1378_Utomo_et_al+KOR

by 7392457193940 7392457193940

Submission date: 13-Apr-2026 01:20PM (UTC+0800)
Submission ID: 2930256757
File name: 1378_Utomo_et_al_KOR.pdf (440.77K)
Word count: 8013
Character count: 45347

Sustainability of MSMEs in IPAT Perspective: Econometric Analysis of the Impact of Infrastructure and Environment on Profitability and Insolvency in New Capital City, Indonesia

Kurniawan Prambudi Utomo[1]
M. Aziz Winardi [2]
Suhardoyo[3],
Mic Finanto Ario Bangun[4]
Devy Sofyanty[5]

[1,3,5]Bina Sarana Informatika University, Indonesia
[1]*Email: Kurniawan.kpu@bsi.ac.id*
[3]*Email:*suhardoyo.syo@bsi.ac.id
[5]*Email:*devy.dyy@bsi.ac.id
[2]GICI College of Economics, Indonesia
Email: azizwinardi@stiegici.ac.id
[4]Bhayangkara University of Jakarta Raya, Indonesia
Email: mic.fianto@dsn.ubharajaya.ac.id

ABSTRACT

This study examines the effects of infrastructure development on MSME sustainability, environmental impact, profitability, and insolvency risk in Indonesia's new capital city Ibu Kota Nusantara using an IPAT based econometric framework. A quantitative survey of 85 MSMEs was analyzed using Stata V.18. The findings show that infrastructure development and environmental impacts do not have a significant direct effect on MSME profitability or insolvency risk. However, infrastructure and environmental impact have a significant positive effect on MSME sustainability, while short-term profitability is not significant. MSME sustainability strengthens the effect of infrastructure, and although infrastructure and environmental factors do not increase profitability, they reduce insolvency risk, emphasizing financial resilience. These results indicate that MSME financial outcomes in the IKN region are shaped primarily by mediated environmental dynamics rather than direct infrastructure effects, emphasizing the role of sustainabilityoriented adaptation in large scale development contexts.

Keywords: Sustainability of MSMEs, infrastructure development, IPAT perspective, environmental impact, profitability, insolvency.

Contribution/Originality: This research develops IPAT's perspective in analyzing the sustainability of MSMEs affected by infrastructure and environment on profitability and insolvency risk in the Nusantara Capital City (IKN) area and provides a conceptual basis for the formulation of the IKN Authority in formulating development policies that are inclusive, adaptive, and oriented towards the economic resilience of MSMEs in the midst of the development of Indonesia's New Capital City.

1. INTRODUCTION

Infrastructure development in Indonesia continues to advance in line with the government's long-term vision to create new centers of economic growth in the regions. The development of the Indonesian Capital City, Ibu Kota Nusantara (IKN) in East Kalimantan is a key supporting infrastructure element in regional development in Indonesia (Paramananda & Iskandar, 2024). The IKN development area covers an area of 199,962 ha, with the IKN Area covering an area of 56,180

ha and the Central Government Core Area (KIPP) covering an area of 6,596 ha (Supratman et al., 2025). The development of the IKN is part of the national strategy to optimize the management of economic resources and national economic growth (Utomo, Faroman et al., 2018), one of which is the construction of toll roads as the main infrastructure for logistics mobilization (Ruas et al., 2016). The development of other infrastructure, ports, dams and other strategic projects is no less important, and continues to be developed in line with technological advances (Cheng et al., 2023; Saleh et al., 2025; Zhou et al., 2025) especially in the areas of Balikpapan City and Samarinda City as buffer zones for the IKN in transportation (Hidayat et al., 2024). Such as the construction of a toll road such as the Balikpapan-Samarinda toll road, which is 99.02 km long, connecting two major cities in East Kalimantan (Rezky et al., 2023), and the 47-km Balikpapan-IKN toll road via the 30-km Balang Island Bridge. While the toll road has the positive effect of streamlining intercity economic logistics distribution, it also has a negative impact on the environmental ecosystem (Hua et al., 2021). This also affects economic growth and has direct implications for micro, small, and medium enterprises (MSMEs). A strategic sector in the Indonesian economy, with more than 64 million businesses contributing approximately 60.5% of the national Gross Domestic Product (Dira et al., 2023; Wibowo & Aumeboonsuke, 2020). Therefore, the role of MSMEs is very important, especially as drivers of the local economy and job providers (Rodríguez-Gulías et al., 2024). Initial field surveys show that MSMEs experience both positive and negative impacts, with some maintaining operations through increased productivity, while others face financial pressure due to reduced consumer access. MSMEs adopting digitalization and product diversification exhibit higher resilience. Along the IKN development corridor, new MSMEs such as Pawon Prona, Mamapapa Bakery, and Chumbucked have emerged alongside traditional businesses, including amplang producers (Smith Purba, 2024). One MSME directly affected by the development of the new capital city is “Jo Noleh,” located in Argo Mulyo Village, Sepaku District. However, some MSMEs also experience vulnerability to business resilience due to environmental degradation from infrastructure development (Meng et al., 2025). Things like pollution, changes in land use, and declining ecosystem quality can reduce productivity, increase operational costs, and even trigger the relocation or closure of Small businesses (Chetty et al., 2024), especially if there is no effective risk mitigation, then MSMEs will not be able to survive in the long term(Joy-Camacho & Thornhill, 2024). Previous research was limited to only MSMEs from the perspective of access to capital, adoption of digital technology (Zhao, 2024), and only in plantations and development in aggregate (Anisa et al., 2021; Loureiro et al., 2020). This research will use a more in-depth approach, namely to determine the impact of infrastructure development on the sustainability of MSMEs by considering environmental degradation on profitability and bankruptcy risk (Chontanawat, 2018). Therefore, an in-depth study of the sustainability of MSMEs in the context of infrastructure development is crucial and necessary for sustainability. One approach is the IPAT (Population, Affluence, Technology) approach, which is used to assess the interaction between demographic factors, economic well-being, and technology that can influence environmental impacts and, ultimately, MSME business performance. The IPAT model was originally developed in the context of modern ecology (Dietz & Rosa, 1997). This study expands the sustainability of MSMEs through the IPAT econometric approach. Several key indicators used to assess MSME financial performance include Return on Assets (ROA), Net Profit Margin (NPM), and the Altman Z-Score as an indicator of bankruptcy risk (Nguyen et al., 2024), especially those related to the sustainability of MSMEs for local economic growth (Winardi et al., 2024). This research combines three main theoretical frameworks to explain the phenomena that occur, namely Ecological Modernization Theory (Julkovski et al., 2021), to understand the relationship between innovation,

policy, and environmental harmonization; Financial Distress Costs (Purnanandam, 2008), to analyze financial pressures due to environmental degradation; and Regional Development Theory (Dawkins, 2003), to evaluate the contribution of development to local economic development in the MSME region (Li et al., 2018). The IPAT framework, used as a conceptual perspective, explains the interactions between infrastructure development, environmental impacts, MSME sustainability, and financial performance, rather than as a rigid mathematical formulation. This perspective allows for the integration of ecological, economic, and regional development theories in analyzing MSME sustainability in the IKN region.

2. LITERATURE REVIIEW

2.1. Definition of MSMEs

Based on Law Number 20 of 2008 concerning Micro, Small, and Medium Enterprises (MSMEs), it explains that businesses with a maximum income of Rp. 50 million, with an annual income of Rp. 300 million at most; small businesses with assets of Rp. 50 million - Rp. 500 million with an annual turnover of more than Rp. 50 million up to Rp. 500 million and Rp. 300 million up to Rp. 2.5 billion; and medium businesses with an annual turnover of Rp. 500 million - Rp. 10 billion, with an annual turnover of Rp. 2.5 billion - Rp. 50 billion at most (Law of Republic Indonesia, 2008).

2.2. Definition of Infrastructure

Infrastructure impacts the physical environment, spatial planning, and socioeconomic conditions of a community, directly or indirectly, to become the infrastructure of the local environment. Infrastructure begins with the conversion of secondary forests and vegetative lands, which are then transformed into infrastructure for construction and business areas (Bohnenberger, 2020).

2.3. Definition of Environment

The environment is a regional spatial plan (RTRW) designed to support logistics, trade, hospitality, and environmentally friendly public facilities. The environment can be seen by comparing before and after infrastructure development begins, such as rest areas and construction worker housing (HPK), which are designed to meet the basic needs of workers and visitors to an area, thus creating a sector that responds to environmental change (James, 2014).

3. RESEACH METHOD

The data analysis in this study aims to understand the relationship between environmental changes resulting from infrastructure development and MSME performance. Data collection was conducted through direct observation and in-depth interviews with MSME actors to obtain contextual and comprehensive qualitative information (Mackiewicz, 2018), and supplemented with information such as writing, notes, audio recordings, visuals, and images, as well as a questionnaire containing questions related to the research problem given to MSME actors. The analysis used a mixed qualitative method using the Python application in Google Colab (Naik et al., 2021). To find out and measure qualitative analysis based on datasets from respondents' statements and to find out how infrastructure development impacts the sustainability of MSMEs through environmental degradation that affects profitability and insolvency risk. This change in location not only has physical impacts but also influences the process of business adaptation to the new social, economic, and infrastructure environment.

At the outset, the study identified 108 MSME actors around the IKN area. However, 23 actors were nomadic or non-permanent and therefore excluded to avoid potential response bias. Consequently, the effective population consisted of 85 permanent MSME actors, all of whom were included as research respondents. Data collection began with screening questions to confirm ownership status and business permanence; nomadic actors were excluded as non-respondents. The study applied a purposive proportional sampling technique with a 5% margin of error, ensuring that the sample reflected the sectoral characteristics of the target population. The adequacy of the sample size was further validated using the Slovin formula.

$n = N / (1 + N \times e^2)$

Information:

n = number of samples

N = population size

e = margin of error (level of error)

So the calculation of the number of samples is as follows:

n = 108 / (1 + 108 × 0.0025) n = 108 / (1 + 0.27) n = 108 / 1.27 = 85.03

Previous studies on MSME sustainability have largely focused on access to capital, digitalization, and digital technology, providing a basis for comparison with the present study (Zhao, 2024). Meanwhile regarding the environmental impact on business sustainability, this is mostly done in the large industrial or plantation sectors, and infrastructure (Loureiro et al., 2020). Such as dams, buildings, and toll roads(Anisa et al., 2021). However, this research is different, namely by integrating environmental degradation with profitability and insolvency quantitatively, which is still limited in Indonesia, especially for MSMEs (Nguyen et al., 2024), especially those related to the development of toll road infrastructure, this is what becomes the novelty value, especially the sustainability of MSMEs for local economic growth (Winardi et al., 2024). The research uses an econometric approach to determine the factors that influence MSMEs with Stata V. 18, so that the researcher makes the following hypothesis:

The figure below shows that infrastructure development and environmental impacts influence the profitability or insolvency of MSMEs in the IKN, while profitability determines the sustainability of MSMEs and sustainability acts as a moderating variable for the relationship conceptually. The research model design can be shown in Figure 1 below:

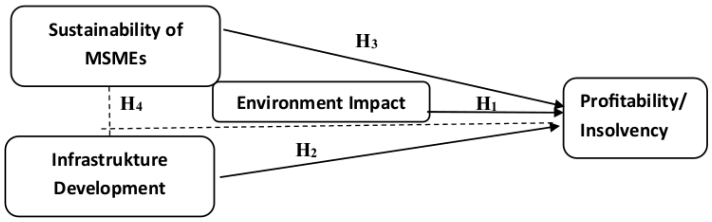


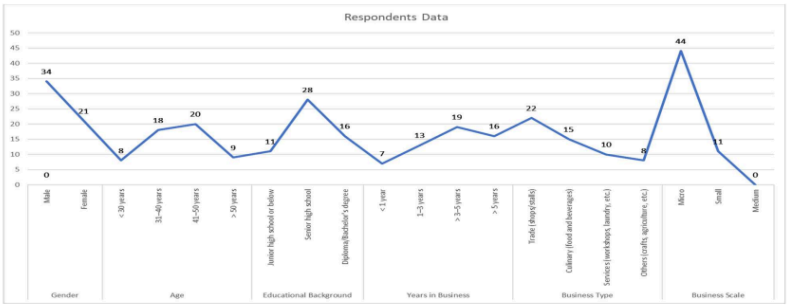
Figure 1. The research model design

H1: Infrastructure development has a significant effect on profitability/insolvency in the area of MSME sustainability.

H2: Environmental impact has a significant positive effect on profitability/insolvency
H3: The sustainability of MSMEs has a significant effect on infrastructure development on profitability/insolvency.
H4: Infrastructure development and environmental impacts simultaneously affect the profitability and insolvency risk of MSMEs in the MSME sustainability area.

4. RESULT

The results of the analysis of MSME respondents affected by infrastructure development in the IKN area and its surroundings are as follows. Respondent characteristics such as gender, age, education, and other demographic aspects of Micro, Small and Medium Enterprises (MSMEs).



Source: Author Estimate, 2025

Figure 2. Respondent Data

Based on Figure 2 explaining the respondent characteristics table, this study involved 55 respondents with the following details. In terms of gender, the majority of respondents were male, 34 people (61.8%), while 21 were female (38.2%). Based on age, most respondents were in the age range of 41–50 years (36.4%) and 31–40 years (32.7%), while rest were under 30 years old (14.5%) and over 50 years old (16.4%). In terms of education, the majority of respondents were high school graduates (50.9%), followed by diploma or bachelor's graduates (29.1%), and the rest were junior high school graduates or below (20.0%). Based on the length of business, respondents who had been running a business for 3–5 years dominated (34.5%), followed by those who had been in business for more than 5 years (29.1%), 1–3 years (23.6%), and less than 1 year (12.7%). The type of business run by the most respondents was trade (shops/kiosks) with 22 people (40.0%), followed by culinary businesses (27.3%), services (18.2%), and other businesses such as crafts and agriculture (14.5%). Based on business scale, the majority of respondents ran micro-enterprises (80.0%), while the rest ran small businesses (20.0%), and none ran medium-sized businesses. After the respondent data was obtained, a statistical analysis of the respondents was carried out to determine the distribution and simplify the data for easier understanding as follows:

Descriptive Statistic

Descriptive statistical analysis was conducted to provide an initial overview of the characteristics of the research data. The statistics include measures of central tendency (mean, median), measures of dispersion (standard deviation, range), as well as data distribution through skewness and kurtosis. This information is essential to understand the general tendencies of the variables, the variation in values, and indications of distribution normality before proceeding to further testing.

Table 1. Descriptive Statistics

Variable	N	Mean	SD	Med	Min	Max	Range	Skewness	Kurtosis	SE
X1	85	22.13	1.72	22	19	25	6	0.34	-0.77	0.19
X2	85	23.04	2.22	24	18	25	7	-0.51	-1.35	0.24
X3	85	16.52	2.06	16	12	20	8	0.26	-0.28	0.22
Y1	85	1.61	2.33	1.15	-5.84	9.42	15.26	1.35	4.4	0.25
Y2	85	4.01	3.79	2.88	-0.26	15.21	15.47	1.41	1.3	0.41

*Note.*n = number of observations; SD = standard deviation; MAD = median absolute deviation.
Source: STATA primary data processing (2025)

Based on Table 2, it explains the descriptive statistics of the five research variables (X1, X2, X3, Y1, Y2) X1 is Sustainablity of MSMEs, X2 is Infrastructure Development, X3 is Environment Impact, Y1 is Profitability and Y2 is Insolvency with 85 respondents. The average value (mean) ranges from 1.61 to 23.04, while the standard deviation (SD) shows relatively moderate data variation. The median of each variable is close to the mean, indicating a relatively balanced distribution. The skewness value is partially positive (right skewed) and negative (left skewed), while the kurtosis varies, indicating differences in the sharpness of the distribution, the largest range is found in Y1 and Y2.

Validity and Reliability Test

The validity test was conducted by comparing the calculated r and table r values. An item is said to be valid if the calculated r > table r, and invalid if the calculated r < table r, while the reliability test used in this study is the Cronbach's Alpha value. If Cronbach's Alpha > 0.6, then the instrument is declared reliable. If Cronbach's Alpha < 0.6, then it is valid.(Hair et al., 2019), then the instrument is declared unreliable, the following are the results of the validity and reliability tests:

Table 2. Validity Test

```
Factor analysis/correlation                       Number of obs    =         55
    Method: principal factors                     Retained factors =          2
    Rotation: (unrotated)                         Number of params =          9

    Factor  |  Eigenvalue   Difference    Proportion   Cumulative
-------------+------------------------------------------------------------
    Factor1 |      2.27856      1.06716        0.7221       0.7221
    Factor2 |      1.21140      1.23993        0.3839       1.1060
    Factor3 |     -0.02852      0.09810       -0.0090       1.0970
    Factor4 |     -0.12662      0.05276       -0.0401       1.0568
    Factor5 |     -0.17938            .       -0.0568       1.0000
LR test: independent vs. saturated:  chi2(10) =  144.91 Prob>chi2 = 0.0000

Factor loadings (pattern matrix) and unique variances

    Variable |   Factor1    Factor2   Uniqueness
-------------+--------------------------------
sustainabi~s |      0.7401    0.3853       0.3038
Infrastruc~t |      0.7422    0.2188       0.4013
Environmen~t |      0.8066    0.3085       0.2543
Profitabil~A |     -0.5327    0.6566       0.2851
Insolvency~e |     -0.4957    0.6991       0.2655

. alpha sustainabilityofMSMEs InfrastructureDevelopment EnvironmentalImpact
```

Source: STATA primary data processing (2025)

Table 3. Reliability test

```
. alpha sustainabilityofMSMEs InfrastructureDevelopment EnvironmentalImpact

Test scale = mean(unstandardized items)

Average interitem covariance:     3.024804
Number of items in the scale:            3
Scale reliability coefficient:      0.8702
```

Source: STATA primary data processing (2025)

Based on table 2 and table 3 above, a variable is said to be valid if the correlation value between items with the total construct is greater than or greater than 0.6. The values that indicate validity are in the sustainability of MSME of 0.740, infrastructure development 0.742 and environmental impact 0.806, while the profitability and insolvency values are below 0.60. Therefore, the conclusion is that the data is valid, while the reliability value can be seen from the Cronbach alpha value> 0.6 then it is reliable, if the Cronbach alpha value <0.6 then it is not reliable, from the data it can be seen the variable value of 0.8702 from all variables> 0.6 then the data is reliable. Thus, all instruments are declared reliable because they show strong internal consistency.

Regression Analysis Results

The results of the linear regression analysis include the common effect model regression, fixed effect model, and random effect model, namely as an analysis of the simultaneous relationship between more than one independent variable and one dependent variable as follows:

Table 4. Model selection results

	Coefficient		
Variable	**CEM**	**FEM**	**RESULT**
Environmental Impact	0.4834596	0.6988933	0.7116801
Profitability (ROA)	-0.1602003	0.0391763	0.515371
Insolvency (Z-Score)	0.1495895	-0.0857153	-0.948418
Prob (f-statistic)	0.0000000	0.0000010	0.0000000

Source: STATA primary data processing (2025)

Table 5. Chow test results

Model Fit Test	F (5.46)	Prob > F	Results
Chow Test	3.98	0.0044	*Fixed Effect Model* (FEM)

Source: STATA primary data processing (2025)

From the results of table 4 and table 5, the results of the Chow Test ($F = 3.98$; $p < 0.05$) show that the Fixed Effect Model (FEM) was chosen as the most appropriate approach in analyzing the influence of infrastructure development factors, environmental impacts, and the sustainability of MSMEs on profitability and insolvency risk. To complement the Chow test, a Hausman test will be carried out so that the model selection is more appropriate whether to continue using FEM or REM. The following are the test results:

Table 6. Hausman test results

Model Fit Test	Chi2	Prob > chi2	Results
Hausman test	0.66	0.8826	*Random Effect Model* (REM)

Source: STATA primary data processing (2025)

Based on Table 6, the results of the Chow and Hausman tests show that the Random Effects Model (REM) is the most appropriate model for estimating the relationship between infrastructure development, environmental impact, and MSME sustainability on profitability and insolvency risk. Although the Chow test results indicate significant individual effects, the Hausman test results confirm that individual influences are uncorrelated with the independent variables, making the REM model more efficient in obtaining unbiased results.

T-test

Decision making compares the calculated t value with the t table or the significance level. If $t > t$ table or sig < 0.05, H_0 is rejected, indicating a significant effect. If $t < t$ table or sig > 0.05, hypothesis is accepted, indicating no significant effect, with a calculated t of 2.006.

Table 7. t-test

sustainabilityofMSMEs	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
InfrastructureDevelopment	.1933653	.0944434	2.05	0.046	.0036701	.3830605
EnvironmentalImpact	.4834596	.0985808	4.90	0.000	.2854543	.6814649
ProfitabilitasROA	-.1602003	.1258248	-1.27	0.209	-.4129269	.0925262
InsolvencyZScore	.1495895	.083385	1.79	0.079	-.0178942	.3170733
_cons	9.320624	1.631068	5.71	0.000	6.044527	12.59672

Source: STATA primary data processing (2025)

From table 8 it can be explained that each variable has the following meaning: **H1** This result is supported by a t-value of 2.05 with $p = 0.046 < 0.05$, indicating that infrastructure development has a significant positive effect on MSME sustainability. Improved accessibility, market connectivity, and logistics efficiency contribute directly to stronger business continuity. These findings align with Regional Development Theory, which suggests that infrastructure investment encourages the emergence of new economic activity centers in densely populated areas through intensified market competition (Knox, 2016). **H2** This relationship is strongly supported by a t-value of 4.90 and $p = 0.000 < 0.01$, indicating that environmental impacts have a highly significant effect on MSME sustainability. This finding supports the Ecological Modernization approach, which emphasizes that environmental awareness and ecological risk management contribute to long-term business sustainability and competitive advantage. In contrast, the profitability variable (ROA) shows a t-value of −1.27 with $p = 0.209 > 0.05$, indicating no statistically significant effect on MSME sustainability. This suggests that short-term profitability is not a primary determinant of sustainability for micro and small enterprises, which instead rely more on infrastructure conditions, environmental pressures, and adaptive innovation within a modernization framework (Jänicke, 2008). The insolvency variable Z-Score exhibits a marginally significant positive effect with $t = 1.79$ and $p = 0.079$ on MSME sustainability, indicating that lower bankruptcy risk is associated with improved resilience. This finding aligns with Financial Distress Cost Theory, which argues that financial pressures can constrain MSMEs' capacity to adapt to structural changes induced by large-scale infrastructure development (Mol & Spaargaren, 2014). **H3** The role of MSME sustainability in enhancing the relationship between infrastructure and business performance is supported by the interaction regression results. The findings suggest that MSMEs with higher sustainability levels are better positioned to capitalize on infrastructure development and demonstrate greater resilience to external pressures. **H4** shows an unexpected result in which infrastructure development and environmental impacts do not significantly increase short-term profitability, but instead reduce insolvency risk. This indicates that infrastructure and environmental adaptation strengthen MSME financial resilience rather than immediate profit generation, supporting Ecological Modernization and Financial Distress Cost theories.

F test

Decision criteria if F count > F table or sig < 0.05, H_0 is rejected and the regression model is simultaneously significant; if F count < F table or sig > 0.05, Hypothesis is accepted and the model is not simultaneously significant.

Table 8. f test

```
. regress sustainabilityofMSMEs InfrastructureDevelopment EnvironmentalImpact ProfitabilitasROA InsolvencyZScore
```

Source	SS	df	MS		
Model	107.036076	4	26.7590189	Number of obs	= 55
Residual	61.9457424	50	1.23891485	F(4, 50)	= 21.60
Total	168.981818	54	3.12929293	Prob > F	= 0.0000
				R-squared	= 0.6334
				Adj R-squared	= 0.6041
				Root MSE	= 1.1131

Source: STATA primary data processing (2025)

Based on table 9, the results of the f test show that the calculated f value is 21.6, which is greater than the f table value of 5.69, and the significance value is 0.0000 which is smaller than 0.05, which means that the overall model is statistically significant. This shows that simultaneously, the combination of the variables Infrastructure Development, Environmental Impact, Profitability (ROA), and Insolvency (Z-Score) has a significant influence on the sustainability of MSMEs.

5. DISCUSSION

5.1. Impact of MSME Sustainability

The regression results show that infrastructure development has a significant effect on MSME sustainability ($t = 2.05$; $p = 0.046$), indicating that road, electricity, and internet access drive operational efficiency and market expansion. This finding supports the Regional Development Theory, which states that infrastructure improves connectivity and competitiveness of local businesses. Environmental impacts have the strongest effect ($t = 4.90$; $p = 0.000$), reinforcing the Ecological Modernization Theory, where ecological pressures drive innovation and the adoption of sustainable business practices. MSMEs that are responsive to environmental issues demonstrate greater resilience. Conversely, profitability (ROA) does not have a significant effect ($t = –1.27$; $p = 0.209$), indicating that short-term profit is not a primary indicator of sustainability in the context of IKN development. Meanwhile, the Z-Score as an indicator of insolvency shows a weak but positive effect ($t = 1.79$; $p = 0.079$), in line with the Financial Distress Cost Theory, which states that financial resilience influences the resilience of MSMEs (Mol et al., 2009). Overall, the sustainability of MSMEs is more strongly influenced by structural and environmental factors than by short-term financial performance.

5.2. Impact on Infrastructure Development

Micro, small, and medium enterprises (MSMEs) can play a dual role as both recipients and drivers of infrastructure development in the capital city (IKN) and its surrounding areas. Within this development context, market accessibility increases significantly, opening up opportunities for tourism, logistics services, and local culinary development, such as the production of local specialty Amplang (rice cakes). However, if MSMEs lack legal standing, limited capital, or limited access to technology, they cannot capitalize on these opportunities, creating economic disparities. Regional Development Theory explains that infrastructure development will tend to create new growth centers but also regional disparities, in line with Regional Development Theory (Dawkins, 2003). Empirical findings show that the sustainability of MSMEs that are not adaptive can be crushed by changes in the local economic structure due to national strategic projects.

5.3. Impact on the Environment

The development of large-scale infrastructure such as toll roads, bridges, and the IKN KIPP area has a direct impact on environmental quality, both in terms of pollution, conversion of oil palm plantations, and pressure on local ecosystems. A study by (Hua et al., 2021). Emphasizes that massive development without mitigation results in water and air degradation and the loss of productive space. This is consistent with research showing that environmental degradation impacts operational and financial performance, as well as business location, leading to increased logistics costs and business relocation. Environmental Distress Theory and the IPAT approach demonstrate that environmental variables are impact modifiers of business profitability and risk, consistent with research suggesting that environmental shocks can become economic shocks when small businesses lack adaptive capacity. This is the environmental insolvency loop (Nguyen et al., 2024).

5.4. Implications for Profitability and Insolvency

The implications of profitability and insolvency can be measured through financial indicators such as Return on Assets (ROA) and the Altman Z-Score, as demographic and economic pressures negatively impact profitability, particularly in areas facing competitive pressures from similar businesses, legal limitations, and spatial planning changes. However, MSMEs that adopt and utilize digital technology demonstrate increased efficiency and

resilience to insolvency risk. The Adjusted R^2 value of 25.12% indicates that the combination of IPAT variables can explain a quarter of the impact on MSMEs in the IKN area and its surroundings. The remainder is influenced by external factors such as regulations, IKN Authority policies, market stability, and institutional support (Andrade & Kaplan, 1998). The Financial Distress Cost Theory asserts that environmental pressure without risk management can increase implicit costs and lead to business failure.

6. CONCLUSIONS, IMPLICATIONS AND LIMITATIONS

This study analyzes the sustainability of MSMEs impacted by infrastructure development using the influence of population, affluence, and technology variables on profitability and insolvency. Using a multiple linear regression approach and statistical analysis support, several findings were obtained indicating that the sustainability of MSMEs in areas affected by the development of the Indonesian Capital City (IKN) is influenced by a combination of structural, environmental, and financial factors. The results of the multiple linear regression revealed that environmental impact is the most significant factor in improving MSME sustainability, followed by profitability, while the bankruptcy score (Z-Score) shows a weak negative influence. Infrastructure development has been shown to contribute significantly to MSME sustainability through increased connectivity and access to economic resources. However, this influence is only optimal when MSMEs have adequate adaptive capacity and institutional readiness, as indicated by a calculated F value greater than the F table and a significance below 0.05. Simultaneously, the model explains that MSME sustainability is the result of a complex interaction between infrastructure and ecological support and internal performance, including profitability and insolvency. Therefore, IKN development policies must integrate a cross-sectoral approach that includes strengthening the MSME ecosystem and managing environmental impacts. The findings of the study show that the sustainability of MSMEs in the IKN area requires an integrated development policy that is affected to align infrastructure development with environmental management and strengthen the capacity of MSMEs in the Capital City of the Archipelago (IKN). Infrastructure provides optimal income if supported by adaptive capacity and adequate institutional readiness for MSMEs. However, this study has limitations in the form of limited data use only in the IKN area so that the limitations of environmental and institutional indicators, as well as the focus on the context of the IKN, thus limiting the generalization of the broader research.

Funding: This study received financial support from the Directorate of Research and Community Service (DPPM) of the Ministry of Education and Science and Technology 2025.
Statement of the Institutional Review Board: The Ethics Committee of Bina Sarana Informatika University, Jakarta, Indonesia has given approval for this study on August 13, 2025 (No. Ref. 118/LPPM-UBSI/VIII/2025). Informed verbal consent is obtained from all authors, and all data is anonymized to protect the confidentiality of the author.
Transparency: The authors state that this manuscript is honest, true, and transparent, that no key aspects of the investigation were omitted, and that any discrepancies from the study as planned have been clarified. This study follows all writing ethics.
Conflict of Interest: The authors state that they have no conflict of interest.
Author Contributions: All authors contribute equally to the conception and design of the study. All authors have read and approved the published version of the manuscript.
AI use Disclosure: The author uses OpenAI's ChatGPT (GPT-5) to edit and refine the wording in the Introduction and Literature Review. All results have been thoroughly reviewed and verified by the authors.

REFERENCES

Andrade, G., & Kaplan, S. N. (1998). How costly is financial (not economic) distress? Evidence from highly leveraged transactions that became distressed. *Journal of Finance*, *53*(5), 1443–1493. https://doi.org/10.1111/0022-1082.00062

Anisa, K., Prasetyo, P. K., & Pujiriyani, D. W. (2021). Dampak Pengadaan Tanah Jalan Tol Trans Sumatera pada Kondisi Penghidupan Masyarakat di Desa Serdang. *Tunas Agraria*, *4*(3), 340–351. https://doi.org/10.31292/jta.v4i3.154

Bohnenberger, K. (2020). Money, vouchers, public infrastructures? A framework for sustainable welfare benefits. *Sustainability (Switzerland)*, *12*(2). https://doi.org/10.3390/su12020596

Cheng, Y., Zhou, X., & Li, Y. (2023). The effect of digital transformation on real economy enterprises' total factor productivity. *International Review of Economics and Finance*, *85*(January), 488–501. https://doi.org/10.1016/j.iref.2023.02.007

Chetty, D. R. V. B., Ravindra, Bhagwant, S., & Levy, L. (2024). Factors affecting the occupational safety and health of small and medium enterprises in the Construction Sector of Mauritius. *Social Sciences and Humanities Open*, *10*(May), 100964. https://doi.org/10.1016/j.ssaho.2024.100964

Chontanawat, J. (2018). Decomposition analysis of CO2 emission in ASEAN: An extended IPAT model. *Energy Procedia*, *153*, 186–190. https://doi.org/10.1016/j.egypro.2018.10.057

Dawkins, C. J. (2003). Regional development theory: Conceptual foundations, classic works, and recent developments. *Journal of Planning Literature*, *18*(2), 131–171. https://doi.org/10.1177/0885412203254706

Dietz, T., & Rosa, E. A. (1997). Effects of population and affluence on CO2 emissions. *Proceedings of the National Academy of Sciences of the United States of America*, *94*(1), 175–179. https://doi.org/10.1073/pnas.94.1.175

Dira, A. F., Utomo, K. P., Finanto, M., Bangun, A., & Yani, E. (2023). *Pengaruh Investasi dan IPM terhadap Pertumbuhan Ekonomi Hijau di Provinsi Kalimantan Timur*. *11*(2), 1437–1446.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Hidayat, A., Hadid, M., & Hijriah. (2024). Planning, Optimization and Development of River Transportation in Supporting The Development of Mega City IKN, Balikpapan and Samarinda. *IOP Conference Series: Earth and Environmental Science*, *1353*(1). https://doi.org/10.1088/1755-1315/1353/1/012006

Hua, T., Zhao, W., Cherubini, F., Hu, X., & Pereira, P. (2021). Sensitivity and future exposure of ecosystem services to climate change on the Tibetan Plateau of China. *Landscape Ecology*, *36*(12), 3451–3471. https://doi.org/10.1007/s10980-021-01320-9

James, B. (2014). Recent Literature on the Economic Development of Backward Areas. *Oxford Journals*, *68*(4), 585–602.

Jänicke, M. (2008). Ecological modernisation: new perspectives. *Journal of Cleaner Production*, *16*(5), 557–565. https://doi.org/10.1016/j.jclepro.2007.02.011

Joy-Camacho, W., & Thornhill, I. (2024). Opportunities and limitations to environmental management system (EMS) implementation in UK small and medium enterprises (SMEs) – A systematic review. *Journal of Environmental Management*, *367*(June). https://doi.org/10.1016/j.jenvman.2024.121749

Julkovski, D. J., Sehnem, S., Bennet, D., & Leseure, M. (2021). Ecological Modernization Theory (EMT): Antecedents and Successors. *Indonesian Journal of Sustainability*

Accounting and Management, *5*(2). https://doi.org/10.28992/ijsam.v5i2.303
Knox, A. . (2016). The Suntory and Toyota International Centres for Economics and Related Disciplines London School of Economics Review. *The London School of Economics and Political Science*, *27*(August).
Li, S., Zhang, Y., Wang, Z., & Li, L. (2018). Mapping human influence intensity in the Tibetan Plateau for conservation of ecological service functions. *Ecosystem Services*, *30*, 276–286. https://doi.org/10.1016/j.ecoser.2017.10.003
Loureiro, S. M. C., Guerreiro, J., & Ali, F. (2020). 20 years of research on virtual reality and augmented reality in tourism context: A text-mining approach. *Tourism Management*, *77*(September 2018). https://doi.org/10.1016/j.tourman.2019.104028
Mackiewicz, J. (2018). A Mixed-Method Approach. In *Writing Center Talk over Time*. https://doi.org/10.4324/9780429469237-3
Meng, T., Li, Q., He, C., & Dong, Z. (2025). Research on the configuration path of manufacturing enterprises' digital servitization transformation. *International Review of Economics and Finance*, *98*(February). https://doi.org/10.1016/j.iref.2025.103952
Mol, A. P. ., Spaargaren, G., & Sonnenfeld, D. A. (2009). *Ecological Modernisation Theory : where do we stand ? January*, 1–32.
Mol, A. P. J., & Spaargaren, G. (2014). Ecological modernisation theory in debate: A review. *Ecological Modernisation Around the World: Perspectives and Critical Debates*, *September 2013*, 17–49.
Naik, P., Nail, G. R., & Patil, M, B. (2021). *Conceptualizing Python in Google COLAB* (Issue January). https://www.researchgate.net/publication/357929808
Nguyen, N. M., Sun, S., & Welters, R. (2024). The impact of FDI on R&D investment of small and medium-sized enterprises in Vietnam: The role of institutions. *International Review of Economics and Finance*, *95*(August), 103519. https://doi.org/10.1016/j.iref.2024.103519
Paramananda, D., & Iskandar, D. A. (2024). Tingkat Kesiapan Masyarakat Balikpapan dalam Pembangunan IKN Nusantara. *Riset Pembangunan*, *7*, 50–65.
Purnanandam, A. (2008). Financial distress and corporate risk management: Theory and evidence. *Journal of Financial Economics*, *87*(3), 706–739. https://doi.org/10.1016/j.jfineco.2007.04.003
Rezky, Z. I., Hajji, A. M., & Siswanto, H. (2023). Evaluasi Efektivitas Layanan Pada Jalan Tol Balikpapan-Samarinda Dalam Memenuhi Kepuasan Pengguna. *Bentang : Jurnal Teoritis Dan Terapan Bidang Rekayasa Sipil*, *11*(2), 139–150. https://doi.org/10.33558/bentang.v11i2.5957
Rodríguez-Gulías, M. J., Fernández-López, S., & Rodeiro-Pazos, D. (2024). Foreign knowledge sources and innovation: Differences across large and small and medium-size multinational enterprises (MNEs). *International Review of Economics and Finance*, *92*(February), 741–757. https://doi.org/10.1016/j.iref.2024.02.036
Ruas, P., Tol, J., Pt, D. I., Marga, J., Jakarta-tangerang, P. T. B. K. C., Ghaisani, F. A., Njatrijani, R., Studi, P., Ilmu, S., Hukum, F., & Diponegoro, U. (2016). *DIPONEGORO LAW REVIEW Jalan Tol melalui Peraturan Menteri*. *5*(43), 1–12.
Saleh, A., Djakfar, L., & Wicaksono, A. (2025). Development of Road Networks to Support the Development of the Government Center in the Capital City of Nusantara (IKN). *Rekayasa Sipil*, *19*(2), 178–190. https://doi.org/10.21776/ub.rekayasasipil.2025.019.02.6
Smith Purba, A. (2024). Analisis Penerapan Akuntansi pada Usaha Mikro Kota Balikpapan. *Forum Ekonomi Jurnal Ekonomi, Manajemen Dan Akuntansi*, *26*(4), 751–757.
Supratman, H. F. D., Pratama, H. A., Setiawan, B., Pratama, M. A., Sucipta, S., Nur, S. H., Ekaningrum, N. E., Nurliati, G., Hikmat, M. C. C., Setiawan, A., Pamungkas, N. S., Putra, Z. P., & Yusuf, M. (2025). Sorption and diffusion studies of radiocesium in soil

samples from Ibu Kota Nusantara region of Indonesia. *Environmental Chemistry and Ecotoxicology*, *7*(October 2024), 252–262. https://doi.org/10.1016/j.enceco.2024.12.008

Undang-Undang Republik Indonesia Nomor 20 Tahun 2008. (2008). *Undang-Undang Republik Indonesia Nomor 20 Tahun 2008*. *1*.

Utomo, Kurniawan Prambudi, Faroman, S., Winardi, M. A., Fadly, R., Widjaja, W., Setyorini, R., & Tiris. (2018). Dasar Manajemen dan Kewirausahaan. In *Angewandte Chemie International Edition, 6(11), 951–952.* (Vol. 3, Issue 1).

Wibowo, M., & Aumeboonsuke, V. (2020). Bank financial capability on MSME lending amid economic change and the growth of Fintech companies in Indonesia. *Thailand and the World Economy*, *38*(2), 63–87.

Winardi, M. A., Dira, A. F., & Utomo, K. P. (2024). *Mengembangkan Green Job dan Soft Skill : Pengaruh Strategi Pariwisata Berkelanjutan untuk Peningkatan Layanan di Jawa Barat*. *12*(1), 13–27.

Zhao, Z. (2024). Digital Transformation and Enterprise Risk-Taking. *Finance Research Letters*, *62*(January), 104036. https://doi.org/10.1016/j.frl.2024.105139

Zhou, Z., Zhang, J., & He, C. (2025). Manufacturing enterprise digital transformation, manager cognition, and strategic Risk-Taking—Evidence from China. *International Review of Economics and Finance*, *98*(August 2024), 103906. https://doi.org/10.1016/j.iref.2025.103906

2506-IJMS-17320

ORIGINALITY REPORT

22%	16%	17%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	systems.enpress-publisher.com Internet Source	1%
2	Submitted to Universidad Nacional de Colombia Student Paper	1%
3	jurnal.unived.ac.id Internet Source	1%
4	Submitted to University of Warwick Student Paper	1%
5	conference.undana.ac.id Internet Source	1%
6	journals.univ-danubius.ro Internet Source	1%
7	jurnal.darmaagung.ac.id Internet Source	1%
8	Bhayu Bomantara, Lukmanul Hakim, Sarjani Sarjani, Wan Repli Kurnia. "The Effect of Store Atmosphere, Hedonic Shopping Motivation, Price Discount and Shopping Lifestyle on Impulse Buying at Miniso Grand Mall Batam", Proceedings of Forum Manajemen Indonesia's International Conferences, 2025 Publication	1%
9	W. Toyyibah, M.F.W. Chandra, D.R.W. Sishartami, B.P. Belinda, F. Abidzar, H. Winarso. "Human natural and artificial intelligence collaboration in urban design: a	1%

	case study of Indonesia's new capital city", IOP Conference Series: Earth and Environmental Science, 2024 Publication	
10	Submitted to FoEN Student Paper	<1 %
11	ijmra.in Internet Source	<1 %
12	rjoas.com Internet Source	<1 %
13	hdl.handle.net Internet Source	<1 %
14	npaformosapublisher.org Internet Source	<1 %
15	Arief Hidayat, Muhammad Hadid, Hijriah. "Planning, Optimization and Development of River Transportation in Supporting The Development of Mega City IKN, Balikpapan and Samarinda", IOP Conference Series: Earth and Environmental Science, 2024 Publication	<1 %
16	jpas.ub.ac.id Internet Source	<1 %
17	Submitted to The University of Notre Dame Student Paper	<1 %
18	Martino Wibowo, Heffi Christya Rahayu, Faizul Mubarok, Ahmad Subagyo, Krisna Sudjana, Saif Ur Rahman. "Infrastructure expansion and its environmental impact on micro-business profitability and sustainability", Journal of Infrastructure Policy and Development, 2024 Publication	<1 %

19	journal2.uad.ac.id Internet Source	<1 %
20	Adi Mulyadi, Fuad Ardiyansyah, Muhammad Zainal Roisul Amin, Budi Liswanto, Widhi Winata Sakti. "Applications of Convolutional Neural Networks and Transfer Learning for Enhancing the Accuracy of Dragon Fruit Classification", ENERGY: JURNAL ILMIAH ILMU-ILMU TEKNIK, 2025 Publication	<1 %
21	Dewi Ayu Dyah Ningrum, Salsabila Citra Devi, Ely Siswanto, Subagyo Subagyo. "The Effect of ESG Disclosure on Firm Value: A Study of Companies Listed on the Indonesian Stock Exchange in the Manufacturing Sector", Formosa Journal of Applied Sciences, 2026 Publication	<1 %
22	manualzz.com Internet Source	<1 %
23	"Assessing the Impact of Tuberculosis on Economic Growth in ASEAN Countries: A Conceptual Framework and Panel Data Analysis", Jurnal Ekonomi Kesehatan Indonesia, 2024 Publication	<1 %
24	Submitted to Adtalem Global Education, Inc. Student Paper	<1 %
25	Rini Rachmawati, Eko Haryono, Rizki Adriadi Ghiffari, Hilary Reinhart et al. "Achieving Sustainable Urban Development for Indonesia's New Capital City", International Journal of Sustainable Development and Planning, 2024 Publication	<1 %

26	ummaspul.e-journal.id Internet Source	<1 %
27	drum.lib.umd.edu Internet Source	<1 %
28	thesis.sgu.ac.id Internet Source	<1 %
29	www.ncbi.nlm.nih.gov Internet Source	<1 %
30	Anindiya Salsabila, Tengku Narasiya Adiza, Ananda Jaya Irdianti, Dwi Saraswati. "Strategy to Increase the Competitiveness of MSME Businesses in the Era of Digitalization for Rural Communities in the Medan Region of North Sumatra", Jurnal Pemberdayaan Ekonomi dan Masyarakat, 2024 Publication	<1 %
31	Huni, Tendai. "Social Power Configurations Influencing Relationship Strength and Supplier Performance in the Construction Industry", Vaal University of Technology (South Africa), 2025 Publication	<1 %
32	Kurnia Yusro, Indah Nurhidayati, Siti Fathiyatus Sholihah. "Influence of Islamic Religious Education Teachers' Competence on the Formation of Students' Religious Character", ISLAMIKA, 2026 Publication	<1 %
33	journal.formosapublisher.org Internet Source	<1 %
34	onlinelibrary.wiley.com Internet Source	<1 %
	scholar.sun.ac.za	

35	Internet Source	<1%
36	www.pids.gov.ph Internet Source	<1%
37	www.repository.unipr.it Internet Source	<1%
38	Ardiprawiro. "THE INFLUENCE OF PRICES, SERVICE QUALITY, AND FACILITIES ON CUSTOMER SATISFACTION ALFAMART BEKASI BARAT", International Journal Management and Economic, 2024 Publication	<1%
39	Submitted to University of Limpopo Student Paper	<1%
40	iceb.johogo.com Internet Source	<1%
41	mafiadoc.com Internet Source	<1%
42	media.neliti.com Internet Source	<1%
43	Submitted to Bocconi University Student Paper	<1%
44	Eunho Cho, Mohammad Hashemi Joo. "Does board ethnic diversity mitigate bankruptcy risk?", International Review of Financial Analysis, 2024 Publication	<1%
45	Monica A. Breiby, Ingunn Elvekrok, Terje Slåtten. "Services, Experiences, and Sustainability", Routledge, 2026 Publication	<1%
46	ideas.repec.org Internet Source	<1%

47	jurnal.feb-umi.id Internet Source	<1 %
48	jurnalku.org Internet Source	<1 %
49	www.anserpress.org Internet Source	<1 %
50	www.elsevier.es Internet Source	<1 %
51	www.equaltimes.org Internet Source	<1 %
52	www.stata.com Internet Source	<1 %
53	"Green Policies for a Sustainable World", Springer Science and Business Media LLC, 2026 Publication	<1 %
54	Ali Sulaiman Talib Al Shuaili. "The Impact of Occupational Stress on Job Satisfaction among Teachers and School Principals in Oman: Analyzing the Relationship and Role-Specific Differences", Open Journal of Social Sciences, 2024 Publication	<1 %
55	Atika Zainab, Wisnu Sadhana, Rizki Yeni Wulandari, Rika Damayanti, Abdullah Abdullah. "Phenomenological Study of Community Experience in Obtaining Services from Aubilee Health Center", Indonesian Journal of Global Health Research, 2025 Publication	<1 %
56	Enrico Fioravante Geretto, Egidio Palmieri. "Innovation in Banking and Financial	<1 %

Intermediaries - The Disruptive Role of ESG Policies and Fintech Players", Routledge, 2025
Publication

57	Friska Dhea Narulita, Adiati Trihastuti. "The Impact of Accounting Students' Competencies and Information Technology Adoption on Financial Reporting Quality (A Study at Universitas 17 Agustus 1945 Surabaya)", Journal of Economics, Assets, and Evaluation, 2025 Publication	<1 %
58	Lang Zhao, Jiawei Xu, Baofeng Zhang, Jianjun Lu. "Leveraging AI to enhance firms' resource efficiency: ecological modernization theory and resource-based view perspectives", International Journal of Production Economics, 2026 Publication	<1 %
59	Xinyuan Zhang, Yidi Wang, Farina Khan. "Beyond one-size-fits-all: Paradoxes in environmental fiscal policy and renewable energy impacts on ASEAN CO2 emissions", Journal of Environmental Management, 2025 Publication	<1 %
60	e-journal.stkipsiliwangi.ac.id Internet Source	<1 %
61	emrbi.org Internet Source	<1 %
62	files.eric.ed.gov Internet Source	<1 %
63	journal.feb.unmul.ac.id Internet Source	<1 %
64	proceedings.ums.ac.id Internet Source	<1 %

65	pub-data.leuphana.de Internet Source	<1 %
66	pure.port.ac.uk Internet Source	<1 %
67	scholar.harvard.edu Internet Source	<1 %
68	tpmap.org Internet Source	<1 %
69	www.econstor.eu Internet Source	<1 %
70	www.ispeco.org Internet Source	<1 %
71	www.utupub.fi Internet Source	<1 %
72	Satria Bangsawan, MS Mahrinasari, Ernie Hendrawaty, Rindu Rika Gamayuni et al. "The Future Opportunities and Challenges of Business in Digital Era 4.0", Routledge, 2020 Publication	<1 %
73	Sultan Karima Adytia Purnama, Mochammad Arfani, Galuh Ajeng Ayuningtiyas, Sarwani. "The Influence Of Price And Payment Method On Purchase Decisions At Sakinah Sukolilo Supermarket Surabaya", Journal of Business Management, 2025 Publication	<1 %
74	Hendro Gunawan, Benyamin Langgu Sinaga, Sigit Purnomo WP. "Assessment of the Readiness of Micro, Small and Medium Enterprises in Using E-Money Using the Unified Theory of Acceptance and Use of Technology (UTAUT) Method", Procedia Computer Science, 2019	<1 %

Publication

75	Joy Elly Tulung, Jullie Jeanette Sondakh, Shinta Jeanette Camelia Wangke, Raynaldo Fabian Karel Posumah. "Effects of capital ratio, quality of receivables, liquidity, and gearing ratio on profitability: A study financial institutions' governance", Journal of Governance and Regulation, 2024 Publication	<1 %

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	On		

2506-IJMS-17320

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14