DESIGNING THE RESILIENCE ECOSYSTEM FOR ENTREPRENEURS IN MALAYSIA'S RURAL TOURISM: A CONCEPTUAL MODEL

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ABSTRACT

The rural tourism sector is a vital destination that become a choice among tourist from domestic and international markets in Malaysia. Rural tourism activities, including homestays, campsites, adventures, cultural arts and crafts, culinary experiences, and ecotourism, significantly contribute to local economic development (LED). These activities are essential strategies frequently advocated to alleviate poverty and foster job creation, especially amid global trends towards decentralization and the transformation of governmental structures. However, tourism is a delicate sector, vulnerable to economic, social, political, and environmental issues, owing to its dependence on external variables. Natural disasters, economic downturns, terrorist incidents, and public health issues consistently jeopardize the sustainable development of the rural tourism sector. Aside from that, the COVID-19 pandemic profoundly impacted the progression of digital economy transformation in Southeast Asia, including Malaysia and its bordering nations, from early 2020 to the end of 2022. The digital revolution includes Artificial Intelligence (AI) usage is evidently a significant influence in societal transformation and will be the mediation in the ecosystem. The objective of this study is to design the resilience model for entrepreneurs in the Malaysia rural tourism ecosystem with the application of system dynamics to simulate the ecosystem. A causal loop diagram (CLD) is created to illustrate the feedback structure of the system. With the employment of Actor Network Theory, the study has analyzed the factors that contribute to the resilience of rural tourism's entrepreneurs within the impact of tourism crises in Malaysia, and identified two (2) main survival factors, which are adaptive capacity and spatial bricolage.

Keywords: *Resilience, Adaptive Capacity, Spatial Bricolage, System Dynamics, Artificial Intelligence, Malaysia*

INTRODUCTION

The rural tourism sector is a vital destination that become a choice among tourist from domestic and international markets in Malaysia. Rural tourism activities, including homestays, campsites, adventures, cultural arts and crafts, culinary experiences, and ecotourism, significantly contribute to local economic development (LED). These activities are essential strategies frequently advocated to alleviate poverty and foster job creation, especially amid global trends towards decentralization and the transformation of governmental structures. Rural tourism may be efficiently combined with rural development resources, which is essential for fostering regional economic growth (Aithal, Anil, & Angmo, 2023; Brown et al, 2022). However, the tourism industry relies on the movement of humans (Aminudin & Jamal, 2024; Yang, Li, & Tang, 2022). Tourism is a delicate sector, vulnerable to economic, social, political, and environmental issues, owing to its dependence on external variables (Dogru et al, 2019). Natural disasters, economic downturns, terrorist incidents, and public health issues consistently jeopardize the sustainable development of the rural tourism sector (Hall, 2017).

Tourism crises are unforeseen events that undermine tourists' confidence in a destination or disrupt the standard operations of the sector. Tourism crises can be categorized as external or internal (Wut, Xu, & Wong, 2021). The initial crisis, termed an "external emergency," is generally precipitated by uncontrollable circumstances, including environmental, economic, or social occurrences. Examples include Ebola, Middle East respiratory syndrome (MERS), severe acute respiratory syndrome (SARS), the September 11, 2001, terrorist attacks, the 2008 global economic crisis, the Zika virus outbreak, climate change, earthquakes, tsunamis, and other natural disasters (Wang, Wang, He, & Zhu, 2022). The internal crises of tourism encompass the decline in revenue and adverse effects on its operation and development (Wut et al., 2021), stemming from deficiencies in the development, management, and operation of tourism entities, inability to adapt to technological disruptions, and improper resource allocation and mismanagement (Gabriel-Campos et al., 2022). Aside from that, the COVID-19 pandemic profoundly impacted the progression of digital economy transformation in Southeast Asia, including Malaysia and its bordering nations, from early 2020 to the end of 2022. The digital revolution is evidently a significant influence in societal transformation. The swift and significant pandemic of COVID-19 has profoundly impacted all economies (Jones et al., 2023).

The prevention and control of the COVID-19 pandemic have attained a state of normalization. Although the disease has been effectively contained in Malaysia, its economic implications persist (Selamat et al., 2022). Furthermore, Malaysia has seen climate change-induced calamities in recent years. Deforestation has resulted in landslides and rising sea levels, potentially causing catastrophic floods that could further ravage the sector (Lu, 2022). The research states that "the economic effects of catastrophic weather disasters can be overwhelming," noting that the December 2021 floods in Malaysia incurred costs ranging from RM5.3 billion to RM6.5 billion. Increasing temperatures and significant weather fluctuations also affect productivity (Singh, 2022). For this reason, the business sector has acknowledged resilience as a strategic instrument for crisis management, enabling companies to maintain solvency and readiness to address various risks, particularly following natural disasters or other calamities. Adaptability in post-disaster contexts is correlated with resilience (Bartelet et al., 2024; Supardi & Hadi, 2020). Resilience solutions

should encompass coordination, diverse crisis management strategies, robust relationships among stakeholders, an extensive network, risk and opportunity identification, and swift, scalable responses (Alves, Lok & Luo, 2020).

Businesses can get resilient outcomes if they possess the capacity to manage both internal and external influences (Nanda et al., 2021). To ensure that growth is inclusive both in the short and long term, it is crucial to reduce the risk of disruptions while improving adaptability in managing and responding to diverse crises. Enhancing resilience necessitates addressing the impacts of: (i) climate change and environmental stressors; (ii) financial, health, and various crises; and (iii) technological improvements, especially the swift shift to a digital economy (Menon, 2024). Most experts recognize the shift in tourist preferences towards health, relaxation, and shorter domestic travel due to the pandemic. In the post-pandemic era, greater emphasis is required on the potential of rural tourism to fulfil this demand, regarding both products and proximity. The development of rural tourism is crucial for reinforcing poverty alleviation achievements, aiding the rural revitalization plan, and fulfilling various objectives (Wang et al., 2022), and it is integral to rural development strategy.

Artificial intelligence (AI) trend have become essential for revolutionizing industries by improving efficiency, decision-making, and innovation. Artificial Intelligence comprises many technologies, including machine learning, natural language processing, and computer vision, which are progressively employed throughout multiple sectors like as healthcare, finance, education, and marketing. AI-driven solutions in digital marketing facilitate personalized consumer experiences, predictive analytic, and automated content generation, markedly enhancing campaign results and audience engagement (Chaffey & Smith, 2022). In manufacturing, AI-driven robotics and predictive maintenance solutions enhance production processes and reduce downtime (Nguyen, Chen, & Lee, 2020). Notwithstanding these developments, hurdles including data privacy issues, ethical considerations, and skill deficiencies in workforce adaptability persist as significant obstacles to the extensive deployment of AI. Resolving these concerns necessitates collaborative endeavor among politicians, educators, and industry leaders to guarantee the appropriate and inclusive adoption of AI technologies (Dewi et al., 2025).

Consequently, the researcher has underscored the quintessential representation of the current state of enterprises in rural tourism in Malaysia, along with its resilience, which, in turn, demands that business operators or entrepreneurs be dynamic and responsive individuals attuned to specific circumstances (Sentosa et al., 2021; Ferreira et al., 2017). The objective of this study is to design the resilience model for entrepreneurs in the Malaysia rural tourism ecosystem with the application of system dynamics. The study has analyzed the factors that contribute to the resilience of rural tourism's entrepreneurs within the crisis in Malaysia, and identified two (2) main survival factors, which are adaptive capacity and spatial bricolage. This study will support the government's goals, which Malaysia aims to rank among the top 10 global tourism destinations for both visitor arrivals and receipts by 2030 (MOTAC, 2020). The Ministry of Tourism, Arts, and Culture is enhancing the overall quality of tourism product categories by focusing on product creation, strengthening facilitators, and mitigating barriers to growth and development. Moreover, the capacity to compete successfully and generate profit are essential elements of tourism resilience (Lu, 2022).

LITERATURE REVIEW

The Importance of Resilience Competency

Revitalizing the tourism industry will necessitate modifications including recommencement, reorganization, and adaptation to contemporary standards and regulations (Lew et al., 2020). The government's reaction to climate change and the imperative for a carbon-neutral economy will impact renewal (Rastegar, Seyfi, & Shahi, 2023). Post-pandemic, global economic and political institutions will transition towards proactive strategies that enhance sustainable tourism, address climate change, fortify local communities, and elevate the well-being of individuals globally. Presently, the topic of resilience in tourism is increasingly favored in research and policy analysis (Gocer et al., 2024). To have a comprehensive knowledge of this topic, it is essential to examine the notion of resilience from many disciplinary viewpoints. Resilience, in psychological terms, is the ability to respond effectively and surmount challenges (Ran, Chen, Wang, Wu, Zhang & Tan, 2020). It emphasizes the psychological and emotional efforts necessary for adaptation and recuperation from adverse circumstances. Manning, Ferris, Narvaez Rosario, Prues, and Bouchard (2019) contend that spiritual resilience is the ability to sustain self-comprehension through a framework of beliefs throughout stress, hardship, and trauma. Through robust spiritual devotion, it fosters resilience. In physics, resilience is characterized as elasticity; conversely, in business, resilience pertains to crisis preparedness or the execution of strategies for sustainability and flexibility in the face of disasters and emergencies (Martin, Ginns & Collie, 2023).

Currently, commercial organizations are evaluating their performance in other ways (Yeh, 2021; Kindermann et al., 2020). Historically, an organization's success was evaluated solely on its assets, market position, and liabilities (Jansson, Nilsson, Modig, & Hed-Vall, 2015). The concept of resilience increasingly impacts organizational performance (Kampel, 2020). In addition to adhering to economic and statutory standards, firms must amalgamate economic, environmental, and social performance to bolster resilience and promote sustainable growth (McCartney, Pinto & Liu, 2021; Jaswadi, Iqbal & Sumiadji, 2015). Businesses are experiencing a beneficial transition by associating their financial success with their social and environmental performance; this phenomenon is termed resilience (Zheng, Luo & Ritchie, 2021). Additionally, tourism constitutes a multifaceted industry involving various stakeholders, including governmental entities and their agencies, the hospitality sector, tour operators, transportation providers, the food and beverage sector, and retail establishments, among others (Wahyuninsih, Sentosa & Hizam, 2022; Zaman, Nadeem & Nawaz, 2020). Entrepreneurs in the tourism sector who engage directly with customers are essential components of the industry's supply chain and fulfill a vital function (Vax, Gidugu, Farkas & Drainoni, 2021).

This entrepreneur's community emphasizes aspects of the environmental, cultural, and historical legacy of a region that may be marketed as a tourism destination (Chin et al., 2021). The collective actions and endeavors of these individuals and organizations consistently manifested and transformed the elements, aspects, viewpoint, and forecasts of tourism's

growth (Carroll & Conboy, 2020). Loi and Sentosa (2015) believe that both the tourism supply chain and entrepreneurs significantly influence the overall competitiveness of the destination. Furthermore, the emerging global economic paradigm requires a framework founded on resilience due to the Covid-19 pandemic (Sharma, Thomas & Paul, 2021). The competency of resilience has been recognized by the business community as a tool for crisis management and a strategy for business continuity and adaptability to diverse risks (Vax et al., 2021). To examine the resilience of rural tourism, it is essential to address certain inquiries, such as: How swiftly do rural tourism entrepreneurs react to and recuperate from tourism crises? To what extent do rural tourist entrepreneurs maintain the sustainability of their enterprises in a dynamic and challenging environment? Although it is a fundamental inquiry, it necessitates comprehensive analysis and resolution in an academic context. Envisioning resilience as a survival mechanism and the ability to endure despite challenges is central to all these concepts.

The Critical Factors of Resilience

Adaptive Capacity

Jakku and Lynam (2010) define adaptive capacity as a system's ability to modify itself in response to perceived or actual stress to sustain or achieve a desirable state. The tourism sector can be regarded as an integrative system, characterized by interconnected elements, agents, and their behaviors (Hartman, 2016), and is considered one of the least prepared major industries for the threats and opportunities posed by climate change (Schliephack & Dickinson, 2017). Adaptive posits that tourism zones must be dynamic, perpetually evolving entities that participate in an ongoing process of renewal and reorganization to maintain or improve their performance (Sharin, Shamsudin, & Sentosa, 2023). Fostering adaptive capacity is intrinsically linked to sustainable tourism development (Singh et al., 2021) as it can facilitate, for instance, increased policy flexibility for innovative and sustainable tourism practices, avert decline, enhance the reutilization of previous tourism investments, and create employment opportunities (Hartman, 2016). Complexity emerges in systems when interactions among components generate feedback loops in their cause-and-effect linkages. This indicates that the effects of a modification in the initial component on the subsequent components function as feedback to the initial component itself. Hartman (2016) emphasizes significant factors that enhance the adaptive capability of tourist destinations. It highlights the existence of several governance issues to address when creating sites for adaptive tourism (Phan, Jou, & Lin, 2021).

Simultaneously, the heightened dynamism of changes in the external environment has escalated the imperative for enterprises to enhance their adaptive capacity in recent years. A company's capacity to adapt to change is essential for its survival (Bartelet et al., 2024). A small to medium enterprise (SME) is more susceptible to challenges when its adaptability is constrained; yet a SME with robust adaptive capability may effectively navigate unforeseen conditions (Wahyono & Hutahayan, 2020). Organizations enhance their adaptive capacity and reduce their vulnerability through both reactive and proactive measures (Cheer & Lew, 2018). Enterprises can enhance their adaptive capacity through four primary variables: (i) Adapting to change and uncertainty; (ii) Cultivating variety for resilience; (iii) Integrating

diverse knowledge types for learning; (iv) Generating opportunities for self-business to support the sustainability of small and medium-sized enterprises (Tian, Wei, & Xi, 2018).

Spatial Bricolage

Spatial bricolage, a distinct form of entrepreneurial bricolage, exemplifies a localized activity. It is characterized as "utilizing combinations of available resources to address new challenges and opportunities within the current spatial context" (Korsgaard et al., 2018). Baker and Nelson's (2005) original definition of "at hand" has experienced a minor yet notable modification. Spatial bricolage underscores that entrepreneurs can leverage resources they do not entirely possess or govern. Moreover, spatial bricolage regards geographical context as a valuable resource. Korsgaard et al. (2018) proposes three strategies to aid entrepreneurs in managing limited resources: (i) local sourcing; (ii) commodification through storytelling; and (iii) community involvement. Local sources of resources, under the framework of spatial bricolage, refer to the material and immaterial resources accessible in the immediate spatial environment. According to Kang (2017), physical resources encompass landscapes, natural features, artificial constructions, and materials that are low-cost or free. Culture, history, and practices exemplify intangible resources specific to a particular region (AlQershi, Abas, Bin, & Mokhtar, 2021). The second sort of activity, termed "commodification through storytelling," delineates how entrepreneurs employ tales to enhance their products and services with local tangible and intangible resources. The narrative construction and commodification of regional customs and environments confer authenticity to the company's products and enhance their worth (Anderson, 2000). Thirdly, community involvement entails engaging with locals through jobs, collaborations, and exchanges. Korsgaard et al. (2018) asserts that non-traditional labor sources, including volunteers, retirees, and those with impairments, constitute accessible human resources for organizations struggling to recruit or retain personnel. These individuals are generally dedicated staff who are either more economical or adaptable.

Historically, the term "bricolage" was first introduced in 1962 in Lévi-Strauss's work La pensée sauvage to illustrate how individuals engage with their surroundings. While Lévi-Strauss did not define this notion, business theory generally perceives it as a type of creativity that arises spontaneously to fulfill a particular need utilizing the resources at the disposal of an individual, referred to as "the bricoleur." It is the capacity to "utilize available resources" (Baker & Nelson, 2005). Bricolage was consequently associated with the notion of social resource generation to achieve a "practical" comprehension of operational mechanisms (Fisher, 2012). Bricolage has been utilized to characterize entrepreneurship as the process of repurposing and amalgamating resources, which, when integrated without a specific goal or strategic application, aid individuals in navigating unpredictable circumstances. Both definitions pertain to the characterization of organizational practices associated with innovation as an alternative approach to routine activities (Putra, Romli & Arkeman, 2021; Baker & Nelson, 2005).

This principle has developed into the foundation for the concept of entrepreneurial bricolage, which posits that in a resource-constrained environment, an entrepreneur has three alternatives: (1) pursuing external resources; (2) avoiding challenges through passivity, downsizing, or fragmentation; and (3) adopting bricolage by utilizing various accessible resources to tackle emerging problems and opportunities. Consequently, in a resource-limited context, organizations may utilize entrepreneurial bricolage to surmount these constraints and maintain competitiveness (Baker & Nelson, 2005; Levi-Strauss, 1962). Recent findings by Park and Seo (2024) indicate that small and medium-sized firms (SMEs) utilizing bricolage strategies have more resilience than those that depend solely on traditional crisis management approaches. Their resilience depends on their ability to increase resource availability. Small and medium-sized firms (SMEs) must exhibit adaptability in their behaviors to enhance resource availability and identify innovative methods for resource transformation when confronting crises.

The Lens of Actor Network Theory

The actor-network theory (ANT) is a transformative framework that seeks to reconceptualize actors as all entities, whether human or nonhuman, that influence or disrupt the functioning of a techno-social system, rather than solely as intentional agents (Unsworth, 2024). This theory influences the framework of the network, facilitating the resilient evolution of rural tourism through strategic transformation, including the development of new tourism packages and structural modifications, to adapt to future changes (Deason et al., 2021). Actor-Network Theory (ANT) provides an innovative viewpoint on players and agencies within tourism, development, and conservation research (Duim, Ampumuza, & Ahebwa, 2014; Alcouffe, Berland & Levant, 2008). Although there is a new call for Actor-Network theory to facilitate a "radical democratic inclusivity of the non-human" in addressing ecological issues, its use in research concerning climate change and crisis outbreaks in tourism remains infrequent (Hetherington, 2020). Consequently, innovation in the material aspects of tourism, business procedures, or operations is essential for tourism entrepreneurs (Sentosa et al., 2022).

Van der Duim (2005), the author of Tourismscape, identifies three pertinent elements of Actor-Network Theory (ANT) in relation to tourism. The primary elements of Actor-Network Theory (ANT) are the principle of symmetry (Law, 1994), which allows for the inclusion of non-human entities, as "tourist things" (Liao et al., 2022) are integral to tourism alongside the visitors themselves. Typically, non-human entities utilized in tourist operations encompass governmental bodies, digital platforms, systems, equipment, religious artifacts, cultural and historical treasures, the environment, and natural resources. Duim (2005) theoretically delineates these qualities according to the materiality of tourism, categorized into three types: (i) bodies for bodies; (ii) objects; (iii) Information and Media (Law & Hetherington, 1999).

The Actor-Network constitutes the second element in the tourism-centric narrative of Actor-Network Theory (Duim, 2005). The actor and the network are interconnected, akin to their relationship in any other sector. The theory examines the relationships and interactions among actors to identify structural explanations for actions and events (Renato, Jillian, Kari & Jeff, 2022). This theory offers a rational elucidation of the mechanisms by which effects are generated (Jones & Graham, 2003). It is delving farther by illustrating the connection

between emotions and other disparate interests. The establishment of a logical methodology indicates that this theory is subject to testing, and to corroborate assumptions, an inquiry may be conducted (IvyPanda, 2019).

The third emphasis of ANT is on translation (Duim, 2005), which examines the factors enabling players to enact and represent a relationship or network in tourism through the definition of their roles. Beard, Scarles, and Tribe (2016) assert that in the context of tourism research, Actor-Network Theory (ANT) functions primarily as a translation instrument or a framework of concepts for narrative construction (Oppenheim, 2007), rather than as a philosophical or epistemological constraint (Tribe, 2004). Each actors on the network as equally important.

This theory aims to eliminate the duality between human and nonhuman, with actor-network theorists striving to transcend the distinctions between actor and structure, micro and macro, as well as global and local. These are all persistent issues in the social sciences (Duim, 2005). In actor-network theory, stakeholders cannot presume that the network's scale is either global or local, nor can they conclude that the network's size is limited or extensive. Consequently, the development of a resilience model for rural tourism entrepreneurs in this study utilizing system dynamics addresses the necessity for all components to be significant within the same ecosystem.

MODEL DEVELOPMENT

The system dynamics methodology has been employed in this study to address various specific issues. Literature contains studies that utilized system dynamics across numerous areas, including healthcare, finance, environmental issues, agriculture, and higher education. In 2018, evidence indicates an increasing trend in the application of system dynamics within the tourism sector. Employed a system dynamics metamodel to address complicated challenges and developed an original system dynamics model to examine various factors such as policies, sustainability, and the logical outcomes for different stakeholders within a selected regional rural tourism business (Mustafa & Hawari, 2022).

A causal loop diagram (CLD) is created to illustrate the feedback structure of the system. Link polarity is employed to demonstrate variations that may indicate positive or negative polarity. In CLD, the arrows denote the causal relationships between variables, with plus (+) and minus (-) marks indicating the direction of effect (Hawari & Rozari, 2022). The plus sign represents a direct correlation, indicating that an increase in the cause results in a corresponding increase in the effect, whereas a drop in the cause leads to a decrease in the effect (Figure 1). Future research can continue to develop the stock flow diagram by utilizing additional steps in system dynamics, such as data calibration and the incorporation of data and equations for the simulation. This will enhance the final simulation model, which will assess the resilience of rural tourism entrepreneurs in Malaysia.

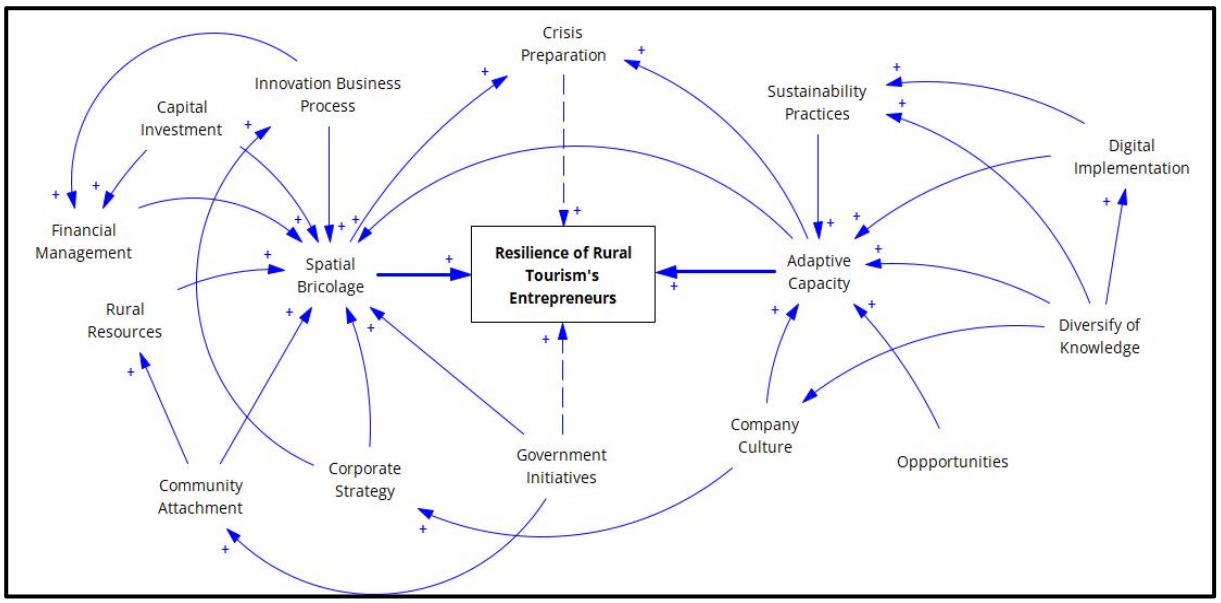

Figure 1. Causal Loop Diagram for Resilience Model of Rural Tourism's Entrepreneurs in Malaysia

Figure 1 illustrates a causal loop diagram for the initial phase of a simulation model for the resilience of rural tourism entrepreneurs in Malaysia. It identifies two primary survival factors (spatial bricolage and adaptive capacity) that contribute to the resilience of entrepreneurs, along with thirteen sub-factors: crisis preparation, innovation in business processes, capital investment, financial management, rural resources, community attachment, corporate strategy, government initiatives, company culture, opportunities, diversification of knowledge, digital implementation, and sustainability practices, which enhance the efficiency of these two competencies for entrepreneurs (Gupta & Peschken, 2022).

Singh et al. (2023) endorsed this establishment of models for future research and presenting case studies of innovation and adaptation to illustrate how rural tourism may contribute to the socioeconomic advancement of rural areas. In the aftermath of challenging periods such as the recent COVID-19 pandemic, it is essential to enhance the theory and practice of rural tourism by providing in-depth insights into the recovery and growth strategies utilized by stakeholders in varied rural tourism destinations. The resilience framework is an essential tool for assessing adaption processes and identifying the most appropriate policy options. A decision-making process and associated actions are executed to maintain the ability to address current or anticipated future changes (Sharin, Sentosa, & Perumal, 2022).

CONCLUSION AND RECOMMENDATION

Resilience is essential for sustaining enduring organizational excellence. Rural tourism entrepreneurs may find solace in the understanding that resilience is not an inherent quality and cannot be attained through extraordinary methods. They can develop their resilience. The

simulation of resilience model introduced in this study will serve as a significant resource and direction for rural tourism entrepreneurs seeking support in navigating their endeavors within the shifting business landscape. The future simulation model with consideration of several factors such as business model design, resource orchestration, risk mitigation, and strategy execution, to assure survival during crises and to facilitate recovery and address future uncertainties.

Furthermore, we can simulate complex dynamic systems to gain insights into their behavior over time using system dynamics, a methodology for holistic analysis. This research elucidates the influence of two primary survival factors (spatial bricolage and adaptive capacity) on the resilience of rural tourism sectors in the country's economy. In addition, this study advocates responsible tourism (Yakti et al., 2024; Wen Keat & Musa, 2014), highlighting its potential to influence various industries, including income, gross domestic products, employment opportunities, and national sustainability goals. The resilience of rural tourism is progressively bolstered by the implementation of artificial intelligence (AI) methods, which improve operational efficiency and consumer interaction while fostering responsible tourism. Artificial intelligence technologies, including machine learning algorithms, predictive analytic, and natural language processing, empower tourism communities to enhance resource management, optimize guest experiences, and mitigate environmental impact (Dewi et al., 2025).

Finally, the simulation results provide a foundation for policymakers to formulate judgments concerning tourism development strategies. Additional investigation is advised in the subsequent domains. The methodology employed in this research ought to be implemented in several nations, thereby augmenting the data accessible for future comparisons of cost-benefit aspects in infrastructure projects across diverse cultural contexts. Encapsulating information from the activities in a general system dynamics model that can parameterize for diverse scenarios would be advantageous. Future research is required as well related the impact of the COVID-19 pandemic on tourism and the economy in Malaysia using system dynamics modeling.

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