Article

Infrastructure expansion and its environmental impact on micro-business profitability and sustainability

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Abstract: This study investigates the impact of toll road construction on 59 micro, small, and medium enterprises in Kampar, Pekanbaru, and Dumai cities. The research aims to analyze the economic and environmental effects of infrastructure expansion on businesses' profitability and sustainability, providing insights for policymakers and stakeholders to develop mitigation strategies to support MSMEs amidst ongoing infrastructure development. Structural equation modeling, spatial environmental impact analysis, and qualitative data analysis using five-level qualitative data analysis (FL-QDA) were all used together in a mixed-methods approach. Data collection involved observations, interviews, questionnaires, and geospatial analysis, including the use of a Geo-Information System (GIS) supported by drone reconnaissance to map affected areas. The study revealed that the toll roads significantly enhanced connectivity and economic growth but also negatively impacted local economies ($\beta = 0.32$, $R^2 = 0.60$, P-value ≤ 0.05). and the environment ($\beta = 0.34$, P-value ≤ 0.05), as 49% of respondents experienced a 50% decrease in profitability. To mitigate the risk of impact, policymakers should prioritize the principle of prudence to evaluate the significance of mitigation policy implementation ($\beta = 0.144$, P-value ≥ 0.05). In a nutshell, toll road construction significantly impacts MSMEs' business continuity, necessitating an innovative strategy involving monitoring and participatory approaches to mitigate risk.

Keywords: infrastructure development; environment; sustainability; profitability; insolvency

1. Introduction

Development becomes part of the demands of society to achieve progress and prosperity. Infrastructure development carried out by the government is based on the increasing population growth rate and the increasing public need for infrastructure facilities. One form of facility provided by the government to meet the needs of the community and promote economic equality is the construction of toll road routes. Social and economic changes occur due to the conversion of people's land, which is often used for business space, green environments, agriculture, and residential areas, into toll roads. The construction of this toll road will impact people's life patterns in terms of livelihood, income, and social status (Murshed, 2022; Stagl, 2005). Micro and small and medium enterprises (MSMEs) that stand around the toll road construction are no exception (Manulang and Samosir, 2019). Every toll road construction will inevitably cause several problems for the community both directly

and indirectly, including environmental impacts that will cause the income of people who carry out business activities to be reduced and even threatened with bankruptcy (Greening et al., 1996).

According to a study by Manullang and Samosir (2019); Sandhyavitri and Saputra (2019) on the Trans Sumatra toll road and Aeni et al. (2021); Herianto and Utomo (2012) in the construction of toll roads in Central Java, it was identified that infrastructure development is a form of government service for the community. However, the presence of toll roads in an area will hurt the community both socially and economically, when development requires the conversion of productive land into land for toll roads (Kim and Woo, 2022). This is different from the results of panel data analysis (Brown et al., 2005) or regression (Kim and Woo, 2022) done by Ikhwan and Nugroho (2019) shows that the existence of toll roads increases economic growth in the districts/cities it crosses. Therefore, the agenda of expanding the coverage of districts/cities reached by toll roads must be continued to support balance and equitable development (Stagl, 2005). Meanwhile, other factors in the form of human resources and sector contributions also affect economic growth (Oliveira and Jabbour, 2017). This research problem is formulated as follows: (i) Does the construction of this toll road impact the sustainability of MSMEs around the Pekanbaru-Kampar and Dumai-Pekanbaru toll roads if the environmental risk is not mitigated?; (ii) Does the construction of the Pekanbaru-Kampar and Dumai-Pekanbaru toll roads cause a decrease in MSME profits/income; (iii) How does the construction of the Pekanbaru-Kampar and Dumai-Pekanbaru toll roads affect business sustainability and profitability; (iv) Where is the location point of MSME business space that is most affected by the construction of the Pekanbaru-Kampar and Dumai-Pekanbaru toll roads. Henceforth, the research objectives are threefold as follows: (i) To evaluate the impact of toll-road construction on sustainability if environmental risks are not mitigated; (ii) To investigate the impact of toll-road construction on profitability and to evaluate how toll-road construction impacts the profitability and sustainability of MSME businesses; (iii) To identify the extent of the impact of toll-road construction in the Pekanbaru-Kampar-Dumai area.

The previous studies that have been carried out have different methods, locations, and times. As a novelty, this study provides reinforcement and improvisation to previous research so that there is a better understanding of the environment and small businesses in areas affected by toll roads in areas that have not been explored by previous research. There is a lack of quantitative methodologies to assess sustainability in the civil construction industry, with material, project management, business sustainability assessment, and energy being the main areas explored (Lima et al., 2021). After synthesis, this study has three aspects of the state of the art: (i) The development of the current state which refers to the evidence gap and empirical gap. Research by Kim and Woo (2022) conveying that there are negative or positive impacts from the development of new infrastructure, it needs more attention, especially to MSME actors; (ii) Methodological gap. Research in this domain has used a variety of methodologies, showing developments in research approaches (Gormley et al., 2011); (iii) Research gap. Although many studies have been conducted, there is still a need to better understand the long-term impact (Aluko et al., 2022) formulate solutions that can reduce the negative impact of toll road infrastructure development

along the Bangkinang-Pekanbaru and Dumai regions. This research will provide views and input for stakeholders in determining policies and efforts to develop MSMEs with the existence of infrastructure development in Riau Province. In addition, this study includes the relationship between the impact of toll roads on environmental aspects and assessments of business sustainability on profitability and insolvency and risk mitigation using a mixed method.

The results of this study have several significant contributions. First, it can provide a better understanding of the relationship between infrastructure expansion and microenterprises. By analyzing the impact of infrastructure on the profitability and sustainability of small businesses, this research can reveal how local infrastructure development affects the minor business sectors in society. The second contribution is the focus on environmental impacts. This article emphasizes the environmental impact of infrastructure expansion on micro-enterprises, which has often not been the main focus of previous research. The mixed approach used, combining qualitative and quantitative methods in the analysis, is an essential contribution as it allows the research to provide a more comprehensive and in-depth view of the impact of infrastructure on microenterprises and the surrounding environment. In addition, this article has the potential to address the issue of sustainability, i.e., how infrastructure growth can affect the sustainability of small businesses, which is increasingly relevant in the context of the emphasis on economic and environmental sustainability. The results of this study can also provide a basis for more thoughtful policy-making in infrastructure development, primarily if negative impacts on microenterprises and the environment are found and how to mitigate the problems. Finally, the contribution of this article to the academic literature in various disciplines, such as infrastructure, microenterprise, sustainability, and mixture analysis, is expected to enrich our knowledge in these areas and provide a foundation for further research.

2. Methods

A preliminary survey is requisite to ascertain the ramifications of development through spatial analysis, which serves the dual purpose of delineating the geographic coordinates of Micro, Small, and Medium Enterprises (MSMEs) and creating comprehensive business profiles within the vicinity impacted by the construction of the toll road. In alignment with the delineation of research problematics and the articulation of research objectives, the employed methodological approaches encompass the discipline of management science, the empirical methodology, and the deterministic causal analysis, all underpinned by the tenets of descriptive qualitative research.

2.1. Geo spatial environment impact analysis

The utilization of the management science approach further facilitates the assessment of operational and financial risks faced by MSMEs as a consequence of environmental degradation and functional transitions. Simultaneously, the empirical approach harnesses primary data sources, obtained directly from respondents, to rigorously and accurately scrutinize conformance with the postulations, premises, and assumptions intrinsic to this research endeavor. As a first step to obtain relevant data

as expected, researchers will use several methods, including observation, interviews and questionnaires and also environmental mapping using geo-spatial analysis (Kim and Woo, 2022). In order to facilitate the delineation of profiles and the cartographic representation of impacted micro, small, and medium enterprises (MSMEs), a Geo Information System (GIS) was employed for precise geolocation, complemented by aerial reconnaissance conducted via drone aircraft, which subsequently generated a comprehensive geographic representation of the affected region. The subject of investigation in this study encompasses micro, small, and medium enterprises (MSMEs) situated along the 186.7 km construction route of the 55.7 km Pekanbaru-Bangkinang, Kampar, and 131 km Dumai-Pekanbaru toll roads.

2.2. Five-level qualitative data analysis (FL-QDA)

Observation is carried out directly, intended to record information directly in the field. While interviews are conducted with oral activities to obtain information (Creswell and Poth, 2016). The form of information obtained is expressed in writing, or recorded audio, image or audio-visual (Woolf and Silver, 2017). The questionnaire is a list of questions containing a set of questions related to the research problem. In this study, a questionnaire will be submitted to MSME actors. The analysis that will be used in this study is a qualitatively mixed-method that will be carried out using Five-Level Qualitative Data Analysis (FL-QDA) using NVIVO support (Bazeley, 2000; Edwards-Jones, 2014). To measure qualitative analysis based on the responses provided in the dataset, the steps shall be applied as follows: (i) Review the variables and identify the ones that contain information related to the impact of toll road development on the environment and MSMEs. For example, propose questions such as: "How does toll road development impact your business?" and "What is your opinion on the impact of toll road development on environmental sustainability?" may provide insights into the environmental impact. (ii) Analyze the impact on MSMEs Examine the responses related to the impact of toll road development on MSME by finding specific examples or cases where MSME face challenges due to environmental degradation caused by infrastructure development and record the details provided by the respondents, such as decreased revenue or changes in business operations. (iii) Assess the responses regarding whether MSME in the area have taken steps to reduce their environmental impact caused by infrastructure development and evaluating the sustainable practices, adoption of environmentally friendly technologies, collaboration with environmental organizations, or advocacy for stricter environmental regulations.

2.3. Structural equation model (SEM) on environment impact analysis

Moreover, an in-depth analysis of survey responses is conducted to assess the efficacy of actions undertaken by Micro, Small, and Medium Enterprises (MSMEs), with the primary objective of appraising the effectiveness of measures taken by MSMEs in mitigating their environmental footprint. This analysis encompasses the examination of both positive outcomes and challenges encountered by MSMEs in the implementation of these measures. Furthermore, the study undertakes a comprehensive review of survey responses to discern the prevailing environmental

issues stemming from infrastructure development within the study area. Particular emphasis is placed on identifying recurring themes or concerns articulated by respondents, such as air pollution, deforestation, soil erosion, and loss of biodiversity.

Additionally, the study extends its purview to the assessment of the level of environmental consciousness exhibited by MSMEs in the study area. This entails an exploration of MSMEs' understanding of the potential environmental repercussions associated with infrastructure development and their willingness to proactively address these concerns. The overall sustainability of MSMEs is also rigorously evaluated, with a careful examination of survey responses to gauge the extent to which MSMEs adopt long-term perspectives, integrate sustainable practices, and conscientiously consider the environmental ramifications of their operational activities. Building upon this comprehensive analysis, the study proceeds to interpret the findings derived from the Environmental Impact Assessment (EIA), providing a nuanced assessment of the overarching impact of toll road development on both the environment and the MSMEs situated within the study area. Referring to various concepts from Lion et al. (2013), this study also uses Structural Equation Model Partial Least Square (SEM-PLS) to see the impact of toll road construction to test and measure the relationship between latent variables (which are not directly measured) and observational variables (which are measurable) in a model. This makes it possible to understand cause-and-effect relationships between various constructs in the model directly and indirectly. Hypotheses are inferred from each of the interrelationships between variables, as follows:

H1: $\beta_1 \neq 0$, The toll road construction affects business profit and insolvency if the risk is not mitigated.

H2: $\beta_2 \neq 0$, Business sustainability is affected if the risk of toll-road construction establishment is not mitigated.

H3: $\beta_3 \neq 0$, The environmental issues affect the business sustainability and profitability if the risk of toll-road construction is not mitigated.

2.4. Research design

The sampling methodology employed herein can be categorized into two principal classes: probability sampling and non-probability sampling. In the context of this study, a probability sampling technique is employed due to its equitable allocation of sampling opportunities across all elements (or members) of the target population. Additionally, the data collection methodology utilized herein relies on a simple random sampling technique.

The target population for this study includes a population (*N*) of micro-small medium enterprises located along Pekanbaru-Kampar and Dumai-Pekanbaru toll road constituting *N* = 70 MSME owners, consisting of 68 micro businesses, 1 small business and 1 medium business owner who are permanent and non-nomadic business owners. Meanwhile, around 36 MSME business units are located at toll road stops and entrances and 34 other units are along toll roads but not at toll road stops and entrances. The criteria for MSME businesses refer to Law no. 20 of 2008, namely for micro businesses, having a maximum income of Rp. 50 million, with an annual income of Rp. 300 million; small businesses with assets of Rp. 50 million–Rp. 500 million with

annual revenues of more than Rp. 50 million to Rp. 500 million and Rp. 300 million to Rp. 2.5 billion; and medium businesses of Rp. 500 Million–Rp. 10 Billion, with annual sales of Rp. 2.5 Billion–Rp. 50 Billion. The sampling technique uses non-probability sampling through the convenience and purposive sampling approach, by taking data from people who provide information comprehensively and have businesses around the toll road. The determination of the number of samples using the Kritchie method at $\alpha = 0.05$ is around 59 people.

At the beginning of the study, there were 102 MSME businesses around the toll road, but the 32 business owners were business owners who were nomadic or did not provide accurate information. Because this will give bias to the research. Therefore, the researcher reduced the number of observed population (N) to 70 people with a sample (N) of 59 people. The filling in of data by the respondents was preceded by giving instructions for filling in and giving the most basic questions about whether the respondents were the owners or not, trying to settle down or move around. If the MSMEs are nomadic, they will be excluded as a non-respondent. Filtering of respondent data is carried out at each stage of the research. For qualitative data, trail audits and peer debriefing are carried out, namely by. Meanwhile, to see the validity and reliability of qualitative data, it was done by analyzing the outer loading data. If the latent variable indicator is less than 0.70, it is not included in further calculations (Hair et al., 2019).

To prevent unfocus, complexity, and repetition of the analysis results, the data analysis used in this study is limited to data analysis techniques that answer the formulation of the research problem comprising: (i) using geospatial analysis to find out and describe the affected location; ii) using qualitative data analysis to see the community's response to the decrease or increase in profits and how the impact of toll construction on the environment, thus affecting their income; (iii) using quantitative analysis in the form of a structural equation model (SEM) to evaluate the impact of risks and mitigation due to the construction of toll roads. Utilizing the aforementioned equations, we gauge the environmental impact of toll road construction predicated on survey responses. Subsequently, we can derive the values of these variables by applying the available data, thereby affording us a more concrete and empirically grounded assessment. In accordance with the principles of descriptive statistics, this study has drawn upon a sample comprising Micro, Small, and Medium Enterprises (MSME) stakeholders situated in regions influenced by the construction of the Bangkinang toll road, encompassing a total of 59 MSME stakeholders. An examination of respondent demographics reveals that the gender composition comprises 47 MSME stakeholders, constituting 80 percent of whom are female, with an additional 12 MSME stakeholders, representing 2.0 percent, being male.

Based on the level of education, it can be seen that the education level of respondents is mostly high school education or equivalent, consisting of 2 MSME owners or 3 percent with a bachelor's education from all respondents. Then as many as 51 MSME owners, or 86 percent, have senior high school education, and 2 MSME owners, or 3.0 percent, have junior high school education and the other 4 or 7% are graduates from elementary schools. In addition, there are 38 people, or 64 percent, with a business income of less than 5 million rupiah per month; 19 business people, or 32 percent, have an income of more than 5 million rupiah to 50 million per month; and

only 2 people, or only 3 percent of people, have an income above 50 million rupiah.

In addition, interviews have been done with MSMEs affected by the toll-construction of Pekanbaru-Kampar-Dumai in Riau Province, including: 13 of business owner of "Lopek Bugih Cake" in the Kampar area, 13 producers of "Gulai Ikan Baur" in Simpang Muara Fajar, Pekanbaru area, 13 producers of "Bengkalis Sago Noodles" and Lempok Durians Cake"in Balairaja, Bengkalis area, 13 business owner of "Bolu Kemojo" Cake in Kota Duri, Bengkalis area and 7 of pineapple producers in Bagan Besar, Dumai City.

3. Results

3.1. Location point of the affected business space

Analyzing the geographic distribution, as illustrated in **Figure 1**, reveals that a substantial majority of respondents primarily dwell in the proximity of Pekanbaru, encompassing 50 percent of the total respondent cohort. Pekanbaru City, specifically within the Kecamatan Rumbai district, emerges as a pivotal epicenter for souvenir procurement. This is primarily attributed to its strategic geographic positioning, serving as both the embarkation point for motorists entering the Pekanbaru-Dumai toll road and the final destination for those traversing the Bangkinang-Pekanbaru toll road. Conversely, the remaining 25 percent of respondents maintain residences at a relatively greater distance from the Bangkinang toll road area, mitigating the intensity of the impact experienced. The route of data collection activity can be obtained in the form of a video at the following link: https://sl.ut.ac.id/LitDRTPM.

Figure 1 illustrates that before the operation of toll roads, economic activity in the Bangkinang to Dumai route corridor was dominated by food and grocery businesses, with an average profit margin of Rp. 1,200,000 to Rp. 3,749,000 per month. In this route, there are also retail trading businesses and restaurants that have an average profit margin above Rp. 4,000,000. After the operation of toll roads, there was an increase in the number of businesses moving from the Sumatran causeway to toll crossings in the Pinggir and Mandau and Bagan Besar in Bengkalis region, Dumai The reddish mapping area shows the extent of the impact of toll road construction on the existence of MSME businesses in the area where the toll road passes.

Micro, Small and Medium Enterprises (MSME) located in the Pekanbaru-Bangkinang toll road area, have more than 59 micro and small businesses, which are spread in Bangkinang District and Kampar area with one type of MSME produced, namely processed Kampar typical food called Lopek Bugih. Lopek Bugih traders around the twin bridges area of Bingkuang Lake, Palung Raya Village, Tambang District, estimate that the Pekanbaru-Bangkinang highway on the Riau-West Sumatra causeway will be quiet after the toll road operates. This area is one of the icons of various shopping centers typical of Kampar.
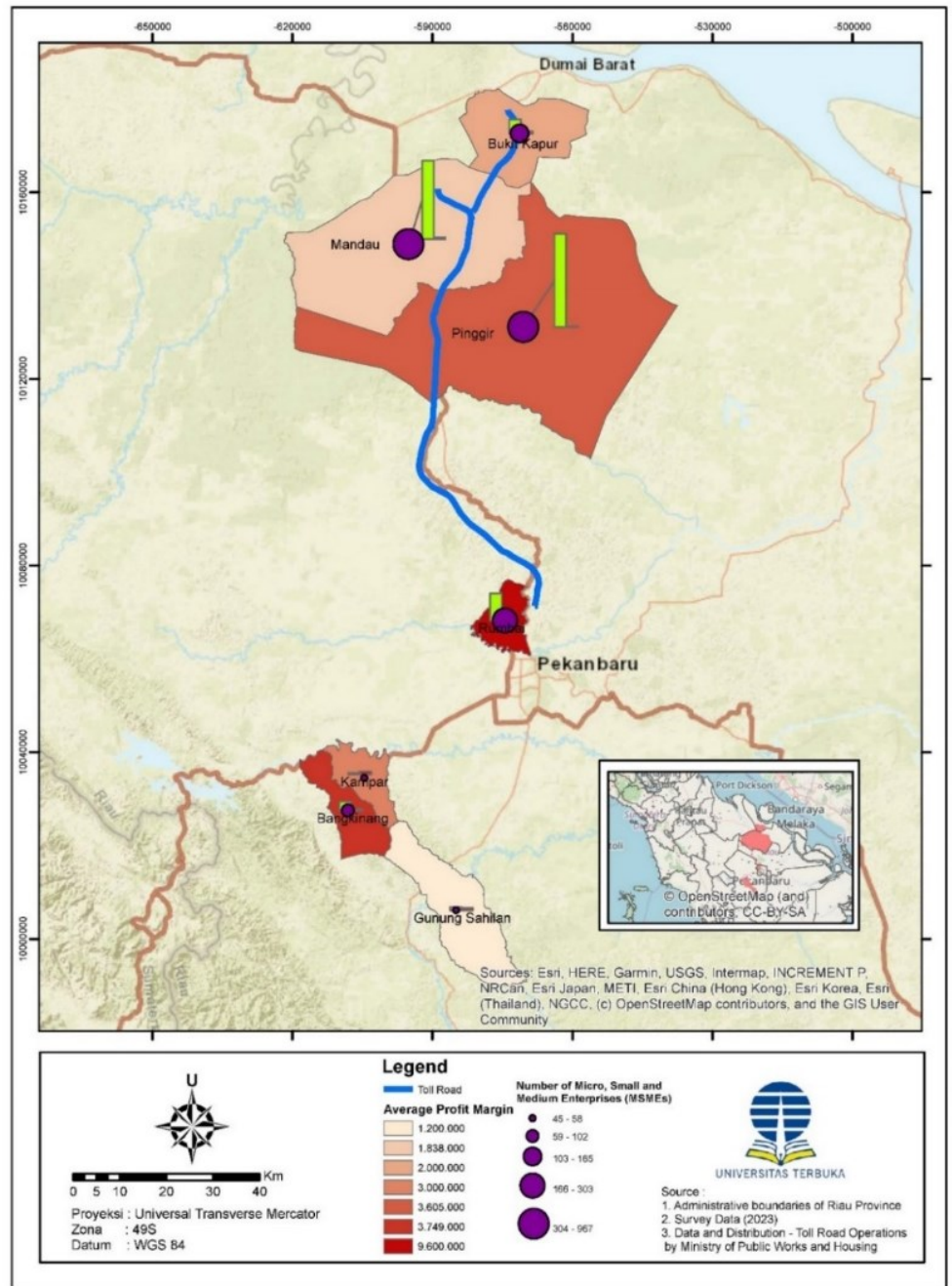
Figure 1. Map of the distribution of MSMEs affected by infrastructure development in Riau province.

Source: Geo Information System, made by Author (Copyrighted 2023).

3.2. Impact of the toll-road construction on environment, business profitability and sustainability

This research also incorporated qualitative data acquisition through observations and interviews conducted with 59 business proprietors located in the vicinity of toll roads. For instance, the producers of "Lopek Bugih" cakes expressed their desire for the government to establish a dedicated Kampar souvenir retail outlet within the rest area, thereby facilitating the continued viability of "Lopek Bugih" Micro, Small, and Medium Enterprises (MSMEs). Respondents elucidated their interest in producing "Lopek Bugih" cakes due to its status as an authentic product of the Kampar

community, which garners demand not only among local residents but also among individuals residing outside the Kampar community, who acquire the cake as souvenirs. Furthermore, respondents expressed their intent to establish an "Lopek Bugih" MSME cluster within the vicinity preceding the construction of the Bangkinang toll road, driven by the strategic location of the area. The route is a preferred choice for many motorists traveling towards West Sumatra and the Rokan Hulu Regency, rendering the region an ideal locale for the development of "Lopek Bugih" MSMEs. However, with the advent of the Bangkinang toll road, there has been a notable shift, as motorists no longer traverse this route to reach West Sumatra. Consequently, "Lopek Bugih" domestic industry workers have transitioned to roles in toll road construction due to the establishment of the toll road.

Several remarks were obtained regarding environmental impacts on income and business sustainability which were summarized on **Table 1** as follows:

Table 1. A summary of qualitative findings.

Comments	Coverage
Impact on the environment	
"There needs to be collaboration with environmental organizations"	15%
"Developers compensate for environmental damage"	15%
"The construction of toll roads does have an impact on the environment because of dust, dirt and deforestation of trees	15%
"Environmental degradation has a very negative impact on the sustainability of MSMEs"	15%
"Changing land use conversion into buildings with concepts while preserving the environment"	15%
"Environmental degradation does not have a significant impact on the sustainability of MSMEs"	14%
"Need to adopt eco-friendly technology"	3%
"There needs to be advocacy for stricter environmental regulations"	5%
"The presence of air pollution, soil erosion, noise pollution and biodiversity loss"	15%
"Developers are destroying land and neglecting environmental sustainability."	15%
"Developers must take responsibility by reforesting "	15%
"The road feels more congested by large lorry vehicles"	12%
"Changing land use conversion into buildings with concepts while preserving the environment"	15%
"Developer has committed to carrying out development without damaging the environment"	15%
"Be responsible by reforesting"	15%
"Implementation of sustainable green practices"	3%
"Environmental degradation does not have a significant impact on the sustainability of MSMEs"	14%
"Water pollution significantly degrades the quality of life"	15%
"Access to clean water sources for consumption are indispensable in production operations"	15%
Impact of Toll Road Construction	
"The impact is very beneficial for the community"	15%
"Toll roads make it easy to conduct business activities between regions"	15%
"The construction of toll roads causes deforestation, soil erosion and noise pollution"	15%
"The developer has also carried out greening around the toll road"	15%
"Toll road is very helpful in shipping logistics and supply chain"	15%
Impact on Business Profitability and Business Sustainability	
"Negative impact on revenue and business continuity in the future"	16%

Table 1. (*Continued*).

Comments	Coverage
"The business survives because this business has been passed down for generations before the existence of toll roads"	11%
"The construction of the toll road harms street vendors because of the loss of walk-in consumers"	15%
"Haven't seen yet the impact on the current business"	15%
"Business is proliferating because it is near the toll road access"	15%

Source: NVIVO qualitative data processing analytical results.

As for instance, the amount of income of MSME cluster of "Lopek Bugih" around the Pekanbaru-Bangkinang toll road for sellers who were established before the construction of the Pekanbaru-Bangkinang toll road, there is a fluctuating level of income generation. At an income level of IDR 6,000,000 before the construction of the Pekanbaru-Bangkinang toll road on one of the Lopek Bugih MSMEs. However, after the Pekanbaru-Bangkinang toll road operated, the level of revenue obtained was reduced to Rp. 3,000,000. This means that after the operation of the toll road, MSME "Lopek Bugih "experienced a 50% decrease compared to before the construction of the Pekanbaru-Bangkinang toll road.

Around 93% of "Gulai Ikan Baur" business actors who have an average income of Rp. 9,600,000 per month in the Muara Fajar intersection area said that the existence of toll roads had a positive impact and the rest said negatively. This also applies to the businesses "Bengkalis Sago Noodles" and "Durian Clay" (revenue = 3,650,000/month), and "Bolu Kemojo" (revenue = 1,838,000/month) in Balairaja and Duri City. This area is indeed a road passed by new toll roads.

However, for the "Pineapple" business cluster (revenue = Rp. 2,000,000), 40% moved and 1.6% closed due to financial difficulties due to revenue and business insolvency. 1.6% closed their businesses. This is due to the business location that was initially passed by logistics vehicles and passengers changed towards the direction passed by the toll road to shorten the trip. The condition of non-toll roads in the area also suffered damage because many vehicles were traversed by trucks transporting mining materials and palm oil.

Quality analysis can be conducted to assess the ramifications of toll road development on Small and Medium Enterprises (SMEs) and the environment. The dataset comprises responses from 59 respondents, including business owners and individuals with family members engaged in businesses near toll roads. These responses were elicited through a structured questionnaire, which delved into the effects of toll road construction on their businesses and the surrounding environment.

The findings reveal a discernible decrease in both customer footfall and revenue, particularly pronounced among smaller enterprises such as street vendors. However, it is noteworthy that some respondents also reported favorable outcomes, including improved accessibility and expanded business prospects. Furthermore, a substantial proportion of respondents firmly assert that toll road developers are responsible for safeguarding the environment and compensating affected businesses. They advocate for measures such as reforestation initiatives, the implementation of soundproofing measures, and equitable compensation for land acquisition as it has been included in the questionnaire.

Nevertheless, it is essential to note that there exists a diversity of viewpoints concerning the environmental impact of toll road construction. While some posit that it positively influences traffic congestion alleviation and air quality enhancement, others contend that it engenders deleterious effects such as deforestation, erosion, and biodiversity loss. Furthermore, respondents exhibit varying degrees of awareness and concern regarding environmental sustainability and the toll road's impact on SMEs. Some display a heightened awareness and advocate for prioritizing sustainability principles and minimizing adverse effects on SMEs. Conversely, some respondents exhibit limited awareness or concern on these matters.

3.3. The risk and mitigation of the toll-road construction impact on business sustainability and profitability

This exogenous construct measurement is carried out on the six latent variables where there are originally twenty-four indicators filtered into twenty-two indicators through an outer loading test (see **Figure 2**). Each indicator variable is embodied in several questions in the questionnaire that has been distributed showing a loading factor value of $\beta > 0.5$. The following are the results of the outer model test for exogenous constructs against endogenous constructs (see **Table 2**).

Table 2. Outer loading factor and validity-reliability test.

	Construct/item	Outer loading	Cronbach's α	ρ_A	CR	AVE	VIF
Y	**Profitability and Insolvency**		0.84	0.84	0.90	0.75	
Y1-1	Increased revenue after toll road construction	0.92					2.83
Y1-2	No losses due to toll road construction	0.85					1.81
Y1-3	Impact on insolvency after toll road construction	0.84					2.08
X1	**Toll-Road Construction Impact**		0.80	0.80	0.89	0.72	
X1-1	The general impact of toll road development on the business carried out	0.82					1.62
X1-2	The construction of toll roads has a positive impact on the business carried out	0.83					1.82
X1-3	There was a decrease in revenue from business after the construction of toll roads	0.89					2.36
X2	**Risk Mitigation**		0.84	0.84	0.89	0.68	
X2-1	Receive a form of compensation for toll road construction	0.73					1.67
X2-2	The form of compensation provided by the Developer is in accordance with the value of business assets	0.74					1.72
X2-3	Whether the compensation payment received is in accordance with the expected value	0.73					1.69
X2-4	Have scenarios to reduce the environmental impact caused by infrastructure development	0.74					1.83
X2-5	The effective steps taken by business actors in reducing the impact of environmental degradation	0.72					1.58
X2-6	Willingness to be moved to another place that has more business prospects (eg: rest area)	0.76					2.04

Table 2. (*Continued*).

	Construct/item	Outer loading	Cronbach's α	ρ_A	CR	AVE	VIF
X3	**Environment Risk**		0.80	0.82	0.87	0.62	
X3-1	Toll road construction has a destructive impact on environmental sustainability	0.73					1.85
X3-2	The positive impact of infrastructure development on environmental degradation in MSME areas is located	0.82					2.11
X3-3	Major environmental problems caused by the development of infrastructure development	0.78					1.59
X3-4	Awareness of businesses in your area about the potential environmental consequences of infrastructure development	0.83					1.82
X4	**Business Sustainability**		0.83	0.83	0.88	0.54	
X4-1	Overall business sustainability assessment	0.83					2.03
X4-2	Understanding the relationship between environmental degradation caused by infrastructure development and business sustainability	0.84					2.02
X4-3	The implementation of strategic measures to be taken environmental degradation significantly affects business aspects	0.86					2.21
X4-4	Knowledge of the existence of infrastructure development projects that cause sustainable environmental degradation	0.76					1.54

Source: Author estimation.
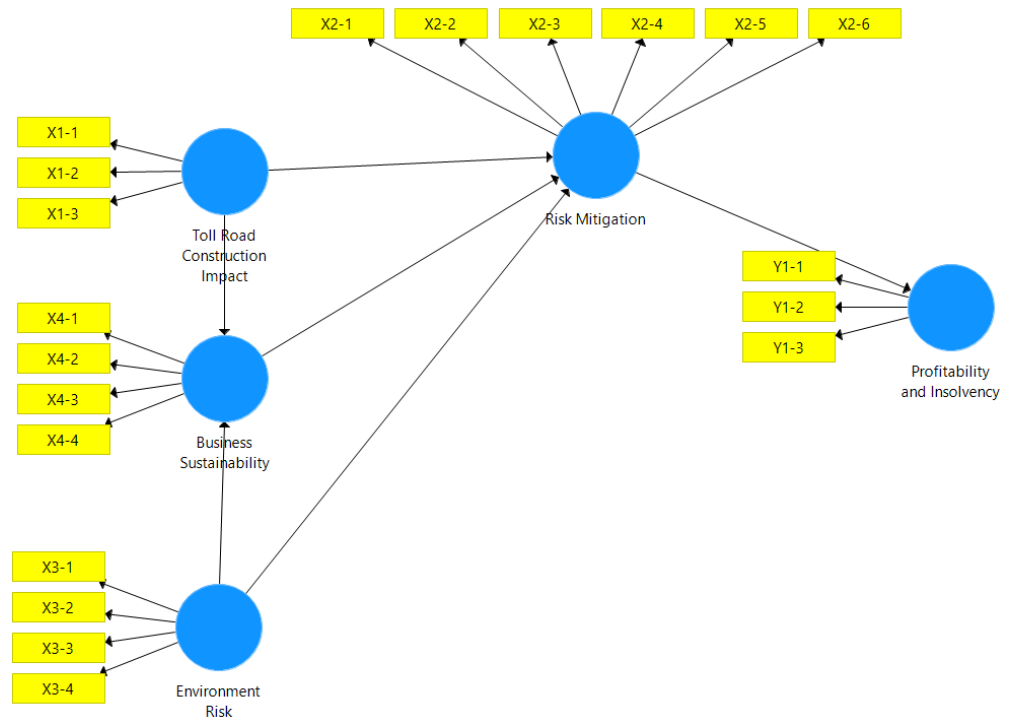
Figure 2. Diagram of structural equation model.

Based on the results of goodness of fit testing (Hair et al., 2019), it can also be seen on **Table 2** that all existing criteria have met the cut-off value, namely Average Variance Extracted (AVE) and construct reliability (CR) > 0.5. So that it can be concluded that the model is valid, it is proven that there is a match between the observation input and the predictions of the proposed model. In addition, all tests were declared to have reliability with a Cronbach Alpha value > 0.7 with an average

discriminant validity > 0.7. The robustness test shows that VIF > 3 means no collinearity issues on this data.

The result of discriminant validity can be viewed from **Table 3** the cross-loading value of each indicator against its construct. The combined set of indicators is not expected to be unidimensional (Fornell and Larcker, 1981). The measurement of discriminant validity shows a higher outer loading indicator value against other constructs.

Table 3. Discriminant validity.

Construct	Profitability and Insolvency	Toll-Road Construction Impact	Business Environment Sustainability	Risk Evaluation	Risk Mitigation Alternatives
Profitability and Insolvency	**0.87**				
Toll-Road Construction Impact	0.71	**0.85**			
Business Sustainability	0.58	0.62	**0.82**		
Environment Risk	0.53	0.38	0.53	**0.79**	
Risk Mitigation	0.78	0.59	0.74	0.62	**0.74**

Source: Author estimation.

R^2 value results on **Table 4** indicates respectively that profitability and insolvency and risk mitigation, more than 60 percent can explained its exogeneous variable. While the variable business sustainability is only 49 percent.

Table 4. R-square test.

	R Square	R-Square Adjusted
Profitability and Insolvency	0.60	0.61
Business Sustainability	0.49	0.47
Risk Mitigation	0.64	0.62

Source: Author estimation.

Table 5. Bootstrapping inner model test of the direct effect.

Direct Effect	O	M	SD	*T* Stat	*P*-Value
Toll-Road Construction Impact → Business Sustainability	0.49	0.49	0.09	5.26	0.000***
Toll-Road Construction Impact → Risk Mitigation	0.19	0.21	0.16	1.16	0.245
Toll Road Construction Impact → Profitability and Insolvency	0.32	0.34	0.13	2.46	0.014**
Business Sustainability → Risk Mitigation	0.47	0.44	0.13	3.52	0.000***
Business Sustainability → Profitability and Insolvency	0.36	0.35	0.10	3.61	0.000***
Environment Risk → Business Sustainability	0.34	0.35	0.11	3.17	0.002**
Environment Risk → Risk Mitigation	0.30	0.3	0.14	2.21	0.028**
Risk Mitigation → Profitability and Insolvency	0.78	0.79	0.05	15.28	0.000***

Note: *p-value < 0.10; **p-value < 0.05; *** *p*-value < 0.01.
Source: Author estimation.

Based on **Table 5**, regarding bootstrapping inner model test of the direct effect below, it can be concluded that there is a causal relationship that is not proven to be significantly directly related; it is the relationship between toll-road construction impact and risk mitigation ($\beta = 0.185$, $p = 0.245$). Whereas, toll road construction

significantly directly and positively influences business sustainability ($\beta = 0.490$, $p = 0.000$) and profitability/inslovency ($\beta = 0.320$, $p = 0.014$); business sustainability significantly directly and positively influences risk mitigation ($\beta = 0.471$, $p = 0.000$); environment risk significantly directly and positively influences business sustainability ($\beta = 0.340$, $p = 0.002$) and risk mitigation ($\beta = 0.340$, $p = 0.002$).A part from that is that risk mitigation also directly and significantly influences the profitability and insolvency of MSMEs, but not their sustainability.

Table 6 shows the indirect relationships between the construct variables. It shows that risk mitigation does not have a big effect on how toll road construction affects profits and insolvency ($\beta = 0.144$, $p = 0.239$), but other construct variables are linked positively and significantly.

Table 6. Bootstrapping inner model test of the indirect effect.

Indirect Effect	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	*T* Statistics	*P* Values
Environment Risk → Business Sustainability → Risk Mitigation → Profitability and Insolvency	0.13	0.12	0.05	2.45	0.015**
Business Sustainability → Risk Mitigation → Profitability and Insolvency	0.36	0.35	0.10	3.55	0.000***
Toll-Road Construction Impact → Business Sustainability → Risk Mitigation → Profitability and Insolvency	0.18	0.17	0.06	2.79	0.005**
Environment Risk → Risk Mitigation → Profitability and Insolvency	0.23	0.23	0.11	2.11	0.035**
Toll-Road Construction Impact → Risk Mitigation → Profitability and Insolvency	0.14	0.17	0.12	1.18	0.239
Environment Risk → Business Sustainability → Risk Mitigation	0.16	0.15	0.07	2.48	0.014**
Toll-Road Construction Impact → Business Sustainability → Risk Mitigation	0.23	0.22	0.08	2.91	0.004***

Note: *p-value < 0.10. **p-value < 0.05, *** *p*-value < 0.01
Source: Author estimation.

Table 7. Model of fit test.

Construct	SSO	SSE	Q^2 (=1 − SSE/SSO)
Profitability and Insolvency	177	98.24	0.45
Toll-Road Construction Impact	177	177	
Business Sustainability	236	162.62	0.31
Risk Evaluation	236	236	
Risk Mitigation	354	237.30	0.33
Model Fit	**Saturated Model**	**Estimated Model**	
SUMMER	0.089	0.10	
d_ULS	1.68	2.03	
d_G	1.127	1.22	ψ rms = 0.019
Chi-Square	622.46	42.14	
NFI	0.92	0.99	

Source: Author estimation.

In reference to Hair et al. (2019); Hu and Bentler (1999) from the model of fit

test in **Table 7**, it can be seen that the model is robust, which is explained by the root mean square residual equal to 0.089 (SRMR < 0.10) Q^2 value which is all positive (Q^2 > 0.025) and the NFI value = 0.90 (NFI > 0.80), ψ rms = 0.019 (ψ rms < 0.120).

4. Discussion

The analysis underscores the considerable influence that toll road development can wield on SMEs and the environment. Consequently, developers are responsible for mitigating detrimental effects and champion sustainability initiatives. Furthermore, Environmental Impact Assessment (EIA) corroborate the multifaceted nature of toll road development's impact, encompassing both positive and negative dimensions with environmental and SME considerations intertwined. Thus, it is incumbent upon toll road developers to uphold environmental protection standards and duly compensate affected businesses, while fostering awareness and proactive measures to curtail adverse environmental repercussions.

4.1. Specific impacts on MSMEs

In particular, based on qualitative data analysis, an average of 84% of MSME owners feel the positive impact of the toll road construction because it is the toll road access that makes it easier for them to be visited by customers. However, in some areas where toll road access has changed the direction of logistics travel that was originally passed by large vehicles, such as Kampar, the income has been reduced by almost half. However, from observations in the field, even though there is a reduction in income, the owners are still trying to survive. This is different from pineapple producers and sellers in the Bagan Besar area, some of whom have changed their sales locations closer to the toll road.

If we look at the results of the study in **Table 5**, it shows that the construction of toll roads directly affects profitability and insolvency (β = 0.32, *P*-value = 0.014). However, the effect can be positive as well as negative. This was also stated by some respondents who stated that the existence of toll roads would cause business to grow, or some others stated that the existence of toll roads would cause the loss of walking customers (see **Table 1**, comments on "Impact on Business Revenue and Sustainability"). Meanwhile, in the Bengkalis area, where toll roads pass MSME business locations, income tends to be stable and does not experience a significant decrease. 13% of entrepreneurs stated that environmental changes due to the construction of toll roads did not have an impact on their business.

From observations in the field, ecological impacts other than water pollution are not so complained about by business owners. Water pollution is still a concern for business owners because it affects their operations in carrying out production. Some respondents said that "water pollution significantly degrades the quality of life" and they need access to clean water sources for consumption for their production operations. So far, environmental damage such as deforestation, air pollution, and biodiversity loss has not fully affected the sustainability of MSME businesses around toll roads.

4.2. Influence on sustainability

The qualitative analysis reveals a 50% decrease in business sustainability on Bangkinang toll road, Pekanbaru-Kampar, but MSMEs entrepreneurs' optimism remains strong, despite the decrease, for instance, entrepreneurs in Balairaja and Duri City, Bengkalis This is in line with research conducted by Manullang and Samosir (2019); Utari and Fathimah (2023) which stated that 40%–50% of MSMEs experienced a decrease in business due to the construction of toll roads. However, of pineapple entrepreneurs around Bagan Besar 40% want to move their business closer to the toll road or sell in the rest area, and 1.6% close their business. Pineapple customers are mostly walk-in customers or trucks that will bring products to the city of Pekanbaru and its surroundings.

Meanwhile, based on quantitative analysis using a structural model, approximately 49% of businesses around the Pekanbaru-Kampar-Dumai area still survive in the next few years (see **Table 5** in the section on the relationship between toll road construction and business sustainability, $\beta = 0.490$, $p = 0.000$). This MSME business is mostly business that is around the construction of toll roads but is not located at the vehicle stop or the entrance of the toll road.

Subsequently, the results in the structural model show that environmental risk factors and their impacts are evaluated to have a significant effect on business sustainability. This is reflected in the qualitative findings and results shown in the participants' statements: "impact of toll road construction on business revenue and business sustainability" and "business is proliferating because it is near the toll road access." Therefore, it can be assumed that the MSME business is not only affected by environmental factors but also by access close to toll road stops, where MSME businesses will survive if they do not affect the loss of walk-in customers. On the other hand, the quantitative analysis using the structural model states that the sustainability business is indeed directly affected by the construction of toll roads and also caused by environmental changes as a result of the development. ($\beta = 0.34$, $p = 0.002$).

The limitation of this study regarding sustainability is that it has not been able to touch the long and short term quantitatively to see the environmental changes vis a vis to business sustainability, as in the research by O'Mahony (2021). Due to a lack of time, the study was unable to fully explore the dynamics of changes over time, as well as the differences in locations and types of businesses between MSMEs. It was also impossible to come up with an exact social discount rate for infrastructure development, such as toll roads, which would lead to the so-called "optimism bias" suggested (Flyvbjerg, 2008).

4.3. Mitigation strategies

The discussion of mitigation strategies is explained through the partial least square structural equation model, stating that it does not reject H-null in Hypothesis 1 (H-1): "The toll road construction affects business profit and insolvency if the risk is not mitigated" (see, bootstrapping analysis on the indirect relationship between toll-road and MSME's profitability and insolvency moderated by risk mitigation on **Table 6**, ($\beta = 0.144$, $p = 0.239$). This means that the construction of toll roads does not fully affect the profitability and insolvency of business owners around toll roads. Some

businesses benefit from toll roads, especially those located at entrance/exit access roads and toll road consumer stop roads, such as, for example, in rest areas.

This also strengthens the findings in several studies that state that there are advantages to the construction of toll roads, as well as several studies that state that there are losses as a result of the construction of toll roads (Siswoyo, 2020; Suseno et al., 2015). In addition, the same thing was stated in the FL-QDA qualitative research (please see **Table 1**, comments on the impact on the environment).). Meanwhile, the results of both the direct and indirect effects in **Tables 5** and **6** stated that it rejected H-null on H-2 and H-3, which means that the sustainability of MSME businesses around the Pekanbaru-Bangkinang-Dumai Toll Road will be affected, resulting in a decrease in profitability, which causes the sustainability of MSME businesses to be hampered.

The direct and indirect effects on the results show that the impact factors of toll road construction do not change even if risk mitigation is applied. Thus, it is important to investigate again whether the desire to move is due to not being able to continue doing business along the route or to going bankrupt because of general downward business trends. Referring to the observation of the indicators of the X4-3 latent variable ($\beta = 0.86$, P-value ≤ 0.05), policymakers need to take action to implement strategic measurements for the impacts of environmental changes affected MSMEs, for example, considering the online marketing due to internet technology could boosts entrepreneurship and business development in rural communities (Cumming and Johan, 2010; Zaheer and Manrakhan, 2001).

4.4. Implications for policy-making

Based on the findings, both qualitative and quantitative, and the extent of the affected areas, it is necessary to carry out planned and comprehensive mitigation, not only moving MSME businesses to a place closer to the toll road but also maintaining the sustainability of the environment where MSMEs are located, such as the quality of water consumption. For affected areas such as Kampar and Bengkalis, the change in route caused profitability to decrease. The placement of sales areas in the pockets of toll entrances and exits and rest areas has a positive impact on MSME entrepreneurs in the area. However, this needs to be prudent in mitigating the impact of the risk because, as stated in the interview, for now, there are MSME owners who still feel comfortable carrying out business activities in the affected areas. Indeed, the firm location and relocation decisions are related to factors such as economic growth, competition, and location-specific factors, such as land rent or purchase which should be considered in integrated transport and land use models (Balbontin and Hensher, 2019).

In addition, as the results on the X2-6 variable ($\beta_{X2-6} = 0.76$, P-value $= 0.05$) stated, "willingness to be moved to another place that has more business prospects (e.g., around the rest area) ", about 76% of respondents expressed a desire to relocate if there are no business prospects., while 24% still did not state. Nonetheless, many respondents also said that they would remain at the site if there were incentives or compensation for the impact of toll road construction and the environment indicated by construct items X2-1 to X2-5 ($\beta_{X2-1} = 0.73$, $\beta_{X2-2} = 0.74$, $\beta_{X2-3} = 0.73$, $\beta_{X2-4} = 0.74$,

$\beta_{X2-1} = 0.72$; *P*-value = 0.05).

Therefore, policymakers need to be careful not to immediately move the MSMEs to the prospect area on the toll road if they do not get an agreement from the MSME owners. Referring to the X4 indicator (ρ A = 0.84, *P*-value $\leq$ 0.05), the role of stakeholders in overcoming environmental changes resulting from the construction of toll roads that affect business sustainability also needs to be included in the policy agenda of stakeholders, so that the natural environment that affects the business environment is maintained, so that MSMEs still feel comfortable doing business to increase the livelihood income surrounding area.

5. Conclusion

Toll road development has engendered multifaceted outcomes for the region's Micro, Small, and Medium Enterprises (MSMEs) alongside of the toll-road of Pekanbaru-Bangkinang, Kampar-Dumai. Responses from participants exhibit a spectrum of effects, with some reporting diminished customer traffic and revenue, while others cite improved transportation accessibility and expanded business opportunities. Toll road development has engendered multifaceted outcomes for the region's Micro, Small, and Medium Enterprises (MSMEs) alongside the toll road of Pekanbaru-Bangkinang- Dumai.

The study targeted micro, small, and medium enterprises (MSMEs) along the Bangkinang toll road, including Pekanbaru-Kampar City and Dumai-Pekanbaru. The population consisted of 70 MSME owners, with 59 samples selected using non-probability sampling through convenience and purposive approaches. Data were collected through surveys and qualitative interviews, ensuring respondents were permanent business owners and not nomadic. The data analysis involved geospatial analysis to map affected locations, qualitative analysis to understand community responses and environmental impacts, and quantitative analysis using Structural Equation Modeling (SEM) to assess the impacts and mitigation strategies.

The construction of toll roads has had a positive impact on 84% of MSME owners, facilitating better customer access. However, some areas experienced a significant income drop due to changed logistics routes, while others maintained stable incomes. Although environmental damage has not significantly impacted business operations, water pollution remains a concern.

Despite a decline in profits for some MSMEs, they still exhibit optimism and resilience. 49% of businesses survive even without any risk mitigation from the impact of toll road establishment. To support MSMEs affected by toll road construction, policymakers could implement programs like access to financial aid, online sales training, innovative marketing strategies, and clean water initiatives using ad-hoc strategy pointing to the objective of the planned problem-solving. This will help maintain the operational efficiency of MSMEs. MSMEs need assistance in relocating closer to toll road access points, ensuring relocation decisions are made in consultation with business owners. Future infrastructure planning is crucial to minimize adverse impacts. Local stakeholders' engagement in decision-making processes is essential for devising beneficial policies and establishing a robust monitoring and evaluation framework. This participatory approach will continuously assess the impacts of toll

road construction on MSMEs.

Further research using Economic Cost Benefit Analysis to know the dynamic long-term effect and rasterized data using a spatial regression approach is needed to find out in detail about the affected area. Rasterized data using a spatial regression approach is needed to find out in detail the affected area. In addition, time-series data is also needed to support changes in impact over time.

Nomenclature

CR	Composite Reliability
AVE	Average Variance Extracted
SRMR	Standardized Root Mean Square Residual
d_ULS	Dillon-Goldstein's Unweighted Least Squares
d_G	Dillon-Goldstein's G
|O/STDEV|	T-Statistics
p-Val	Probability Values
R^2	The coefficient of determination
Q^2	Predictive Relevance or Cross-Validation R-Squared

Greek symbols

ρ_A	Composite Reliability for Reflective Constructs
ψ rms	Root Mean Square Error of Approximation
χ^2	Chi-Square
β	Coefficient/Outer Loading

Subscripts

O	Original Sample
M	Sample Mean

STDEV	Standard Deviation
SSO	Standardized Structural Output
P	Path Coefficient
NFI	Normed Fit Index
VIF	Variance Inflation Factor

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