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GREEN INOVATION, ENVIRONMENTAL SUPPORT, AND DIGITALIZATION TO NAVIGATE URBAN VILLAGE ECONOMIC DEVELOPMENT: EVIDENCE FROM JAKARTA

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Abstract

This study aims to analyze the influence of green innovation, environmental support, and technology adoption on sustainable community economic development. This study uses BPS village potential data collection census data (PODES) in 2014, 2018, and 2021 for DKI Jakarta province. This study uses a spatial panel regression approach: spatial durbin model. The results show that environmental support and technology adoption have a significant effect on sustainable community economic development. There are indications of positive spillovers between sustainable community economic development between regions and are supported by various instruments such as ethnic pluralism and aquaculture. The implications of this study indicate that it is important to navigate environmental support and technology adoption towards community economic development on a regular basis so that Jakarta is able to compete with global cities

Keywords: Green Inovation; Environmental Support, Digitalization, Sustainable Development

INTRODUCTION

Sustainable economic development of communities is critical for cities as it balances environmental, social and economic goals, and ensures long-term prosperity and resilience. Cities including Jakarta should prioritize clean energy sources, efficient waste management, and green building practices to reduce their carbon footprint and mitigate the impacts of climate change. In addition, sustainable cities also focus on creating inclusive and equitable communities by addressing issues of affordable housing, social equity and accessibility. Urban villages, which are compact and walkable, support sustainable economic development by reducing transportation costs, increasing local business activity, and creating more efficient commercial districts. This approach not only increases economic productivity and innovation, but also fosters a sense of community and provides opportunities for all residents to thrive, making cities more resilient and competitive for future generations Jakarta has been under the spotlight as one of the most polluted cities in the world. This

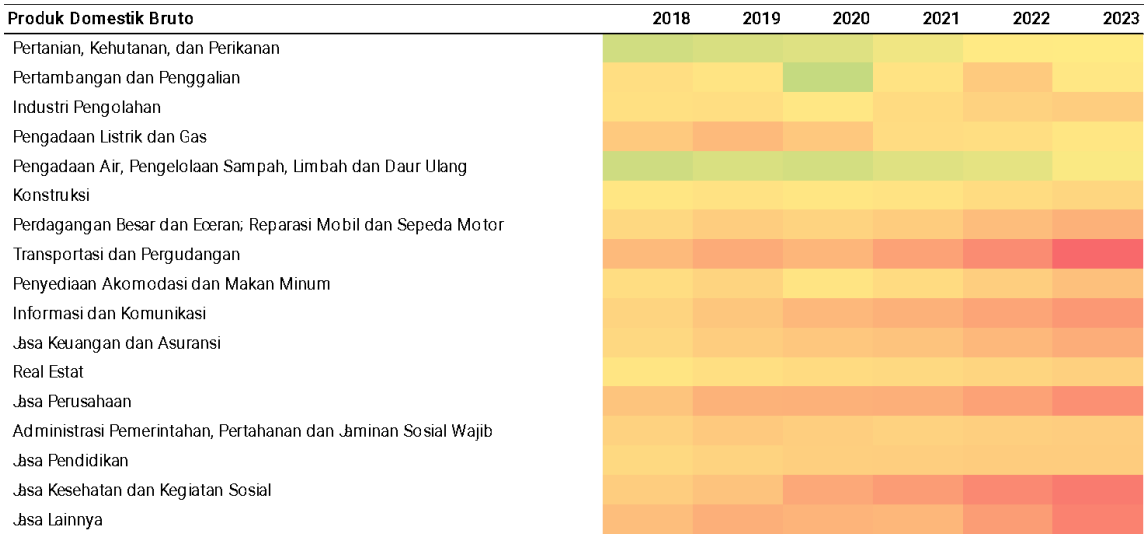

Figure 1. Gross Regional Domestic Product Index DKJ
Source: BPS (2023), processed

Poor air quality not only affects the health of its residents, but also poses a major challenge to supporting sustainable economic development. Air pollution can hamper productivity, damage infrastructure, and lower quality of life, all of which can affect economic growth (Alam & Kabir, 2013). Therefore, Jakarta is faced with the urgent task of balancing economic growth and environmental sustainability. Synergizing policies with strong commitment, innovation, and active participation from the community, Jakarta can transform into a greener and more sustainable city, while still maintaining its economic growth momentum. However, this economic growth sometimes ignores environmental aspects and tends to focus on explorative activities (Kirmanto et al., 2012).

Based on BPS data (2023) , the GDP index shows at Table 1 that the majority of essential sectors have relatively weak competitiveness despite their high growth. This is shown by sectors including agriculture, manufacturing, and services, not growing as fast as other sectors or as fast as expected. Factors contributing to this weak competitiveness can vary widely, ranging from a lack of innovation and investment to regulatory barriers and international competition. This is a serious issue, as these essential sectors are often the backbone of our economy and the source of jobs for millions of residents in DKI. Therefore, there needs to be further efforts to analyze and address the challenges faced by these sectors in order to improve competitiveness, especially in a sustainable economy.

In this context, Green innovation plays an important role in driving sustainable community economic development. By integrating green practices into the local economy, communities can reduce their carbon footprint, conserve natural resources, and mitigate the impacts of climate change. This approach not only benefits the environment, but also creates new job opportunities, stimulates local entrepreneurship, and improves overall quality of life. When communities adopt green technologies and sustainable practices, they become more resilient and self-reliant, leading to long-term economic growth and social development.

Environmental support plays an important role in the economic development of sustainable communities by integrating environmental, economic, and social objectives. This approach involves implementing green technologies and sustainable practices that reduce carbon footprints, conserve natural resources, and mitigate the impacts of climate change. By doing so, communities can create new employment opportunities, stimulate local entrepreneurship, and improve overall quality of life. In addition, environmental support fosters resilience and self-reliance, leading to long-term economic growth and social development. This holistic approach ensures that the needs of the present are met while ensuring adequate resources are available for future generations, thus supporting sustainable community development.

Technology adoption plays an important role in the sustainable economic development of communities. By integrating digital technologies and innovative solutions, communities can increase productivity, reduce their carbon footprint, and conserve natural resources. This approach creates new employment opportunities, stimulates local entrepreneurship, and improves overall quality of life. For example, the adoption of sustainable energy technologies has been shown to have a positive impact on the Sustainable Development Goals (SDGs) and energy regulations, leading to reduced carbon emissions and greener practices. Furthermore, the development of smart systems connected to the Internet of Things (IoT) can create strategic opportunities to overcome barriers related to the SDGs and ensure an environmentally sound, just, and healthy society.

Previous studies directly addressing green innovation, environmental support, and technology adoption in relation to sustainable community economic development are limited. Recent studies highlight the importance of green innovation and technology adoption in driving sustainable economic development. Green innovation, particularly in renewable energy such as solar power, can reduce carbon emissions, provide clean energy, and create jobs (Mabhanda, 2024). Blockchain technology emerges as a game changer for green innovation, mediating the relationship between sustainability orientation and green innovation adoption in SMEs (Polas et al., 2022b). While digital technologies offer opportunities for sustainable development, their adoption also presents challenges that need to be addressed (Al-Emran & Griffy-Brown, 2023). Green innovation patterns show that leading-edge innovation is concentrated in high-income countries, with technologically advanced developing countries emerging as significant innovators in certain areas (Dutz & Sharma, 2012). To encourage green innovation, policies should focus on supporting leading-edge innovation, facilitating catch-up innovation through technology access and uptake, and developing uptake capacity by strengthening skills and improving the business environment for innovation (Dutz & Sharma, 2012).

On this basis, this study aims to explore the influence of green innovation, environmental support, and technology adoption on sustainable community economic development in the Jakarta Special Region. The expectations surrounding research on the influence of green innovation, environmental support and technology adoption on sustainable community economic development are multifaceted and significant. Green innovation is expected to encourage environmentally friendly practices and products, reducing environmental impacts while promoting community economic growth. Environmental support, through policies and incentives, is expected to support these efforts by providing the necessary framework and resources for sustainable practices to flourish. Technology adoption plays an important role in this dynamic, offering advanced tools and systems that increase efficiency and effectiveness in implementing green innovations. Collectively, these elements are projected to create a synergistic effect that drives sustainable economic development, improves quality of life, and ensures environmental sustainability in the long run.

LITERATURE REVIEW AND HYPOTHESIS FORMULATION

Green Innovation and Sustainable Community Economic Development

Based on previous research, green innovation generally has a positive effect on sustainable community economic development. Green innovation plays an important role in promoting sustainable community economic growth by positively impacting various aspects. Research has shown that green innovation, along with green finance and technological innovation, significantly contributes to green economic growth in developing countries (Ali et al., 2024). In addition, the penetration of green innovation has been shown to change the relationship between economic growth and carbon emissions, leading to a considerable reduction in carbon emissions and promoting sustainable economic development. (Nan et al., 2022). In addition, the adoption of green

innovation practices, especially those using blockchain technology, has been linked to the creation of a sustainable green economy and environmental protection, which emphasizes the importance of embracing green innovation for economic and environmental sustainability. (Polas et al., 2022). Overall, sustainable technology transfer and sustainable innovation have been shown to promote green growth, which in turn has a positive impact on economic growth, highlighting the important role of green innovation in fostering sustainable economic growth of societies (Fernandes et al., 2021).

Environmental Support and Sustainable Community Economic Development

Environmental support plays an important role in promoting the sustainable economic development of society by influencing various factors. Sustainable construction, such as green building practices, reduces carbon emissions, improves resource efficiency, and supports the national economy (Eddy et al., 2023). Environmental economics highlights the importance of incorporating environmental considerations into the economic paradigm to achieve sustainability goals (Suleymanov et al., 2023). In addition, community support for sustainable development is influenced by perceptions of environmental and economic factors, with a strong sense of community as a precursor to supporting sustainable community development (Sutisna et al., 2022). In addition, the concept of Green Economy emphasizes the promotion of efficient resource use, low carbon emissions, and economic growth, all of which contribute to sustainable economic development in society (Phoochinda, 2018). By integrating environmental support into community initiatives, economic development can progress in a sustainable manner, providing benefits to both the environment and society.

Technology Adoption and Sustainable Community Economic Development

Technology adoption plays an important role in the sustainable economic development of communities by enabling innovative business models, improving gender equality, and promoting economic sustainability. Various studies emphasize the importance of technology-based initiatives in empowering communities, especially through digital payment systems (Karyotaki et al., 2022; Okunade et al., 2024; Shankaranarayana et al., 2023). Utilizing digital technology not only drives public welfare problem-solving and services, but also contributes to economic growth and reduced environmental impact, ultimately leading to long-term economic stability for a country. (X. Li et al., 2022; Olowolayemo et al., 2023). The adoption of mobile technologies, digital payment systems and digital strategies can positively affect economic and environmental performance in strategic emerging industries, highlighting the transformative power of technology when properly integrated into community development initiatives. Internet abuse poses a threat to sustainable development by increasing the risk of computer and information crime, potentially jeopardizing business and government activities (Agboola et al., 2023). In addition, the introduction of disruptive technologies can lead to job losses, privacy violations, and decreased human control over cyber systems, posing challenges for both workers and companies (Sineviciene et al., 2021).

Other Factors and Sustainable Community Economic Development

Other factors that influence sustainable community economic development include access to water and sanitation, aspects of governance, demographics, creative and blue economy. Water supply, sanitation and public health projects have shown a significant positive relationship with economic development, especially when coupled with better health outcomes. (Clemens & Douglas, 2012). Access to improved water sources and sanitation positively affects economic efficiency and growth in developing countries (Halkos & Tzeremes, 2012). Governance plays an important role in sustainable development, especially at the local and community levels. Various studies have found that effective governance has a positive and significant impact on achieving sustainable development goals (Gündoğdu & Aytekin, 2022; Güney, 2017). Key aspects of governance that contribute to sustainability include e-government development, political reform,

and environmental performance. (Gündoğdu & Aytekin, 2022). Demographic factors play an important role in the economic development of sustainable communities. Population dynamics, including size, distribution, and characteristics, significantly impact environmental burdens, development participation, and adaptability to change (Lutz et al., 2012). The Creative Economy and Blue Economy play an important role in the sustainable economic development of society. The Creative Economy, through digital competence, green behavior, psychological well-being, and innovation behavior, contributes to building a sustainable creative economy (Widodo et al., 2023). The Creative Economy and Blue Economy play an important role in the sustainable economic development of society. The Creative Economy, through digital competence, green behavior, psychological well-being, and innovation behavior, contributes to building a sustainable creative economy (Loe & Duarte, 2023).

Benchmarking Sustainable Community Economic Development

Based on the benchmarking literature, several policy comparisons have been made by global cities to achieve sustainable community economic development (SCED). The details can be stated as follows on Table 2.

RESEARCH METHODS

This study uses primary census data from the Central Bureau of Statistics' Village Potential Data Collection (PODES BPS), which is compiled in a panel of 267 villages in 3 periods, namely 2014, 2018, and 2021 for the object of the Special Region of Jakarta Province. The use of 2014 data is intended to review the initiation of more complex rural development. Meanwhile, the 2021 suffix represents the latest data availability from PODES. The components used in this data include Economic Blocks, Housing, Rural Characteristics, Education, Health, Environment and Disaster.

Empirical Model

Table 1. Benchmarking 5 Global Cities

No	City	Policy for SCED	Source
	1	2	3
1	Singapura	Provide affordable social housing through the Housing and Development Board (HDB) implement green initiatives such as Green Plan 2030 to drive long-term economic growth and attract foreign direct investment (FDI).	Chia (2015); Lim (2023); Liow Li Sa & Choon-Yin, 2023)
2	Kuala Lumpur	Kuala Lumpur's sustainable community economic development policy faces challenges such as limited funding for Sustainable City And Community (SCC), which calls for integrating sports facilities into affordable housing programs for public health	Azudin et al., (2023); Isa & Daud (2023)
3	Bangkok	The Eastern Economic Corridor (EEC) focuses on economic development in a specific region, aiming to reduce regional disparities and promote national growth.	Kamnuansilpa et al (2023)
4	Amsterdam	Amsterdam's sustainable community economic development policy focuses on the transition to a Circullar Economy (CE) to improve the city's competitiveness and sustainability.	Hoek et al. (2017)

5	Canberra	Sustainable Community Economic Development (CED) aims to create a strong sense of community, which is critical to making cities more sustainable, as seen in suburban Canberra where sustainability attitudes are compared in different types of development, emphasizing the importance of community building in fostering positive sustainability attitudes..	Lauer et al (2009)

Based on previous literature, that the components that make up green innovation (Polas et al., 2022), environmental carrying capacity (Eddy et al., 2023; Suleymanov et al., 2023), and technology adoption (X. Li et al., 2022; Olowolayemo et al., 2023) is affixed through the chart with yellow background. Meanwhile, the sustainable community economic development component adapts the calculations from Bappenas and MoV by recalculating them asshown in the chart with the green background.

Furthermore, the conceptual framework was actualized in such a way as to use geography-weighted panel regression analysis techniques: Spatial Durbin Model. With the aim that each of these predictors can be known for their spillover effects, both propagating and spreading. In general, there are three classifications to measure the spatial impact between one place to another, namely the Spatial Error Model (SEM), Spatial Lag Model (SLM), and Spatial Durbin Model (SDM) (Che et al., 2018; J. J. Li & Jing, 2019). SEM is a spatial regression that examines the relationship based on random effects. Meanwhile, SLM is a spatial regression that examines the relationship based on lag time for the explanatory variables. SDM is a spatial regression that examines the relationship based on the lag time for both explanatory and non-explanatory variables and a simplification of SEM-SLM. The detailed modelling can be expressed as follows:

$$\begin{aligned} PEKK_{it} = {} & \alpha_0 + \rho W \times PEKK_{it-1} \\ & + \beta_1 W \times IH_{it} \\ & + \beta_2 W \times DL_{it} + \alpha_1 IH_{it} \\ & + \alpha_2 DL_{it} + \alpha_3 AT_{it} \\ & + \theta Sanitasi_{it} \\ & + \gamma Pemerintahan_{it} \\ & + \pi Demografi_{it} \\ & + \tau kreatif\_biru_{it} + \varepsilon_{it} \end{aligned}$$

(1)

Where $PEKK$ is sustainable community economic development, W is a spatial weighting matrix (which contains the dimensions of distance and center density), IH is green innovation, DL is environmental carrying capacity, $Sanitasi$ is a vector containing variables that make up sanitation, $Pemerintahan$ is a vector containing variables that make up governance, $demografi$ is a vector containing variables that make up community demographics, $kreatif\_biru$ is the number of IMK and water utilization for the economy, and ε is an error term.

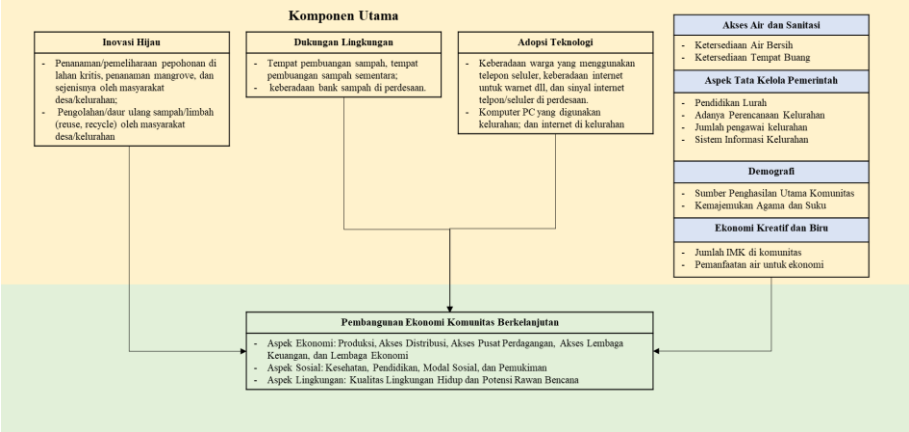

Figure 2. Conceptual Framework
Source: Author's Result

Furthermore, the spatial weight matrix is used as a provider of spatial correlation information between one region and another region, the weight matrix contains the spatial coefficient of distance (d) which can be expressed as follows:

$$W_{ij} = \{\frac{1}{d_{ij}} \; 0 \;\; ; i \neq j \tag{2}$$

Based on the weighting matrix of equation (1), that the measurement process requires guidance in the form of estimating the spatial correlation between green innovation, environmental support and technology adoption on the economic development of sustainable communities. On this basis, the use of the Moran Index is very important to review aspects of spatial autocorrelation. The measurement is as follows:

$$Moran's\ I = \frac{\sum_{i=1}^{n} \quad \sum_{j=1}^{n} \quad w(x_i - \underline{x})(x_j - \underline{x})}{S^2 \sum_{i=1}^{n} \quad (x_i - \underline{x})^2} \tag{3}$$

In equation (3) $\underline{x} = \frac{\Sigma_i^n{}_{n=1} x_i}{n}$, x_i, and x_j are indicators that express the area of a village, n represents the number of villages, and w is the weight matrix. Meanawhile, S^2 is the variance of the size of the village. Moran's index has a relative value between 0-1, if the result shows 0 then there is no spatial correlation and vice versa. On the other hand, if the result of the index calculation is negative then there will be a negative impact on the surrounding area. The spatial regression measurement does not stop there, the last step is done to get direct and indirect relationships. The direct and indirect measurements of sustainable community economic development are as follows:

$$\left[\frac{\partial y}{\partial x_{1k}}, \frac{\partial y}{\partial x_{2k}}, \ldots, \frac{\partial y}{\partial x_{nk}}\right] = \left[\frac{\partial y_1}{\partial x_{1k}} \ldots \frac{\partial y_1}{\partial x_{nk}} \;\vdots\; \frac{\partial y_n}{\partial x_{1k}} \ldots \frac{\partial y_n}{\partial x_{nk}}\right]$$
$$= (I_n - \rho W)^{-1}[\beta_k \; w_{12}\theta_k \; w_{21}\theta_k \; \beta_k$$
$$\vdots \; w_{n1}\theta_k \; \ldots w_{n2}\theta_k \quad \ldots w_{1n}\theta_k \ldots w_{2n}\theta_k \ldots . \vdots \; \beta_k \;\;] \tag{4}$$

Where β_k is the direct impact of green innovation, environmental support, and technology adoption while $w_{ni}\theta_k$ is the indirect impact.

RESULTS AND DISCUSSION

Descriptive Statistics and Correlation Coefficeient Matrix

Descriptive statistics describe 801 observations for each variable. SCED (Sustainable Community Economic Development) has a standard deviation of 1.143, indicating that this data is well distributed around the mean. The Green Innovation PCA, Environmental Support PCA, and Technology Adoption PCA variables have standard deviations of 1.102, 1.05, and 1.238 respectively, indicating fairly consistent variation among observations.

In the water and sanitation component, all households have access to owned sanitation, while access to clean water is adequate for 87.9 percent of the population with a standard deviation of 0.326, and access to washing water is adequate for 100 percent of the population. In the governance aspect, most village heads have tertiary education with a percentage of 99.9 percent, and the number of kelurahan employees averages 97,365 with a standard deviation of 61,121.In the demographic component, there is religious and ethnic pluralism at high mean values.

In the creative economy sector, culinary micro and small industries (IMK) have an average of 9.12 with a standard deviation of 27.715, fashion IMK 16.272 with a standard deviation of 62.489, and craft IMK 16.845 with a standard deviation of 59.924. In the blue economy, water utilization for aquaculture is at 39.1 percent of the population with a standard deviation of 0.193, while water utilization for tourism is 6 percent with a standard deviation of 0.237. Water utilization for capture fisheries was 4.9 percent with a standard deviation of 0.215. Finally, 64 percent of the population lives around economic growth areas called “Poles,” with a standard deviation of 0.48.

Furthermore, the correlation coefficient matrix shows that green innovation, environmental support, internet adoption and other variables show a positive correlation. Meanwhile, aquaculture, aquatic tourism, and capture fish are negatively correlated. Horizontally, it shows that multicollinearity is more emphasized in the context of the water area, which is certainly an association of the Regency of Adm. Thousand Islands. On the other hand, the associated areas on land such as West, Central, North, South, and East Jakarta tend to have a good correlation and precision.

Estimation Results

Based on the estimation results, it shows that there are potential positive spillover and contangious impacts on sustainable community economic development. Furthermore, green innovation consistently has no effect on PEKK, this is also the case for clean water, lurah's last education, number of staff, and creative economy. Meanwhile, environmental support and technology adoption also included ethnic diversity and aquaculture. Interestingly, the estimation results of SLM and SDM-Contangious show something quite interesting, namely there is an indication that the negative spillover of technology adoption to other regions can be a highlight in itself.

The increase in green innovation (pca_green_innov) shows a direct effect of 0.0077% and an indirect effect of 0.0497%. This suggests that green innovation is not only directly beneficial to the regions that implement it, but also provides considerable benefits to surrounding regions. Environmental support (pca_env_support) has a significant direct effect on PEKK of 0.0608% and an indirect effect of -0.0065%. This suggests that environmental support is very important for increasing SEZ in the area, although the impact on surrounding areas is slightly reduced. Technology adoption (pca_tech) has a significant positive direct effect of 0.1383% and a significant negative indirect effect of -0.1598%, resulting in a negative total effect of -0.0215%. This suggests that technology adoption is indeed beneficial for the region, but could have a negative competitive impact on the surrounding regions.

Adequate access to clean water has a positive direct effect of 0.0112 basis points and a negative indirect effect of -0.0121 basis points. This indicates that adequate clean water access has a balanced impact between areas that have such access and surrounding areas. High lurah education has a direct effect of -0.2383 basis points but an indirect effect of 0.2563 basis points. This indicates that lurah education may have more of an impact on the surrounding area than the area itself. Ethnic diversity in the community has a significant positive direct effect of 0.9718 basis

points and a significant negative indirect effect of -1.0450 basis points. This suggests that ethnic pluralism is beneficial for the area in question, but may lead to a decline in SEZ in the surrounding area.

In the creative economy sector, culinary, fashion and craft micro and small enterprises (MSMEs) show a very small or neutral total effect on PEKK, indicating that these types of businesses do not have a significant impact on PEKK. On the blue economy, aquaculture has a highly significant positive direct effect of 1.1657 basis points and a significant negative indirect effect of -1.2536 basis points. This indicates that aquaculture is highly beneficial to the region in question but can be detrimental to surrounding areas. Aquatic tourism shows a significant negative direct effect of -0.4565 basis points and a significant positive indirect effect of 0.4909 basis points. This suggests that aquatic tourism may be less profitable for the area, but provides significant benefits to surrounding areas. Capture fisheries has a highly significant negative direct effect of -1.3028 basis points and a significant positive indirect effect of 1.4010 basis points. This suggests that capture fisheries may be disadvantageous to the area, but provide considerable benefits to surrounding areas

Furthermore, based on the fitted prediction, there is a difference in the pattern of SEZs between areas adjacent to growth centers and their distribution. If it is observed that Figure 3 shows an uneven distribution of SEZs, this may come from the penetration of environmental support and the adoption of technology that causes diversification. Based on observations, this pattern tends to be unevenly distributed in the East Jakarta area and begins to experience turbulence in 2018 and 2021. Meanwhile, Figure 4 shows that the pattern tends to be associated with centers/regions with adequate economic, social, and environmental values. Most of them are dominated by West Jakarta and South Jakarta and this pattern remains relatively unchanged.

Analysis and Discussion

Based on the estimation results and branchmarking alignment, the results of this study are in line with Ali et al (2024) on green innovation, Suleymanov et al (2023) research on environmental support and Sineviciene et al (2021) research on technology adoption.

Environmental support that includes the provision of waste bins, waste banks and disaster mitigation efforts has a significant positive influence on sustainable community economic development. Adequate waste bins help keep the environment clean, improve public health and boost productivity. Waste banks, on the other hand, encourage recycling practices, allow residents to earn additional income through the sale of recyclable waste, and reduce the volume of waste disposed of. Disaster mitigation efforts, such as flood and landslide risk reduction, protect community assets and ensure continuity of economic activity. Taken together, these measures create a safer, healthier and more sustainable environment, ultimately strengthening the community's economic foundation and improving long-term well-being

The adoption of technologies such as telephones, signals and operator services has a significant positive influence on the economic development of sustainable communities. The availability of telephones and strong signals enables faster and more efficient communication, which is essential for business activities and coordination among residents. Reliable operator services ensure greater access to information, from education to economic opportunities, which improves people's knowledge and skills. The technology also supports local innovation and e-commerce, enabling communities to sell products and services more widely and effectively. Thus, the adoption of these technologies not only improves connectivity and efficiency, but also opens up new economic opportunities, reduces the digital divide, and strengthens the economic resilience of communities in the long run.

The adoption of technologies such as telephones, signals, and carrier services can have negative spillover effects on sustainable community economic development for other communities. When one community adopts advanced technologies, neighboring less developed communities may be left behind and face a widening digital divide. This can lead to unequal access to

information, economic opportunities and education between communities that have access to technology and those that do not. In addition, reliance on technology can also reduce face-to-face social interactions, which are important for social cohesion and community solidarity. These disparities can lead to social and economic injustice, hinder collaboration between communities, and create tensions that undermine harmony and overall sustainable economic development.

Tribal plurality within a community can have negative spillover effects on sustainable community economic development for other communities. When a community has high ethnic diversity, differences in culture, language and values can pose challenges in communication and collaboration. If not managed well, this can lead to social conflict, discrimination and segregation, which hinders cooperation and economic progress. Other communities interacting with these diverse communities may face uncertainties and difficulties in establishing harmonious and mutually beneficial economic relationships. Tensions and mistrust arising from ethnic differences can also impede the flow of investment and innovation between communities, undermining the overall potential for sustainable economic development.

Aquaculture has a significant positive influence on sustainable community economic development. By effectively utilizing water resources through fish, shrimp and aquatic plant farming, communities can generate a stable and nutritious food source. The practice also creates local employment opportunities, increases household income, and promotes skills development in aquaculture management and technology. In addition, sustainable aquaculture can reduce pressure on terrestrial natural resources and wild fisheries, support ecosystem conservation, and reduce negative environmental impacts. Thus, aquaculture not only improves food and economic security, but also supportsecological balance and the long-term well-being of communities.

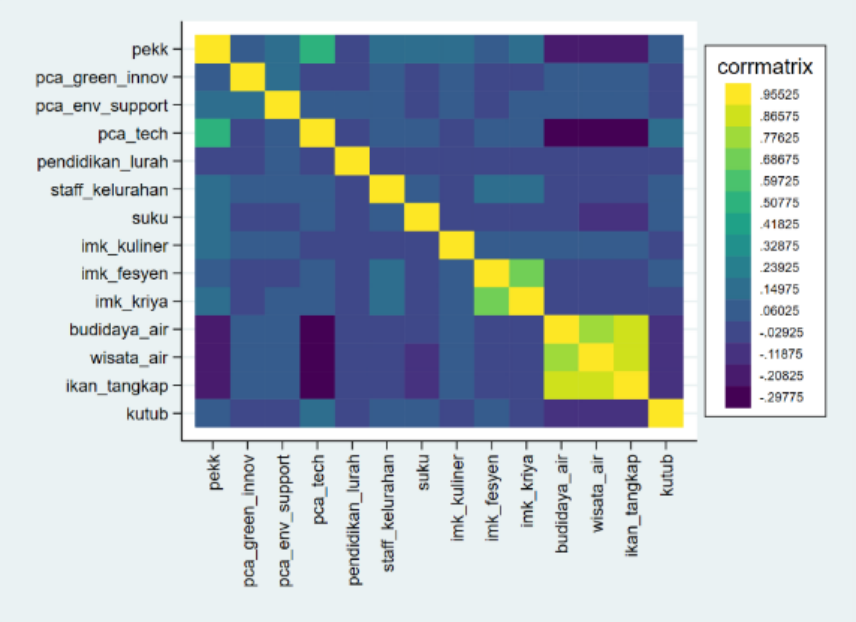

Figure 3

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.
PEKK	801	0	1,143
PCA Green Innovation	801	0	1,102
PCA Environmental Support	801	0	1,05
PCA Adopsi Teknologi	801	0	1,238

Water and Sanitation Component			
Sanitation Access	.	.	.
Owned	801	1	0
Clean Water Access	.	.	.
Inadequate	801	0,121	0,326
Adequate	801	0,879	0,326
Washing Water Access	.	.	.
Adequate	801	1	0
Governance Aspects			
Education of the Head of Village	.	.	.
High School / Equivalent	801	0,001	0,035
Higher Education	801	0,999	0,035
Number of village employees	801	97,365	61,121
Demographics			
Religious pluralism	.	.	.
Yes	801	1	0
Tribal Diversity	.	.	.
None	801	0,001	0,035
Yes	801	0,999	0,035
Creative Economy			
MSe Culinary	801	9,12	27,715
MSe Fashion	801	16,272	62,489
MSe Craft	801	16,845	59,924
Blue Economy			
Water Utilization: Aquaculture	.	.	.
None	801	0,961	0,193
Yes	801	0,039	0,193
Water Utilization: Tourism	.	.	.
None	801	0,94	0,237
Yes	801	0,06	0,237
Water Utilization: Capture	.	.	.
Fisheries			
None	801	0,951	0,215
Yes	801	0,049	0,215
Location			
Poles	801	0,64	48

Table 3. Spatial Panel Regression Estimation Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)

	pekk	pekk	pekk	pekk	pekk	pekk	pekk
Inovasi Hijau	.0358	.0068	.0033	.0117	.0069	.0112	.0089
	(.0292)	(.0172)	(.0174)	(.0192)	(.0187)	(.0183)	(.0181)
Dukungan Lingkungan	.1101***	.0549***	.0554***	.064***	.0609***	.0629***	.0606***
	(.031)	(.0189)	(.0191)	(.0204)	(.0203)	(.0195)	(.0197)
Adopsi Teknologi	.4528***	.1323***	.1346***	.1342***	.127***	.1485***	.1343***
	(.0273)	(.0203)	(.0205)	(.022)	(.0215)	(.0213)	(.0211)
Air Bersih	.088	.0024	.0082	.0273	.0291	.0026	.0109
	(.0986)	(.0649)	(.0657)	(.0675)	(.068)	(.0644)	(.0658)
Pendidikan Lurah	-.3454	-.199	-.2251	-.6365	-.5887	-.2529	-.232
	(.8947)	(.5247)	(.5302)	(.5421)	(.5449)	(.5204)	(.5294)
Jumlah Staff Kelurahan	.0026***	.00056*	.00033	.00046	.00037	.00045	.00035
	(.00053)	(.00029)	(.0003)	(.00031)	(.00036)	(.00029)	(.00035)
Kemajemukan Suku	3.931***	.9935*	.9537*	.8032	.7656	1.078**	.9459*
	(.9557)	(.5479)	(.5549)	(.566)	(.5684)	(.5445)	(.5544)
Ekonomi Kreatif							
IMK Kuliner	.0074***	.0011	.0011	.0012	.0012	.0011	.0011
	(.0011)	(.00073)	(.00074)	(.00076)	(.00076)	(.00073)	(.00074)
IMK Fesyen	-.0013*	-.00022	-.000024	-.00019	-.00027	-.00013	.000024
	(.00072)	(.00057)	(.00057)	(.0006)	(.0006)	(.00056)	(.00057)
IMK Kri	.0019**	.000086	-.000012	.00031	.00042	.00012	-.000067
	(.00076)	(.00051)	(.00051)	(.00053)	(.00054)	(.0005)	(.00052)
Ekonomi Biru							
Budidaya Air	.7389**	1.007***	1.132***	1.225***	1.258***	.9798***	1.135***
	(.3764)	(.2109)	(.2124)	(.2175)	(.2181)	(.2097)	(.212)
Wisata Air	.1742	-.3332	-.4553*	-.3665	-.4141*	-.2944	-.4443*
	(.3004)	(.2326)	(.2354)	(.2479)	(.2488)	(.2315)	(.2356)
Tangkap Ikan	-1.225***	-1.283***	-1.266***	-1.035***	-1.055***	-1.252***	-1.268***
	(.4531)	(.3014)	(.3048)	(.3204)	(.3207)	(.3006)	(.3047)
Konstanta	-3.972***	-.8514	-.5721	-.214	-.2056	-.8661	-.5775
	(1.309)	(.7637)	(.7726)	(.7864)	(.7911)	(.7569)	(.7712)
W:PEKK		.5669***				.575***	

		(.0515)				(.0515)	
W:Inovasi Hijau				-.0108		-.0213	
				(.0428)		(.0409)	
W:Dukungan Lingkungan				-.0157		-.0403	
				(.0459)		(.0438)	
W:Adopsi Teknologi				-.1204**		-.1215**	
				(.0544)		(.0519)	
sigma_u:_cons		.7659***	.7741***	.9341***	.924***	.7703***	.7751***
		(.0418)	(.0412)	(.0475)	(.0474)	(.042)	(.0412)
sigma_e:_cons		.4356***	.441***	.4478***	.4507***	.4314***	.4401***
		(.014)	(.0142)	(.0143)	(.0144)	(.0138)	(.0141)
M:PEKK			2.966***				2.977***
			(.1169)				(.1143)
M:Inovasi Hijau					.2357		-.1606
					(.2483)		(.2396)
M:Dukungan Lingkungan					-.1417		-.163
					(.2617)		(.2532)
M:Adopsi Teknologi					-.2655*		.0306
					(.1585)		(.1547)
Observations	801	801	801	801	801	801	801
Pseudo R^2	.z	.2622	.1544	.2578	.2843	.226	.181

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1*

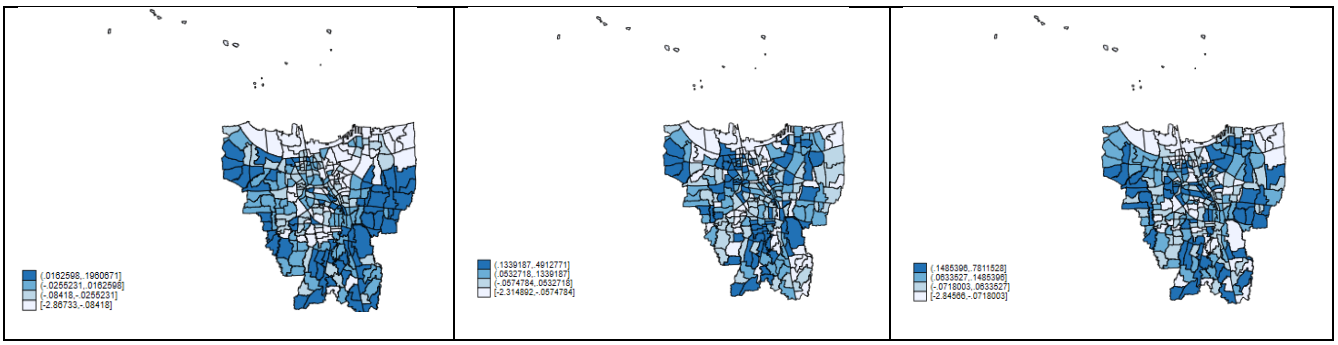

Figure 4. Development of Sustainable Community Economic Development DKJ spillover 2014 (left), 2018 (center), 2021 (right)

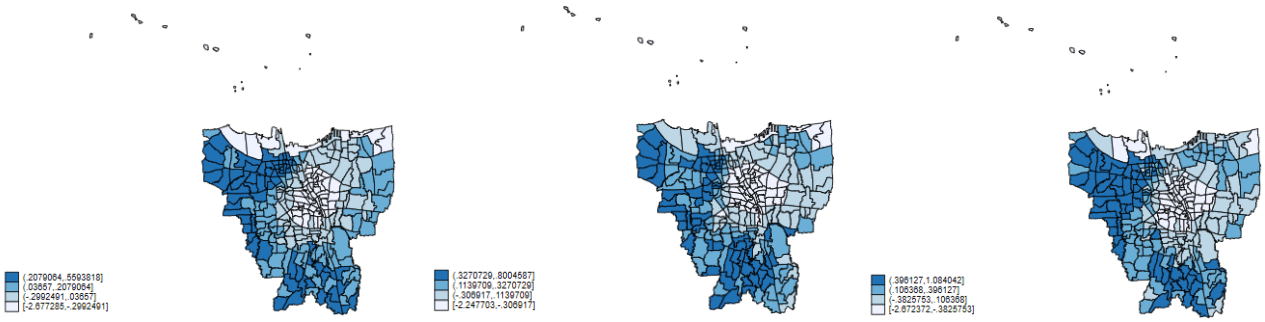

Figure 5. Progress of Economic Development of Contangious DKJ Sustainable Communities 2014 (left), 2018 (center), 2021 (right)

Table 4. Direct and Indirect Impacts

	Direct	Indirect	Total
pca_green_innov	0.0077	0.0497	0.0574
pca_env_support	0.0608***	-0.0065	0.0543
pca_tech	0.1383***	-0.1598***	-0.0215
air_bersih: Memadai	0.0112	-0.0121	-0.0008
pendidikan_lurah	-0.2383	0.2563	0.0180
staff_kelurahan	0.0003	-0.00039	-0.0000
suku	0.9718*	-1.0450*	-0.0733
imk_kuliner	0.0012	-0.0013	-0.0001
imk_fesyen	0.0000	-0.0000	-0.0000
imk_kriya	-0.0001	0.0001	0.0000
budidaya_air	1.1657***	-1.2536***	-0.0879
wisata_air	-0.4565*	0.4909*	0.0344
ikan_tangkap	-1.3028***	1.4010***	0.0982

Standard errors are in parentheses
*** p<.01, ** p<.05, * p<.1

CONCLUSION

The results show that environmental carrying capacity and technology adoption have a significant positive effect on sustainable community economic development in Jakarta. This is supported by the empowerment of ethnic diversity and the development of aquatic culture. The implications of these findings suggest that to continue to foster sustainable community economic development in Jakarta, it is important for the government and stakeholders to strengthen environmental carrying capacity and technology adoption. This effort should be supported by policies that support environmental sustainability such as the provision of waste management facilities and other green initiatives. In addition, increasing access and use of technology should be focused on local economic development and digital inclusion. Given that ethnic diversity and

aquaculture development have been proven to make positive contributions, the next recommendation is to continue facilitating community empowerment programs that value cultural diversity and support aquaculture. Collaboration between the public and private sectors in promoting technological innovation and sustainable environmental practices will be key in achieving inclusive and sustainable economic development in Jakarta.

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