant, $F(7, 388) = 9.649, p < 0.05$. Firstly, economic sensitivity has a positive coefficient ($\beta = 0.117, p = 0.129$) but is not statistically significant. Similarly, health threat sensitivity ($\beta = -0.025, p = 0.772$) and social sensitivity ($\beta = -0.103, p = 0.219$) do not exhibit statistically significant relationships with health resilience. This implies that variations in these factors are unlikely to have a consistent or meaningful impact on health resilience.

In contrast, environmental sensitivity ($\beta = -0.162, p = 0.032$) has a statistically significant negative association with health resilience. This finding indicates that as environmental sensitivity increases, health resilience tends to decrease, potentially reflecting the adverse effects of environmental stressors on health outcomes. On the other hand, several factors demonstrate statistically significant positive associations with health resilience. Asset efficiency ($\beta = 0.184, p = 0.001$) is positively impacting health resilience, meaning that greater efficiency in managing assets contributes to improved health resilience. Similarly, food security ($\beta = 0.125, p = 0.025$) is positively associated with health resilience, suggesting that having stable access to food resources strengthens individuals' ability to cope with health-related challenges. Additionally, resilience itself is a significant predictor of health resilience ($\beta = 0.142, p = 0.005$). The positive coefficient suggests that as resilience increases, health resilience also improves, highlighting the importance of resilience in enhancing individuals' capacity to withstand health adversities.

The third regression model focused solely on individual factors shaping health resilience. The correlation coefficient increased to $R = 0.448$, with $R^2 = 0.201$, indicating that 20.1% of the variance in health resilience is explained by individual factors. The adjusted R^2 (0.186) suggests improved explanatory power compared to Models 1 and 2. The standard error of the estimate was slightly higher (0.069), and the Durbin-Watson statistic was 1.581, indicating no serious autocorrelation issues. The model was statistically significant, $F(7, 388) = 12.627, p < 0.05$. Surprisingly, if it is zoomed into individual perspective, it is evident that the economic sensitivity has a positive coefficient towards health resilience ($\beta = 0.142, p = 0.058$) but is only statistically significant at 10% level. This suggests that an increase in economic sensitivity may be associated with a rise in health

resilience. In other words, a one-unit increase in economic sensitivity would lead to a 0.142-unit increase in health resilience.

Environmental sensitivity ($\beta = -0.191$, $p = 0.009$) is statistically significant and negatively associated with health resilience. This finding indicates that higher environmental sensitivity leads to a decrease in health resilience, with a one-unit increase resulting in a 0.191-unit reduction. Among all the models, environmental sensitivity exhibits the consistent negative effect on the three-version health resilience, highlighting its substantial impact on reducing health resilience. In contrast, health threat sensitivity ($\beta = -0.038$, $p = 0.653$) and social sensitivity ($\beta = -0.082$, $p = 0.312$) do not show statistically significant relationships with health resilience. This suggests that changes in these factors do not have a meaningful or consistent effect on health resilience.

On the other hand, several factors exhibit statistically significant positive associations with health resilience. Asset efficiency ($\beta = 0.207$, $p < 0.001$) is the positive predictor of health resilience, with a one-unit increase in asset efficiency leading to a 0.207-unit increase in health resilience. Food security ($\beta = 0.154$, $p = 0.005$) also demonstrates a significant positive relationship with health resilience, indicating that greater food security contributes to better health resilience. This means a one-unit increase in food security leads to a 0.154-unit increase in health resilience, emphasizing the role of stable access to food in promoting health resilience. Additionally, resilience is also still a crucial factor in predicting health resilience even focused on individual level ($\beta = 0.176$, $p < 0.001$). The positive coefficient indicates that when one become more resilient increases, health resilience

improves, with a one-unit increase in resilience leading to a 0.176-unit increase in health resilience.

Observing these model in overall, the findings suggest that economic sensitivity does not have a significant impact on health resilience at the structural level. However, it does influence health resilience at the individual level. This distinction implies that while Malaysia's macroeconomic stability, government subsidies, and healthcare policies act as buffers against economic fluctuations, individual financial circumstances remain a crucial determinant of health resilience. Specifically, individuals facing financial instability, such as those with low income or precarious employment, often encounter barriers to healthcare access, adequate nutrition, and a healthy lifestyle, aligning with the study by Aldhaen (2024). As a result, these challenges contribute to reduced resilience when dealing with health issues. Given these findings, it is essential to implement policies aimed at reducing income inequality and enhancing financial security, particularly for vulnerable populations.

Furthermore, the study reveals that environmental sensitivity has a significant negative impact on health resilience. This suggests that environmental conditions directly hinder individuals' ability to manage health challenges. In Malaysia, environmental issues, including air pollution from transboundary haze, deforestation, water contamination, and climate-induced disasters such as flash floods, persist and continue to affect public health. These environmental stressors contribute to various health risks, thereby weakening resilience (Baharuddin & Satyanarayana, 2024). In essence, heightened environmental sensitivity reduces health resilience by increasing exposure to pollution, infections, and extreme weather conditions, making recovery from illnesses more difficult. Prolonged

exposure to environmental stressors also impacts mental well-being, further diminishing the ability to cope with health challenges.

The analysis also indicates that health threat sensitivity does not significantly affect health resilience, suggesting that people are becoming more prepared to handle health challenges. Greater awareness of health risks, improved health literacy, and proactive behaviors, such as regular health check-ups, adherence to vaccination programs, and personal hygiene practices, enhance individuals' ability to manage illnesses effectively. Gunawan et al. (2024) argue that widespread public health awareness contributes to a more health-resilient population by mitigating the direct impact of disease outbreaks and healthcare system vulnerabilities. Additionally, past experiences with health crises, such as the COVID-19 pandemic, have reinforced preventive measures and adaptive coping strategies. As a result, individuals are less susceptible to the psychological and physical impacts of health threats, strengthening overall resilience despite disparities in healthcare access.

The study further finds that social sensitivity is not a significant determinant of health resilience. This suggests that social adversity is no longer a major concern for most Malaysians. Research indicates that strong communal bonds and cultural emphasis on family support contribute to social cohesion and well-being (Annamalah & Aravindan, 2024). These close-knit relationships, along with religious and community institutions, foster a sense of harmony and collective support, acting as a protective buffer against social stressors (Tariq et al., 2022). Furthermore, government initiatives, such as financial aid and universal healthcare, help maintain societal stability. As a result, Malaysians experience fewer social

conflicts that could undermine health resilience, allowing individuals to maintain well-being regardless of social challenges. However, certain vulnerable groups, including the elderly and marginalized communities, may still face disparities in accessing essential services.

The findings also indicate that asset efficiency significantly enhances health resilience. Effective management of liquid assets, savings, and productive resources provides financial security during health crises. Previous research by Rokis and Jusoh (2015) suggests that individuals with stable financial resources are better positioned to afford medical treatments, maintain a healthy lifestyle, and manage unexpected healthcare expenses without excessive financial strain. Stable finances allow individuals to cope with health challenges more effectively and adapt to changing circumstances (Mansor et al., 2022). Having sufficient savings and productive assets also reduces stress and uncertainty, enabling individuals to focus on recovery and long-term well-being. This financial stability strengthens their ability to navigate health challenges and maintain resilience.

The study establishes a strong positive relationship between food security and health resilience, highlighting Malaysia's effectiveness in mitigating food insecurity. With stable food supply chains, government initiatives, and economic accessibility, most Malaysians have reliable access to nutritious food, which supports immune function, prevents malnutrition, and improves overall health outcomes (Ibrahim & Othman, 2020). This widespread food security indirectly strengthens health resilience by ensuring individuals maintain proper nutrition, recover more effectively from illnesses, and sustain long-term well-being (Sulaiman et al., 2021). While food insecurity may still affect certain groups,

Malaysia's policies addressing this issue have significantly contributed to national health resilience.

Importantly, the study underscores the critical role of resilience, including adaptive capacity, coping mechanisms, and recovery ability, as a key determinant of health resilience in Malaysia. Individuals and communities with strong psychological, social, and economic coping strategies are better equipped to manage health crises, recover from illnesses, and adapt to evolving health conditions. Psychological resilience helps individuals maintain mental well-being during health challenges, while social support networks provide emotional and practical assistance (Rahman, Kashim, & Noor, 2020). Resilient individuals remain motivated and committed to rehabilitation despite health challenges. Additionally, societal support further strengthens recovery by offering encouragement, guidance, and assistance in managing daily obstacles.

Building on the preceding discussion, it is important to consider how the determinants of health resilience translate into broader policy and development implications. Since resilience is not only a household-level outcome but also a cornerstone of national development, aligning these findings with the Sustainable Development Goals (SDGs) and Malaysia's development priorities provides a useful framework for action. Environmental sensitivity reduces resilience by amplifying exposure to pollution and disease, underscoring the need for environmental health interventions that advance SDG 3 (Good Health), SDG 11 (Sustainable Cities), and Malaysia's environmental sustainability agenda. Similarly, strengthening household asset efficiency through MSME support, financial inclusion, and

skills development enhances adaptive capacity, consistent with SDG 1 (No Poverty), SDG 8 (Decent Work), and national strategies for productivity-led growth.

Food security and psychological adaptive capacity further highlight the social and human dimensions of resilience. Ensuring reliable access to nutritious food not only advances SDG 2 (Zero Hunger) but also aligns with domestic poverty reduction and welfare policies. At the same time, promoting psychological resilience through mental health services, community outreach, and workplace supports strengthens human capital, directly supporting SDG 3 and Malaysia's broader health reform goals. Taken together, these implications demonstrate that resilience is multidimensional: it requires integrated strategies that combine environmental management, economic empowerment, food security, and mental well-being. This integrated approach not only advances the SDGs but also reinforces Malaysia's Shared Prosperity Vision 2030 and the Twelfth Malaysia Plan, making the statistical evidence directly relevant to policy and practice.

All in all, the findings highlight that while economic sensitivity, social sensitivity, and health threat sensitivity have limited direct effects on health resilience, environmental challenges, resource management (asset efficiency), and food security play critical roles in shaping health resilience. Strengthening healthcare infrastructure, promoting sustainable environmental policies, and enhancing social safety nets are essential for improving health resilience in Malaysia. Future policies should prioritize equitable healthcare access, environmental sustainability, and financial stability to ensure a more resilient and health-secure population.

4.10 Chapter Remarks

This study provides a comprehensive analysis of economic vulnerability and health resilience in Malaysia, particularly focusing on disparities across different income groups. By utilizing empirical data and factor analysis, key determinants of economic vulnerability, including social sensitivity, economic sensitivity, and asset deficiency, were identified. Simultaneously, the study highlighted the significance of health resilience factors such as healthcare access, emotional connectedness, and social acceptance. The findings reveal a paradox where higher-income individuals (T20) exhibit greater economic vulnerability, potentially due to high financial commitments and investment risks, while lower-income groups (B40) demonstrate lower economic vulnerability but face significant challenges in health resilience due to limited access to quality healthcare and economic instability.

The study underscores the necessity of targeted policy interventions to enhance economic stability and health resilience, particularly for the most vulnerable populations. Strengthening financial literacy, expanding social welfare programs, and improving access to quality healthcare in rural and underserved areas are crucial measures. Additionally, the disparities observed across income groups highlight the need for holistic, income-sensitive strategies that address both economic security and public health resilience. Future research should explore longitudinal trends and policy effectiveness to further inform sustainable economic and health policies in Malaysia.

CHAPTER 5

CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Introduction

The general objective of this study is to examine the relationship between economic vulnerability and health resilience in the context of Malaysia. To achieve this, two indexes measuring economic vulnerability and health resilience were first developed and analyzed. These indexes provide valuable insights into the extent of economic vulnerability and health resilience by integrating both external economic exposures and individual-level vulnerabilities. Understanding this interplay is crucial for identifying the structural and individual factors that influence health outcomes in the face of economic challenges. This final chapter presents a comprehensive summary of the research findings, highlighting key patterns and implications drawn from the analysis. Additionally, the chapter discusses relevant policy recommendations aimed at mitigating economic vulnerabilities while enhancing health resilience. The study's limitations will also be addressed, along with suggestions for future research to refine and expand upon the current findings. Finally, the concluding remarks will underscore the main takeaways from this research, reinforcing its significance in shaping future policy and academic discourse on economic vulnerability and health resilience in Malaysia.

5.2 Summary of Research Findings and Discussion

The demographic analysis provides a comprehensive overview of the respondents, highlighting the diversity in gender, ethnicity, religion, marital status, education level, employment status, and household income. The sample consists of 388 individuals from Sarawak, with a near-equal gender distribution (54% female, 46% male). Ethnically, Malays form the largest group (40%), followed by Sarawak Indigenous people (33%) and Chinese (27%). Religiously, Islam (43%) and Christianity (39%) dominate, while Buddhism (16%) and free-thinking individuals (2%) form smaller segments. A majority of respondents are either single (51%) or married (46%), with minimal representation of divorced, separated, or widowed individuals. In terms of education, most have completed upper secondary (87 individuals) or attained a first degree (79 individuals). Employment trends indicate that the majority work full-time in the private sector (180 individuals), followed by government employees (91 individuals). The income distribution suggests that most respondents belong to the middle-income bracket, with fewer in the lower- and upper-income groups.

The selection of economic vulnerability indicators was guided by an exploratory factor analysis (EFA), which identified seven key dimensions: social sensitivity, economic sensitivity, food security, resilience, environmental sensitivity, health threat sensitivity, and economic status. The Kaiser-Meyer-Olkin (KMO) test confirmed the suitability of the dataset for factor analysis, with a high value of 0.95. Additionally, Bartlett's Test of Sphericity was statistically significant, further validating the appropriateness of factor analysis. The total variance explained by the first few factors accounted for over 70% of the dataset's variability, ensuring a robust structure. Factor loadings above 0.50 were deemed meaningful, with most variables displaying high correlations with a single factor. The

analysis highlighted asset efficiency as a crucial economic resilience component, while food security emerged as an independent dimension. While most indicators demonstrated strong validity, a few exhibited weaker loadings, suggesting that they may require refinement in future studies for greater analytical precision.

Similarly, the selection of health resilience indicators followed an EFA approach, leading to the identification of nine key components: economic strain, social acceptance, perceived environmental impact, healthcare access, social support, social connectedness, distance to essential services, education and occupational complexity, and emotional connectedness. The analysis ensured that only statistically significant and conceptually relevant indicators were retained. The KMO measure (0.89) and Bartlett's test results confirmed the suitability of the dataset for factor extraction. The first nine factors accounted for approximately 59% of the total variance, suggesting a well-defined factor structure. Among these components, economic strain and social support emerged as particularly influential in shaping health resilience. Additionally, distance to essential services received the highest score, indicating its critical role in resilience assessments. While healthcare access and environmental perceptions were important, their relative impact was less pronounced compared to social and economic determinants, reinforcing the multi-dimensional nature of health resilience.

The Economic Vulnerability Index (EVI) was computed using three versions: a three-year average incorporating external factors, a five-year average for a longer-term assessment, and an individual-focused index excluding external influences. The arithmetic mean approach consistently yielded higher vulnerability scores than the geometric mean,

which was less sensitive to extreme values. The three-year EVI reported a moderate level of vulnerability (0.447), with asset deficiency emerging as the most significant contributor. The five-year average led to a slight decline in the overall vulnerability score (0.439), suggesting that extended periods of analysis provide a more stable representation of economic risks. Excluding external factors further reduced the EVI to 0.422 under the arithmetic mean method, demonstrating that external economic conditions significantly impact vulnerability levels. These findings highlight that while individual financial and social factors contribute to economic vulnerability, exposure to external economic shocks exacerbates susceptibility, making long-term policy interventions crucial for economic stability.

The Health Resilience Index (HRI) was also computed using three versions to capture different perspectives. The arithmetic mean approach yielded an initial HRI score of 0.617, while the geometric mean produced a slightly lower estimate of 0.592, reflecting its ability to moderate extreme values. A five-year average HRI introduced a slight decline in overall resilience (0.609 arithmetic, 0.589 geometric), mainly due to observed decreases in healthcare access and environmental perceptions over time. Excluding external factors resulted in minimal changes, with the arithmetic mean score remaining at 0.616, suggesting that individual-level resilience determinants play a dominant role. The most influential factors were economic strain, social connectedness, and access to essential services. These findings underscore the importance of stable socio-economic conditions in enhancing health resilience, while also indicating that external influences, though relevant, may not be as critical as intrinsic social and economic determinants in shaping individuals' ability to cope with health-related stressors.

The one-way ANOVA test examined disparities in economic vulnerability and health resilience across three income groups: B40 (low-income), M40 (middle-income), and T20 (high-income). Results indicated significant differences in economic vulnerability, with T20 individuals exhibiting the highest vulnerability scores, followed by M40, while B40 had the lowest. This counterintuitive finding suggests that wealthier individuals may experience higher economic exposure due to investment risks and lifestyle dependencies. In contrast, health resilience followed a different pattern, with M40 demonstrating the highest resilience levels, followed by T20, while B40 exhibited the lowest. Post hoc comparisons confirmed that lower-income individuals had significantly lower resilience compared to their middle- and high-income counterparts. These results highlight the dual challenge faced by lower-income groups: lower economic vulnerability due to limited exposure but significantly reduced health resilience, which may stem from restricted access to healthcare, education, and social support networks.

The regression analysis assessed the relationships between sensitivity, adaptive capacity, and health resilience. Across all models, economic sensitivity showed a positive but non-significant association with resilience, indicating that while financial conditions influence resilience, their impact may not be direct. In contrast, environmental sensitivity demonstrated a significant negative effect, suggesting that individuals who perceive higher environmental risks tend to have lower resilience. Among positive predictors, asset efficiency exhibited the strongest influence, followed by food security and overall resilience. These results suggest that improving financial stability, ensuring consistent food access, and enhancing individual resilience strategies can significantly strengthen health resilience. The final regression model, focusing solely on individual factors, explained 20.1% of variance

in health resilience, highlighting the dominant role of personal and social determinants. The findings reinforce that while economic factors matter, resilience is primarily shaped by social and structural conditions rather than direct economic sensitivity.

These findings have important policy implications. The observed disparities in economic vulnerability and health resilience suggest that targeted interventions are necessary to support different income groups. For lower-income individuals, improving healthcare accessibility and strengthening social networks can enhance resilience. Meanwhile, for high-income individuals, policies addressing economic exposure and financial planning may mitigate vulnerability risks. The strong influence of environmental sensitivity highlights the need for policies aimed at reducing environmental stressors and promoting sustainable urban development. Additionally, strengthening asset efficiency and food security can further enhance resilience. These results emphasize the need for a holistic policy approach that integrates economic, social, and environmental strategies to improve overall well-being. By addressing both economic vulnerability and health resilience in a targeted manner, policymakers can create more inclusive and sustainable economic and healthcare frameworks that support individuals across different socio-economic backgrounds.

Table 5.1: Alignment of Objectives with Empirical Results

Research Objective	How Addressed (Method/Analysis)	Outcome
i. Identify the critical domains of economic vulnerability and health resilience	Exploratory factor analysis (EFA) established multi-domain structures for EV and HR; sampling adequacy was high (KMO: EV = 0.95; HR = 0.89)	Achieved
ii. Compute an Economic Vulnerability Index for Malaysia	Composite index construction (arithmetic & geometric aggregation) reported for 3-year, 5-year, and individual-only variants	Achieved
iii. Develop a Health Resilience Index for Malaysia	Composite index construction (arithmetic & geometric) for 3-year and 5-year perspectives	Achieved
iv. Quantify disparities in EV and HR across income groups (B40, M40, T20)	One-way ANOVA with Levene's test and LSD post-hoc comparisons	Achieved
v. Estimate how household-level sensitivity and adaptive capacity jointly predict health resilience	Multiple regression (individual-level predictors)	Achieved

5.3 Policy Implications and Recommendations

The empirical findings of this study highlight that resilience in Malaysia is shaped by interconnected economic, health, environmental, and social dimensions. Building on the discussion, this section sets out four mutually reinforcing pillars: (1) Economic Diversification and Workforce Resilience, (2) Health and Well-Being, (3) Sustainable Infrastructure, Environment, and Mobility, and (4) Social Protection and Cohesion. These pillars are not stand-alone interventions but interdependent strategies that together support the Sustainable Development Goals (SDGs) and Malaysia's long-term development priorities under the Twelfth Malaysia Plan and Shared Prosperity Vision 2030.

Pillar 1: Economic Diversification and Workforce Resilience

Economic diversification and workforce resilience are essential for reducing the risks associated with economic volatility and global market shifts. Given Malaysia's diverse economic landscape, strategic investments in emerging sectors, such as green technology,

the digital economy, and high-value manufacturing, are key to ensuring long-term economic sustainability and competitiveness. To drive this transition, policies should be designed to support the growth of small and medium enterprises (SMEs) and startups through financial incentives, tax relief, and capacity-building programs. Additionally, targeted reforms should focus on increasing research and development (R&D) funding to encourage innovation and technological adoption. Beyond financial support, strengthening vocational training and STEM education is crucial for equipping the workforce with future-ready skills, ensuring smooth transitions into new economic sectors. By implementing these strategies cohesively, Malaysia can foster a more resilient workforce, generate sustainable employment opportunities, and enhance long-term economic stability while mitigating potential risks posed by global market fluctuations.

To render this recommendation operational, diversification can be anchored in regional production and services clusters that already exhibit momentum, technology and high-value manufacturing corridors in the north and south of Peninsular Malaysia and urban hubs in East Malaysia, while deliberately extending supplier-development linkages between anchor firms and local SMEs. Public procurement can be used to prioritise green and digital solutions from domestic suppliers, and university–polytechnic accelerators can provide commercialisation coaching and testbeds for prototypes to convert R&D into marketable products. On the skills side, dual-training models co-designed with industry, stackable micro-credentials in AI/data and clean technologies, and structured work-integrated learning within degree and TVET programmes ensure graduates transition directly into growth sectors for which demand already exists.

Another pressing issue is the employment challenges faced by skilled workers, particularly rural graduates, due to skill mismatches, outdated curricula, and limited local job opportunities. This challenge is further compounded by the rapid transition to an AI-driven economy. Aligning educational curricula with industry demands is essential to ensuring that graduates possess the necessary skills for high-growth sectors such as technology, engineering, and sustainable development. Strengthening public-private partnerships in education can facilitate work-integrated learning opportunities, enhancing graduates' employability. To address these disparities, higher education accessibility should be improved through scholarships, tuition subsidies, and subsidized transportation for rural students to ensure financial constraints do not hinder academic progress. Additionally, establishing regional higher education centers in underserved states can bridge the education gap, providing localized skill development opportunities and reducing rural-urban disparities in educational attainment.

In practice, institutions can formalise industry advisory boards that co-own syllabi and assessments, embed semester-length placements and capstone projects sourced from real firms, and stand up satellite teaching centres in underserved states so rural students access high-quality programmes without relocating. Regional centres in East Malaysia and along the east-coast and northern corridors can specialise in AI, advanced manufacturing, and sustainable development, creating clear ladders from certificate to degree with explicit employer pipelines. Scholarship and transport-hostel support targeted at rural entrants reduce attrition linked to geography rather than ability.

Pillar 2: Health and Well-Being

In addition, improving healthcare accessibility is vital for reducing health disparities and ensuring equitable service delivery across all communities. Many populations still face challenges due to geographical barriers, limited medical facilities, and an uneven distribution of healthcare professionals. To address these gaps, the government must prioritize expanding healthcare infrastructure and optimizing resource allocation to ensure essential services reach underserved areas efficiently. Strengthening healthcare accessibility not only enables early diagnosis and treatment but also alleviates the burden on overstretched facilities, ultimately improving public health outcomes. Moreover, integrating technology-driven solutions such as telemedicine can further bridge accessibility gaps by providing remote consultations and medical support. A well-connected healthcare system ensures that all individuals, regardless of location, receive timely and quality medical care. By committing to these efforts, Malaysia can build a more inclusive and resilient healthcare system, ultimately enhancing long-term public health and well-being.

Concretely, access can be improved by upgrading selected klinik kesihatan in interior and peri-rural districts, especially in Sarawak and Sabah and in rural belts of the peninsula, into extended-hours facilities with basic urgent care, diagnostics, and pharmacy capacity; expanding district hospital beds where occupancy and bypass patterns are persistently high; and instituting regular specialist outreach from state hospitals to peripheral facilities. Teleconsultation links between district clinicians and tertiary centres can standardise triage and reduce avoidable transfers, while ambulance posts and patient-transport staging along rural corridors shorten time-to-care where distance is the binding constraint. These steps

address the practical drivers of access gaps, distance, uneven professional distribution, and referral bottlenecks, without presuming large greenfield builds everywhere.

Mental health is a critical aspect of overall well-being, yet it remains underfunded and underprioritized in Malaysia's healthcare system. Strengthening mental health support at both community and workplace levels is necessary to promote resilience and reduce stigma. Introducing mandatory mental health coverage in insurance policies can improve access to psychological services, ensuring individuals receive the necessary support. Establishing community mental health centers nationwide would provide localized access to counseling and intervention programs, particularly for underserved populations. Additionally, integrating mental health education into employee wellness programs can enhance workplace resilience and productivity while reducing burnout. Expanding school-based mental health awareness programs can also equip students with coping mechanisms and early intervention strategies. By implementing these initiatives, Malaysia can foster a more supportive societal framework, improving overall mental health resilience, reducing stigma, and enhancing the well-being of its population.

Operationally, primary-care clinics can integrate routine screening and brief interventions with rotating counsellors and clear referral protocols to district hospitals for stepped-up care; community mental-health centres can be co-located with district hospitals or health offices to maintain proximity to diagnostics and emergency services while remaining accessible for counselling and group programmes; schools can expand counsellor-led psychoeducation and formalise referral pathways; and employers can codify workplace support through access to counselling and reasonable-adjustment policies. A single, widely

publicised national helpline that routes callers into local services provides a consistent first line of triage.

Pillar 3: Sustainable Infrastructure, Environment, and Mobility

Environmental sustainability plays a crucial role in ensuring long-term economic resilience and public health, necessitating the adoption of robust policies to mitigate climate change impacts. To foster sustainable economic growth, the government should expand incentives for renewable energy projects, such as solar, hydro, and wind energy, to encourage private sector participation in clean energy development. Simultaneously, stricter regulations on deforestation, illegal mining, and land use should be enforced to protect Malaysia's natural resources and preserve biodiversity. Furthermore, offering green tax incentives and sustainable business certifications can motivate industries to adopt eco-friendly practices, accelerating the shift toward a low-carbon economy. Integrating environmental education into academic curricula and corporate training programs can also promote sustainability-conscious behavior, encouraging responsible consumption and production. By prioritizing environmental sustainability through a multi-faceted approach, Malaysia can enhance climate resilience, reduce dependence on fossil fuels, and ensure the long-term well-being of its population while positioning itself as a regional leader in sustainable development. This, in turn, reduces public sensitivity to environmental challenges and strengthens both economic and health resilience.

In practical terms, public buildings and SME industrial parks can prioritise rooftop solar and energy-efficiency retrofits to stimulate clean-energy uptake, municipal and state authorities can tighten land-use enforcement using remote sensing to deter illegal clearing

and mining, and urban councils can expand green buffers and shade corridors near schools and clinics to reduce heat exposure. Routine air-quality disclosure and community vector-control campaigns lower health risks from pollution and dengue, while schools and firms embed applied sustainability modules that shift everyday practices. These measures reduce environmental exposures linked to poorer health outcomes while consolidating economic resilience.

A well-developed transportation network is essential for facilitating economic activity and ensuring equitable access to services. However, many communities still face transportation challenges that limit healthcare access, employment opportunities, and overall mobility. To address this, investments in highway expansion and last-mile transport solutions should be prioritized to improve connectivity between remote areas and urban centers. Expanding ambulance and emergency response coverage in less accessible regions would enhance healthcare accessibility, reducing preventable mortality rates. Additionally, developing affordable intercity bus and rail services can improve labor market mobility, enabling individuals to access job opportunities without transportation concerns. Investing in sustainable transportation infrastructure, such as electric buses and green public transit systems, can also contribute to environmental conservation while enhancing accessibility. Strengthening transportation networks not only bridges urban-rural disparities but also drives economic growth, social inclusion, and environmental sustainability.

To translate this into action, rural districts can operate fixed-timetable feeder services that connect villages to district hubs, complemented by demand-responsive vans where densities are low, while health authorities establish ambulance posts at strategic junctions

and formalise transfer protocols with receiving hospitals so that emergency flows are predictable and monitored. In cities and secondary towns, expanding affordable bus corridors and park-and-ride nodes, together with gradual introduction of electric buses, improves reliability and reduces cost and pollution. These adjustments make the existing network work more effectively for healthcare access and labour mobility without presuming major corridor megaprojects.

Food security is a key pillar of economic and social stability, making strategic investments in sustainable agriculture essential for safeguarding long-term food supply chains. While Malaysia currently enjoys a relatively stable food security status, maintaining agricultural resilience is critical to mitigating risks posed by climate change, supply chain disruptions, and global market fluctuations. To achieve this, the government should continue promoting smart farming technologies, urban agriculture, and vertical farming initiatives to optimize land use, boost production efficiency, and ensure a more sustainable food supply. Additionally, providing financial incentives and capacity-building programs for young farmers is crucial for securing the future of the agricultural sector, encouraging younger generations to participate in farming. By implementing these forward-thinking policies, Malaysia can strengthen national food security, create new economic opportunities in agriculture, and reinforce rural development and sustainable resource management.

In concrete terms, regional agro-food hubs can provide shared storage, grading, and first-mile logistics, reducing post-harvest losses; extension services can prioritise water-efficient irrigation, climate-resilient seed varieties, and pest-management training; and towns can support urban and vertical farming pilots to stabilise supply of perishables close

to consumers. Young-farmer initiatives that combine modest start-up support with mentoring and market contracts help renew the sector's age profile and anchor supply in rural economies.

Pillar 4: Social Protection and Cohesion

A robust social protection system is crucial for enhancing economic resilience, particularly for vulnerable populations facing financial instability and income volatility. Many individuals, especially those in the informal sector, lack access to financial safety nets, making them more susceptible to economic shocks. To address this issue, targeted financial assistance programs should be introduced, including microfinancing, zero-interest loans, and expanded access to digital banking services, ensuring financial inclusion for marginalized groups. Additionally, formalizing land rights for indigenous and rural communities can promote long-term economic security by enabling asset ownership and access to credit, fostering greater financial empowerment. Expanding Employees Provident Fund (EPF) and Social Security Organization (SOCSO) coverage to informal sector workers is also necessary to provide adequate financial protection during crises, reducing the risks associated with economic downturns. By systematically implementing these measures, Malaysia can create a more inclusive financial system, reduce wealth disparities, and strengthen economic stability, ultimately improving the nation's ability to withstand financial uncertainties and safeguard livelihoods.

To give this practical effect, enrolment can be simplified by taking EPF and SOCSO registration to markets, longhouses, and community events with on-the-spot identity verification and e-wallet links so that small, irregular contributions are feasible for informal

workers. Partnerships with digital banks and cooperatives can broaden access to basic accounts and micro-savings, while paralegal support and streamlined procedures accelerate land-title regularisation for indigenous and rural households so that assets can be used securely as collateral. Community-based financial literacy, tied to actual product uptake (savings and micro-insurance), helps convert access into real protection rather than new indebtedness.

Finally, social cohesion plays a pivotal role in shaping health resilience. Strengthening societal unity remains essential for building a more resilient and inclusive nation. The introduction of the MADANI framework by the Prime Minister reflects a commitment to sustainable and holistic national development, emphasizing inclusivity, ethical governance, and social well-being. To reinforce this vision, the government should actively expand MADANI-driven initiatives that promote community engagement, social responsibility, and mutual respect. Policies that encourage civic participation, cultural integration, and collective problem-solving will help cultivate a society that embraces MADANI values, ultimately strengthening national resilience and long-term stability. Encouraging intergenerational engagement and cultural inclusivity is crucial for fostering a more connected and harmonious society. By promoting targeted policies and community-driven initiatives, Malaysia can build a more resilient and inclusive nation capable of withstanding social and economic challenges while advancing national unity and sustainable development.

To move from principle to practice, local governments and youth agencies can sponsor small community grants that require collaboration across ethnic and age groups,

establish multi-use centres where seniors, youth, and civic associations share spaces, and pilot participatory-budgeting exercises that invite residents to prioritise neighbourhood improvements. Schools can embed service-learning as part of the curriculum, and faith and cultural organisations can co-host dialogues and joint community work. These modest mechanisms build trust and shared ownership and, over time, underpin the social cohesion that supports both economic and health resilience.

Taken together, these four pillars demonstrate that resilience in Malaysia must be built on interconnected foundations. Economic diversification cannot succeed without a healthy and skilled workforce; health systems are undermined without sustainable infrastructure; and both economic and health resilience lose traction without robust social protection and strong social cohesion. Embedding these integrated strategies into Malaysia's development agenda not only advances the SDGs but also reinforces the Shared Prosperity Vision 2030 and the Twelfth Malaysia Plan. By addressing resilience in an integrated way, linking economy, health, environment, and society, Malaysia can chart a coherent path toward inclusive and sustainable development.

5.4 Limitations and Suggestions for Future Study

This study offers valuable insights into the relationship between economic vulnerability (EV) and health resilience (HR); however, several limitations warrant acknowledgment. These limitations stem from the study's scope, methodological constraints, and data availability. While the research presents a detailed regional analysis, aspects such as broader geographic representation, temporal depth, data reliability, and the comprehensiveness of determinants could be strengthened. Addressing these constraints would enhance the

generalisability, explanatory power, and depth of future resilience assessments. Accordingly, this subsection delineates the study's key limitations and outlines specific directions for future research that build directly upon the present findings.

A primary limitation lies in the study's focus on a specific regional sample, Sarawak. Although this focus facilitates in-depth contextual analysis, it does not capture the full extent of national heterogeneity in economic structures, healthcare access, and socio-cultural resilience. To improve external validity, future research should adopt a comparative design encompassing both Sarawak and Sabah, employing probability proportional to size (PPS) two-stage cluster sampling at the district and enumeration-area levels. This approach is particularly well-suited for reaching indigenous longhouse communities, interior settlements, and peri-urban townships. To reflect Peninsular Malaysia's dynamics, matched urban–rural corridors (e.g., Kuching/Kota Kinabalu and surrounding rural belts, as well as one urban–rural corridor in Peninsular Malaysia) can be incorporated to explore infrastructure-access gradients. In light of the heterogeneity observed in Chapter 4, oversampling the M40 income group, while maintaining B40 and T20 representation, would enable sharper subgroup comparisons. Targeted subsamples (e.g., female-headed households, gig workers, and older adults aged 60 and above) would further allow analysis of differential adaptive capacities within income strata. This design preserves comparability with the present study while significantly enhancing national representativeness.

A second limitation concerns temporal scope. The current analysis relies on three- and five-year horizons for index construction and a one-off cross-sectional dataset for individual-level variables. While this stabilises estimates, it may understate long-run

structural change and policy effects. To capture such dynamics, future work should employ a longitudinal cohort design with three annual waves, enabling estimation of within-household changes in EV and HR via household fixed-effects and random-intercept multilevel models (households nested within communities or districts). Where policy rollouts or eligibility thresholds exist (e.g., mobile clinics, transport subsidies, targeted primary care expansions), quasi-experimental approaches, such as difference-in-differences and regression discontinuity designs, could enhance attribution of changes in resilience to specific interventions rather than macroeconomic trends, thereby improving policy relevance.

A third limitation involves reliance on self-reported measures for several sensitivity and capacity constructs. While subjective perceptions are essential for capturing lived experiences, they are prone to reporting biases and awareness effects. Future studies should adopt a mixed-source strategy that integrates subjective responses with objective administrative and contextual data. Household survey data, for instance, could be ethically linked to clinic and outreach registries (e.g., utilisation, referrals, immunisation), and to local price/market series for food and transportation to triangulate perceived strain with observable conditions. In parallel, geospatial accessibility should be assessed using network-based travel-time metrics via road and river networks to the nearest clinics or markets, with 30-minute catchments used as a standard. These data can be merged with HRI sub-components on distance and utilisation.

To strengthen measurement quality, the current exploratory factor analysis (EFA)–based scales can be refined through confirmatory factor analysis (CFA) and structural

equation modelling (SEM). Measurement invariance (configural, metric, scalar) should be tested across B40, M40, T20 income groups and major ethnic categories to ensure construct comparability. Where item response properties differ, Item Response Theory (IRT), specifically the graded response model, can be used to derive empirically grounded item weights and reliability coefficients (ω). Given the multilingual context, cognitive interviewing and rigorous translation/back-translation (e.g., Bahasa Malaysia, Iban, Mandarin) should be conducted to reduce item misfit and enhance construct validity.

A further limitation lies in the breadth of determinants included. Although key economic and social variables were considered, other critical dimensions, such as psychological resilience, digital financial inclusion, and informal support networks, were not explicitly modelled. Future studies should extend the framework to incorporate validated psychological scales, indicators of digital account use, financial literacy, and metrics of bonding/bridging social capital and community participation. To explain some of the counterintuitive findings observed in the current analysis (e.g., elevated EV among some T20 households, higher HR among M40 groups), an explanatory sequential design could be employed. This would involve purposively sampling households in the top and bottom deciles of EV and HR indices for semi-structured interviews, using qualitative insights to refine hypotheses related to risk exposure, debt servicing, lifestyle obligations, and the buffering role of social capital, particularly in rural areas.

To evaluate the robustness of findings, the EV and HRI indices can be recomputed using alternative aggregation techniques (e.g., PCA-based weights, AHP/MCDA, harmonic mean) and subjected to bootstrap or jackknife resampling methods to quantify uncertainty,

particularly around asset and healthcare-access components. Although the study reports significant associations and group-level differences, causal inference remains constrained by potential confounding and selection biases. To mitigate these limitations, future analyses should apply causal adjustment techniques such as propensity score weighting and augmented inverse probability weighting (AIPW or doubly robust estimators) when comparing treated versus untreated groups, especially in observational settings. These methods can reduce bias from observed covariate imbalances and improve the credibility of estimated effects.

Finally, while the study is situated within the Malaysian context, its empirical focus on Sarawak limits its immediate generalisability. Nonetheless, the findings serve as a policy-relevant baseline for one diverse state and lay the groundwork for future multi-state studies. Although the depth and contextual specificity of the Sarawak sample are defensible, external validity can be improved by replicating the study across multiple states that capture Malaysia's urbanised and less-developed settings. Stratified or cluster sampling should be employed to ensure cross-site comparability. To determine whether patterns observed in Sarawak (e.g., unexpected behaviours among T20 households) are generalisable, future research should oversample analytically salient groups and examine whether observed differences persist after adjusting for regional context. Methodologically, multi-level models (households nested in districts/communities) and measurement invariance checks across sites and income strata will help disentangle contextual from compositional effects. Additionally, qualitative follow-ups in sites that replicate or diverge from the Sarawak findings will clarify the underlying mechanisms.

In sum, the proposed extensions systematically address each limitation of the current study: broader geographic coverage through multi-site PPS sampling; enhanced temporal depth via longitudinal and quasi-experimental designs; stronger measurement through data triangulation and modern psychometrics; richer explanatory insights via mixed-methods approaches and expanded determinants; and improved causal inference using robust statistical adjustments. Collectively, these enhancements would increase both the internal and external validity of resilience research in Malaysia, sharpen our understanding of underlying mechanisms, and generate evidence that is more actionable for policy-making.

5.5 Final Remarks

This study has developed economic vulnerability and health resilience indexes, providing a comprehensive framework for assessing the relationship between economic stability and health adaptability. These indexes are uniquely designed to capture both macro-level economic exposures and individual-level resilience factors, offering a more holistic perspective on socioeconomic well-being. Unlike traditional measures that focus solely on economic performance or health outcomes in isolation, these indexes integrate key vulnerability indicators, such as income stability, employment security, and healthcare accessibility, with resilience determinants, including adaptive capacity and social support networks. This multidimensional approach enhances the understanding of how economic conditions influence health outcomes and vice versa. Beyond their application in this study, these indexes hold significant potential for broader use in policy formulation, economic planning, and public health strategy development. They can serve as valuable tools for governments, researchers, and international organizations seeking to assess resilience levels across different regions or demographics. By adapting these indexes to various economic

contexts, stakeholders can develop targeted interventions that mitigate economic vulnerabilities and strengthen health resilience. Ultimately, these indexes offer a scalable and adaptable framework, paving the way for more data-driven decision-making in fostering socioeconomic stability and long-term well-being.

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APPENDICES

Appendix A: Survey Questionnaire



INTERPLAY BETWEEN ECONOMIC VULNERABILITY AND HEALTH RESILIENCE IN MALAYSIA

Dear Respondent,

Greetings!

Thank you for agreeing to take part in this research study. The purpose of this questionnaire is to gather valuable insights on the interplay between economic vulnerability and health resilience in Malaysia. Your participation will greatly contribute to our understanding of this important topic.

Please read the instructions carefully and provide honest and accurate responses. Your responses will be treated confidentially, and the data collected will be used for research purposes only. Your anonymity and privacy will be strictly maintained throughout the study.

Instructions:

- Please answer all the questions to the best of your knowledge and abilities.
- There are no right or wrong answers. We are interested in your honest opinions and experiences.
- If you feel uncomfortable answering any particular question, you may skip it and move on to the next.
- Your participation is voluntary, and you may withdraw from the study at any time without any consequences.
- The estimated time to complete this questionnaire is approximately 20 – 30 minutes.

Confidentiality:

- Your responses will be kept strictly confidential.
- Your data will be anonymized and reported in aggregate form, ensuring that individual participants cannot be identified.
- The data collected will be used solely for research purposes and will not be shared with any unauthorized third parties.

Thank you once again for your valuable contribution. Your participation is highly appreciated.

Sincerely,

Liew Yew Kang (yewkang98@hotmail.com)

Your Demographic Profile

Instruction: Please answer the following questions by placing a tick (✓) in the bracket or by writing your answer above the line.

1.	What is your gender? *	☐ Male	☐ Female
2.	What is your age? *	_____ years old	
3.	What is your height? *	_____ cm	
4.	What is your weight? *	_____ kg	
5.	What is your ethnic group? *	☐ Malay ☐ Chinese ☐ Indian ☐ Sarawak indigenous, please state your ethnicity: _____ ☐ Sabah indigenous, please state your ethnicity: _____ ☐ Others, please specify : _____	
6.	What is your religion? *	☐ Islam ☐ Christian ☐ Buddhist ☐ Free-thinker ☐ Hindu ☐ Others, please specify: _____	
7.	What state / federal territory do you live in? *	☐ Johor ☐ Penang ☐ Kedah ☐ Perak ☐ Kelantan ☐ Perlis ☐ Kuala Lumpur ☐ Putrajaya ☐ Labuan ☐ Sabah ☐ Malacca ☐ Selangor ☐ Negeri Sembilan ☐ Terengganu ☐ Pahang ☐ Sarawak	
8.	In which division of Sarawak do you live? *	☐ Betong ☐ Mukah ☐ Bintulu ☐ Samarahan ☐ Kapit ☐ Sarikei ☐ Kuching ☐ Serian ☐ Limbang ☐ Sibu ☐ Miri ☐ Sri Aman	
9.	Please state your district. *	_____	
10.	What is your highest level of education you have completed ? *	☐ Pre-school education / no formal education ☐ Primary education ☐ Lower secondary education ☐ Upper secondary education or equivalent ☐ Post-secondary / pre-university studies ☐ Diploma education or equivalent ☐ Advanced diploma or equivalent ☐ First degree or equivalent ☐ Master's degree or equivalent ☐ Doctoral degree or equivalent ☐ Professional qualification or equivalent	
11.	Please specify the name of the degree / professional programme you have completed. *	_____	
12.	When did you completed your highest qualification? *	_____	

13.	What is your marital status? *	☐ Single / never married ☐ Married ☐ Widowed ☐ Divorced ☐ Separated											
14.	Are you an income earner in your family? *	☐ Yes ☐ No If No, why? _____											
15.	What is your main / primary employment status? *	☐ Government employee ☐ Private sector employee (Full-time) ☐ Private sector employee (Part-time) ☐ Employer (Business Owner with employees) ☐ Own account worker (Business Owner without employees) ☐ Intern, trainee, or apprentice ☐ Gig Worker ☐ Unpaid family worker ☐ Unemployed: ☐ Temporary Unemployed ☐ Long-term Unemployed ☐ Caregiver ☐ Housewife ☐ Government pensioner ☐ Private pensioner ☐ Others, please specify : _____											
16.	How much do you earn from your main / primary employment stated above? *	RM _____											
17.	About how many hours altogether did you work in the past 7 days? *	_____ hours											
18.	Beside your primary employment, did you do any other activities to generate income? *	☐ Yes ☐ No											
19.	What is your secondary occupation / second main activity? *	_____											
20.	How much do you earn from your secondary employment stated above? *	RM _____											
21.	About how many hours altogether did you work in the past 7 days? *	_____ hours											
22.	What is your monthly total household income? *	<table border="1"> <tr> <td>☐ Below RM2,000</td> <td>☐ RM8,001 – RM10,960</td> </tr> <tr> <td>☐ RM2,001 – RM3,500</td> <td>☐ RM10,961 – RM15,000</td> </tr> <tr> <td>☐ RM3,501 – RM4,850</td> <td>☐ RM15,001 – RM20,000</td> </tr> <tr> <td>☐ RM4,851 – RM6,000</td> <td>☐ More than RM20,000</td> </tr> <tr> <td>☐ RM6,001 – RM8,000</td> <td></td> </tr> </table>		☐ Below RM2,000	☐ RM8,001 – RM10,960	☐ RM2,001 – RM3,500	☐ RM10,961 – RM15,000	☐ RM3,501 – RM4,850	☐ RM15,001 – RM20,000	☐ RM4,851 – RM6,000	☐ More than RM20,000	☐ RM6,001 – RM8,000	
☐ Below RM2,000	☐ RM8,001 – RM10,960												
☐ RM2,001 – RM3,500	☐ RM10,961 – RM15,000												
☐ RM3,501 – RM4,850	☐ RM15,001 – RM20,000												
☐ RM4,851 – RM6,000	☐ More than RM20,000												
☐ RM6,001 – RM8,000													

Your Economic Strain

		Never	Seldom	Sometimes	Usually	Almost always
		1	2	3	4	5
1.	In general, it is hard for me and my family to live on our present income. *	☐	☐	☐	☐	☐
2.	I experience money problems. *	☐	☐	☐	☐	☐
3.	Financial problems interfere with my work and daily routine. *	☐	☐	☐	☐	☐
4.	I worry about financial matters. *	☐	☐	☐	☐	☐
5.	Financial problems interfere with my relationships with other people. *	☐	☐	☐	☐	☐
6.	I worry about disappointing my children because I can't give them things they want. *	☐	☐	☐	☐	☐
7.	I worry about having money to celebrate holidays and other special occasions. *	☐	☐	☐	☐	☐
8.	I put off family activities (such as vacations, movies or special events) because of the expense. *	☐	☐	☐	☐	☐
9.	I feel frustrated because I can't afford the education or training I need to get ahead. *	☐	☐	☐	☐	☐
10.	I have to put off getting medical care for family members because of the expense. *	☐	☐	☐	☐	☐
11.	I have to put off getting dental care for family members because of the expense. *	☐	☐	☐	☐	☐
12.	I feel bad that I can't afford to buy my children brand name clothing that other children their age are wearing. *	☐	☐	☐	☐	☐
13.	Compared with other families in Malaysia, would you say your income is.... *	☐ far below average. ☐ below average. ☐ average. ☐ above average. ☐ far above average.				

Household Resilience Assessment

1.	How far (one way) is the household dwelling from the closest accessible/ functioning [SERVICE] in minutes (walking distance)?	
	a) ... workplace... *	_____ minutes
	b) ... school... *	_____ minutes
	c) ... public hospital/ health facility... *	_____ minutes
	d) ... market... *	_____ minutes
	e) ... public means of transport... *	_____ minutes
2.	What describes your household best about your liquid asset? *	☐ We never have many liquid assets ☐ We have some liquid assets, but the amount changes a lot during the year ☐ We have some liquid assets, and the amount changes a little during the year. ☐ We always have many liquid assets.
3.	How much money do you have in savings? *	☐ None or nearly none ☐ Some, but the amount changes a lot during the year ☐ Some, but the amount changes a little during the year ☐ We always have a lot of savings
4.	How would you describe your household's productive assets?	☐ None or nearly none ☐ A little of productive assets ☐ Some productive assets ☐ A lot of productive assets

5.	How many [DURABLES/ASSETS] do the household members own?				
a)	...properties (home, land or commercial lots)... *	_____			
b)	...vehicles... *	_____			
c)	...electric home appliances... *	_____			
d)	...ICT devices... *	_____			
e)	...financial assets... *	_____			
6.	Do the household members use [SERVICES]?				
a)	...drinking water services * (Examples: Coway, Cuckoo, Kangen Water)	☐	Yes	☐	No
b)	...subscription services * (Examples: TM Unifi, Maxis Home Fibre, Astro, NetFlix)	☐	Yes	☐	No
c)	...public healthcare services * (Examples: MOH Clinics, General Hospital, Health Clinics)	☐	Yes	☐	No
d)	...private healthcare services * (Examples: KPJ Specialist Hospital, Private Clinic)	☐	Yes	☐	No
e)	...private tutoring and enrichment services * (Examples: Kumon, Eye Level, Tuition Classes)	☐	Yes	☐	No
f)	...homecare services * (Examples: Cleaning services, Elderly care, Home cooking)	☐	Yes	☐	No
g)	...online retail services * (Examples: Lazada, Shopee, Zalora, GrabMart)	☐	Yes	☐	No
Food Security					
7.	How many meals does your household typically consume in a day? *		_____ meals		
8.	What is the amount of money spent on the food consumed by the household members during the past 7 days? *		RM _____		
		Never	Rarely	Sometimes	Often
		0	1	2	3
9.	In the past four weeks, did you worry that your household would not have enough food? *	☐	☐	☐	☐
10.	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources? *	☐	☐	☐	☐
11.	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources? *	☐	☐	☐	☐
12.	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources? *	☐	☐	☐	☐
13.	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food? *	☐	☐	☐	☐
14.	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food? *	☐	☐	☐	☐
15.	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food? *	☐	☐	☐	☐
16.	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food? *	☐	☐	☐	☐
17.	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food? *	☐	☐	☐	☐

Your Perception on Sensitivity to External Factors

How sensitive		Not sensitive at all	Slightly sensitive	Moderately sensitive	Quite sensitive	Very sensitive
		1	2	3	4	5
Economic Conditions						
1.	...is your household's financial well-being to fluctuations in the overall economy? *	☐	☐	☐	☐	☐
2.	...is your job security to changes in the overall economy? *	☐	☐	☐	☐	☐
3.	...is your household's financial stability to an economic downturn? *	☐	☐	☐	☐	☐
4.	...is the availability of affordable housing for your household's financial stability? *	☐	☐	☐	☐	☐
5.	...is your household's financial well-being to the cost of living? *	☐	☐	☐	☐	☐
Employment Status						
6.	...is your household's financial stability to unemployment or underemployment? *	☐	☐	☐	☐	☐
7.	...is your household's financial well-being to job insecurity? *	☐	☐	☐	☐	☐
8.	...is your household's income to variations in job availability? *	☐	☐	☐	☐	☐
9.	...is your household's income to changes in employment status? *	☐	☐	☐	☐	☐
10.	...is your household's livelihood to the inability to secure stable employment? *	☐	☐	☐	☐	☐
Market Forces						
11.	...are you to changes in market demand regarding household income and livelihood? *	☐	☐	☐	☐	☐
12.	...are job opportunities to technological advancements in your industry? *	☐	☐	☐	☐	☐
13.	...is the profitability of your household business or industry to market competition? *	☐	☐	☐	☐	☐
14.	...is your household's income to changes in consumer preferences and demands? *	☐	☐	☐	☐	☐
15.	...is your household's income to changes in prices of essential goods and services? *	☐	☐	☐	☐	☐
Natural Disasters						
16.	...are you to potential disruptions caused by natural disasters regarding household livelihood? *	☐	☐	☐	☐	☐
17.	...is your household's income and livelihood to damage from floods, landslide, or droughts? *	☐	☐	☐	☐	☐
18.	...are households relying on vulnerable sectors to natural disasters? *	☐	☐	☐	☐	☐
19.	...is your household's income to the destruction of crops and livestock due to natural disasters? *	☐	☐	☐	☐	☐
20.	...is your household's ability to sustain livelihood activities to natural disasters? *	☐	☐	☐	☐	☐
21.	...is the threat of climate change for your household's long-term planning? *	☐	☐	☐	☐	☐
Health Crises						
22.	...are you to the degree of disruption caused by outbreaks of diseases or pandemics on your household livelihood? *	☐	☐	☐	☐	☐
23.	...is your household's job stability and income to health crises? *	☐	☐	☐	☐	☐
24.	...is your household's financial well-being to reduced business activity during health crises? *	☐	☐	☐	☐	☐
25.	...is your household's financial stability to increased healthcare expenses during health crises? *	☐	☐	☐	☐	☐
26.	...is your household income to job loss or reduced working hours due to health crises? *	☐	☐	☐	☐	☐
27.	...is the cost of healthcare for your household's financial stability? *	☐	☐	☐	☐	☐
Social and Political Factors						
28.	...are you to the impact of social unrest, political instability, or conflicts on your household livelihood? *	☐	☐	☐	☐	☐

How sensitive		Not sensitive at all	Slightly sensitive	Moderately sensitive	Quite sensitive	Very sensitive
		1	2	3	4	5
29.	...is your household to loss of property, displacement, or restricted economic opportunities caused by social and political factors? *	☐	☐	☐	☐	☐
30.	...is your household's financial well-being to insecurity and instability caused by social or political factors? *	☐	☐	☐	☐	☐
31.	...is your household's access to opportunities to discrimination or social exclusion? *	☐	☐	☐	☐	☐
32.	...is your household's economic mobility to changes in social or political dynamics? *	☐	☐	☐	☐	☐
Education and Skills						
33.	...is your household's livelihood prospects to access to quality education? *	☐	☐	☐	☐	☐
34.	...are your household's job options and income potential to a lack of education or skills mismatch? *	☐	☐	☐	☐	☐
35.	...is your household's livelihood resilience to developing and improving skills? *	☐	☐	☐	☐	☐
36.	...is your household's income potential to the availability of training and skill development programs? *	☐	☐	☐	☐	☐
37.	...is your household's job prospects and income to access to educational opportunities and vocational training? *	☐	☐	☐	☐	☐
Social Support Systems						
38.	...is your household's livelihood to the availability and effectiveness of social safety nets and welfare programs? *	☐	☐	☐	☐	☐
39.	...are community support networks in providing valuable assistance during challenging times for households? *	☐	☐	☐	☐	☐
40.	...are social support systems in mitigating vulnerabilities and enhancing your household's financial resilience? *	☐	☐	☐	☐	☐
41.	...is the accessibility of financial assistance programs for coping with economic challenges? *	☐	☐	☐	☐	☐
42.	...is your household's well-being to the effectiveness of community-based initiatives in supporting livelihoods? *	☐	☐	☐	☐	☐
43.	...is your household's ability to recover from job loss to the effectiveness of unemployment benefits or job placement services? *	☐	☐	☐	☐	☐

Your Perceived Loneliness

		None of the time	Rarely	Some of the time	Often	All of the time
		1	2	3	4	5
1.	I experience a general sense of emptiness. *	☐	☐	☐	☐	☐
2.	There are plenty of people I can rely on when I have problems. *	☐	☐	☐	☐	☐
3.	There are many people I can trust completely. *	☐	☐	☐	☐	☐
4.	I miss having people around. *	☐	☐	☐	☐	☐
5.	There are enough people I feel close to. *	☐	☐	☐	☐	☐
6.	I often feel rejected. *	☐	☐	☐	☐	☐

Your Experienced Social Support

		Not true at all	Hardly true	Moderately true	Mostly true	very true
		1	2	3	4	5
1.	I experience a lot of understanding and security from others. *	☐	☐	☐	☐	☐
2.	I know a very close person whose help I can always count on. *	☐	☐	☐	☐	☐
3.	If necessary, I can easily borrow something I might need from neighbors or friends. *	☐	☐	☐	☐	☐
4.	I know several people with whom I like to do things. *	☐	☐	☐	☐	☐
5.	When I am sick, I can without hesitation ask friends and family to take care of important matters for me. *	☐	☐	☐	☐	☐
6.	If I am down, I know to whom I can go without hesitation. *	☐	☐	☐	☐	☐

Your Experienced Social Discrimination

		Never	Rarely	Occasionally	Sometimes	Frequently	Usually	Every time
		1	2	3	4	5	6	7
1.	At any time in your life, have you ever been unfairly fired? *	☐	☐	☐	☐	☐	☐	☐
2.	For unfair reasons, have you ever not been hired for a job? *	☐	☐	☐	☐	☐	☐	☐
3.	Have you ever been unfairly denied a promotion? *	☐	☐	☐	☐	☐	☐	☐
4.	Have you ever been unfairly stopped, searched, questioned, physically threatened or abused by the police? *	☐	☐	☐	☐	☐	☐	☐
5.	Have you ever been unfairly discouraged by a teacher or advisor from continuing your education? *	☐	☐	☐	☐	☐	☐	☐
6.	Have you ever been unfairly prevented from moving into a neighbourhood because the landlord or a realtor refused to sell or rent you a house or apartment? *	☐	☐	☐	☐	☐	☐	☐
7.	Have you ever moved into a neighbourhood where neighbours made life difficult for you or your family? *	☐	☐	☐	☐	☐	☐	☐
8.	Have you ever been unfairly denied a bank loan? *	☐	☐	☐	☐	☐	☐	☐
9.	Have you ever received service from someone such as a plumber or car mechanic that was worse than what other people get? *	☐	☐	☐	☐	☐	☐	☐

Your Perceived Environmental Impact

To what extent do you perceive the risk of [ISSUE] impacting your household?		No impact	Low impact	Medium impact	High impact
		0	1	2	3
1.	...flooding... *	☐	☐	☐	☐
2.	...landslides... *	☐	☐	☐	☐
3.	...air pollution... *	☐	☐	☐	☐
4.	...water pollution... *	☐	☐	☐	☐
5.	...deforestation... *	☐	☐	☐	☐
6.	...climate change... *	☐	☐	☐	☐
7.	...waste management... *	☐	☐	☐	☐
8.	...noise pollution... *	☐	☐	☐	☐
9.	...loss of traditional knowledge... *	☐	☐	☐	☐
10.	...illegal wildlife trade... *	☐	☐	☐	☐

Your Health Care Access

		Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
	<i>It is not a big problem for me to access health services in...</i>	1	2	3	4	5	6	7
1.	knowing where to go to get care. *	☐	☐	☐	☐	☐	☐	☐
2.	getting permission to go. *	☐	☐	☐	☐	☐	☐	☐
3.	getting money for treatment. *	☐	☐	☐	☐	☐	☐	☐
4.	distance to health services. *	☐	☐	☐	☐	☐	☐	☐
5.	having to take transport. *	☐	☐	☐	☐	☐	☐	☐
6.	not wanting to go alone. *	☐	☐	☐	☐	☐	☐	☐
7.	concerning about not having a female health worker. *	☐	☐	☐	☐	☐	☐	☐
8.	my ability to visit the hospital in case of personal health problem. *	☐	☐	☐	☐	☐	☐	☐

Your Resilience Level

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
1.	I am able to adapt when changes occur. *	☐	☐	☐	☐	☐
2.	I tend to bounce back after illness, injury, or other hardships. *	☐	☐	☐	☐	☐
3.	I can stay focused under pressure. *	☐	☐	☐	☐	☐
4.	I think of myself as a strong person when dealing with life's challenges and difficulties. *	☐	☐	☐	☐	☐
5.	I am able to handle unpleasant or painful feelings like sadness, fear, or anger. *	☐	☐	☐	☐	☐
6.	When faced with a problem, I can find a way to solve it. *	☐	☐	☐	☐	☐
7.	I can keep going even when things seem hopeless. *	☐	☐	☐	☐	☐
8.	I believe I can achieve my goals, even if there are obstacles. *	☐	☐	☐	☐	☐
9.	I am good at managing and balancing my daily responsibilities. *	☐	☐	☐	☐	☐
10.	I have a strong sense of purpose in life. *	☐	☐	☐	☐	☐

Appendix B: Ethical Clearance Form

Deputy Vice Chancellor's Office
(Research and Innovation)
Human Research Ethics Committee
(Non Medical)
Tel: 082 581222/1223
Fax: 082 665115

**UNIVERSITI MALAYSIA
SARAWAK**
94300 Kota Samarahan

MEMORANDUM

Reference : UNIMAS/TNC(PI)/09-65/02 Jld.2 (24)

To : Dr Shirley Wong Siew Ling
Faculty of Economics and Business

From : Chair
Human Research Ethics Committee (Non Medical)

Date : 17 January 2025

Subject : **Research Ethics Approval for Non-Medical Research on Humans**

With reference to the above, I would like to inform you that your application for research ethics clearance was discussed in the 13th Human Research Ethics Committee (Non-medical) meeting 4/2024 on 2 December 2024. Your application for research ethics has been approved.

Title of project :	Assessing the Interplay between Economic Vulnerability and Health Resilience: A Multidimensional Analysis of Malaysia
No. Ethics Approval :	HREC(NM)/2023 (2)/24
Principal Investigator :	Dr Shirley Wong Siew Ling (Universiti Malaysia Sarawak)
Co-researcher(s):	Liew Yew Kang (Universiti Malaysia Sarawak) Dr Rosita binti Hamdan (Universiti Malaysia Sarawak) Nur Ain Syazwani binti Noraskin (Universiti Malaysia Sarawak)

Thank you.

Yours sincerely,

A handwritten signature in black ink, consisting of stylized, cursive letters that appear to be 'TSH'.

Professor Dr Ting Su Hie

c.c :Deputy Vice Chancellor (Research & Innovation)
:Director, UNIMAS Publisher
:Deputy Dean, Faculty of Economics and Business