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Article

Map to prosperity: Natural resource revenue sharing and infrastructure development in Indonesia

Bachtari Alam Hidayat[1,2,*], Agus Faturohim[1], Loso Judijanto[3], Sidiq Hanapi[4], Alfayanti Alfayanti[4], Marhaendro Purno[5], Firdaus Landekumandang[1], Ribut Nurul Tri Wahyuni[6], Kunihiko Shinoda[7]

[1] Development Planning, Research and Development Agency of Palembang City, Palembang 30131, Indonesia
[2] Universitas Tamansiswa Palembang, Palembang 30126, Indonesia
[3] IPOSS Jakarta, Jakarta 10220, Indonesia
[4] Research Center for Behavioral and Circular Economic, National Research and Innovation Agency (BRIN), Gedung Widya Graha Lantai 4, Jl. Jend. Gatot Subroto, Jakarta Selatan 12710, Indonesia
[5] Universitas Insan Pembangunan Indonesia (UNIPI), Tangerang 15810, Indonesia
[6] Polytechnic of Statistics STIS, Jakarta 13330, Indonesia
[7] National Graduate Institute for Policy Studies (GRIPS), Minato-ku, Tokyo 106-8677, Japan
*** Corresponding author:** Bachtari Alam Hidayat, alamhidayat79@gmail.com

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Abstract: The well-being of society can be realized through meeting basic needs, one of which is providing public infrastructure. This study examines the role of Natural Resource Revenue Sharing Funds (DBH SDA) on government investment in infrastructure in 491 regencies/cities in Indonesia. The testing in this research uses panel data regression analysis. The results show that per capita DBH SDA in Indonesia during the study period of 2010–2012 has a significant and positive influence on government investment in infrastructure. The selection of this period is based on the consideration that a resources boom has occurred, where there is an increased global demand for natural resource commodities followed by an increase in commodity prices, thereby positively impacting revenue for countries or regions abundant in natural resources. Despite DBH SDA having a significant and positive influence, regional spending on infrastructure tends to be more influenced by central government transfers such as General Allocation Fund (DAU), Special Allocation Fund (DAK), and Local Own-source Revenue (PAD). It was found that government investment in infrastructure tends to be influenced by transfer funds, indicating that the role of the central government remains significant in determining the infrastructure expenditure of regencies/cities in Indonesia.

Keywords: natural resources; infrastructure investment; revenue sharing fund; development; panel data regression

1. Introduction

A region or country blessed with vast fertile land and enriched with valuable natural resources, including renewable resources (such as water, forests, and fisheries) and non-renewable resources (such as minerals, coal, gas, and oil) (Poudineh et al., 2018). Under the right conditions, a natural resources boom should act as a catalyst for growth, development, and transition from cottage industries to factory production. However, some literature often associates abundant natural resources with the concept of the resource curse (Turan and Yanıkkaya, 2020). Countries rich in natural resources often get entangled in corrupt political dynamics, hindering their economic progress (Chile et al., 2021). This results in their economic development being locked into an increasingly heightened dependency pattern on the primary sector, thereby reducing their competitiveness on a global scale (Kwakwa et al., 2023).

Indonesia is one of the countries blessed with abundant natural resources, which should benefit its economy and poverty alleviation, especially with the increasing revenue from Natural Resource Revenue Sharing Funds (DBH SDA). The increase in regional income from revenue sharing from natural resources can be utilized by local governments to improve the provision of basic public services such as infrastructure (Hidayat et al., 2024). The increase in regional income from revenue sharing from natural resources, such as the Natural Resource Revenue Sharing Fund (DBH SDA), should be a significant opportunity for local governments in Indonesia to enhance the welfare of the community through the provision of basic public services, especially infrastructure. As a country with vast natural resource potential, the increasing receipt of DBH SDA should act as a catalyst for more equitable and sustainable development across all regions (Savoia and Sen, 2021; Shahbaz et al., 2023). Development that ensures the improvement of economic welfare for the community, the sustainability of social life, the preservation of environmental quality, and the enforcement of justice and good governance (Hidayat et al., 2021).

Previous studies have noted that infrastructure requiring government financing or investment generally falls into three main categories. First, economic infrastructure, which involves physical development to support economic activities, such as public utilities that include the provision of electricity, telecommunications, water distribution, sanitation, waste disposal systems, solid waste management, and gas pipeline networks (Azolibe and Okonkwo, 2020). In addition, public projects such as the construction of highways, irrigation canals, and drainage systems, as well as the transportation sector, including railways, land transport, ports, and runways, are also part of this economic infrastructure. Second, social infrastructure focuses on the development of social and environmental welfare, covering sectors such as education, health, housing, and recreational facilities (Salite et al., 2021). This infrastructure plays a role in improving the overall quality of life for the community. Third, administrative infrastructure includes elements for law enforcement, administrative control, and effective coordination. This infrastructure is essential to ensure the smooth implementation of government policies and create good coordination between agencies.

Regions receiving substantial budget allocations for highway construction experience a greater reduction in unemployment rates compared to the national average (Leigh and Neill, 2011). Regarding transportation infrastructure, road networks, which are crucial parts of a country's infrastructure, drive the development of various economic sectors (Dinga et al., 2024). For example, reducing distances between markets, knowledge, and communities through quality infrastructure will foster growth opportunities across all sectors (Le Clech and Guevara-Pérez, 2023). Additionally, connectivity through road networks can alleviate poverty by providing access to education, healthcare facilities, employment, and various other social amenities (Hidayat et al., 2022; Saksono et al., 2022). The aim of this research is to analyze the role of the Natural Resource Revenue Sharing Fund (DBH SDA) in government investment in infrastructure.

2. Materials and methods

This research utilizes secondary data collected through literature reviews/surveys of publications from authoritative institutions such as the Ministry of Finance, the Ministry of Public Works, and the Central Statistics Agency in the form of annual time series data for the period from 2010 to 2012, as well as cross-sectional (panel) data for 491 regencies and cities in Indonesia. The selection of this period is based on the consideration that a resources boom has occurred, where there was increased global demand for natural resource commodities followed by an increase in commodity prices, thereby positively impacting revenue for countries or regions abundant in natural resources.

The infrastructure per capita model (ZInfraKap) formulated in this research with the independent variables Natural Resource Revenue Sharing Fund (DBH SDAKap), General Allocation Fund (DAUKap), Local Own-source Revenue (PADKap), Special Allocation Fund (DAKKap), and per capita income (PDRBKap) to examine the influence of DBH SDA on government investment in infrastructure for regencies and cities can be represented as follows:

$$\text{Z infra kap}_{it} = \gamma_0 + \gamma_1\text{DBH\_SDAkap}_{it} + \gamma_2\text{DAUkap}_{it} + \gamma_3\text{DAKkap}_{it} + \gamma_4\text{PADkap}_{it} + \gamma_5\text{PDRBkap}_{it} + \varepsilon_{it} \quad (1)$$

where is:

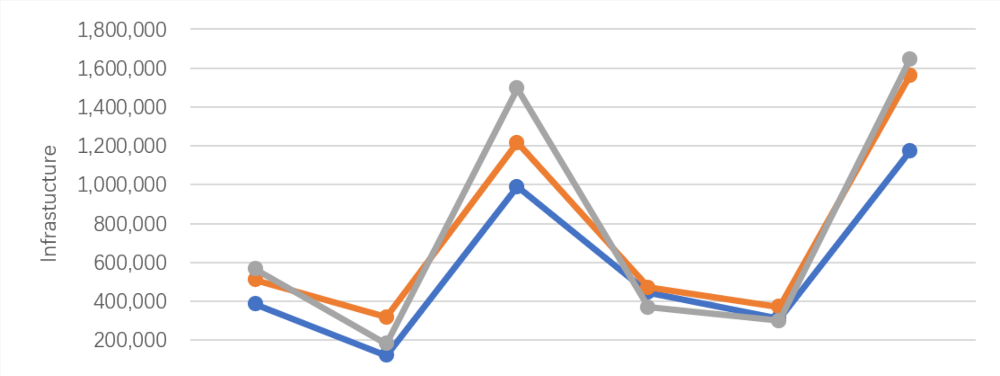
LogZInfraKap = Log local government infrastructure spending per capita;
LogDBH SDAKap = Log Natural Resource Revenue Sharing per capita;
LogDAUKap = Log General Allocation Fund per capita;
LogDAKKap = Log Special Allocation Fund per capita;
LogPADKap = Log Local Own-Source Revenue per capita;
LogPDRBKap = Log Gross Domestic Regional Product/GDRP per capita;
γ_0 = Constanta;
γ_1, ..., γ_5 = Paramater Value of Variables;
i = Regency/City;
t = 2010–2012;
ε = Error term.

This model is formed to simultaneously measure the combined influence of components of local government revenue (APBD) and per capita income on government expenditure allocated to infrastructure, where the variable DBH SDA in this study serves as the main variable and infrastructure sector expenditure as the research object.

3. Results and discussion

This study encompasses 491 regencies/cities in Indonesia, which will be grouped into six island regions based on three natural landscapes, namely: the Sunda Shelf, covering the regions of Sumatera, Jawa and Bali, and Kalimantan. Second, the Sahul Shelf, covering the regions of Maluku and Papua. Third, Transitional Areas, covering the regions of Sulawesi and Nusa Tenggara. The grouping of these six regions is based on territorial components such as biophysical nature, natural resources (infrastructure), human resources, and forms of culture that interact functionally with each other. Additionally, the selection of these regions aims to create geographical proximity, similarity/homogeneity, or functional relationship intensity that forms economic and social structures, thus enabling even development across all regions.

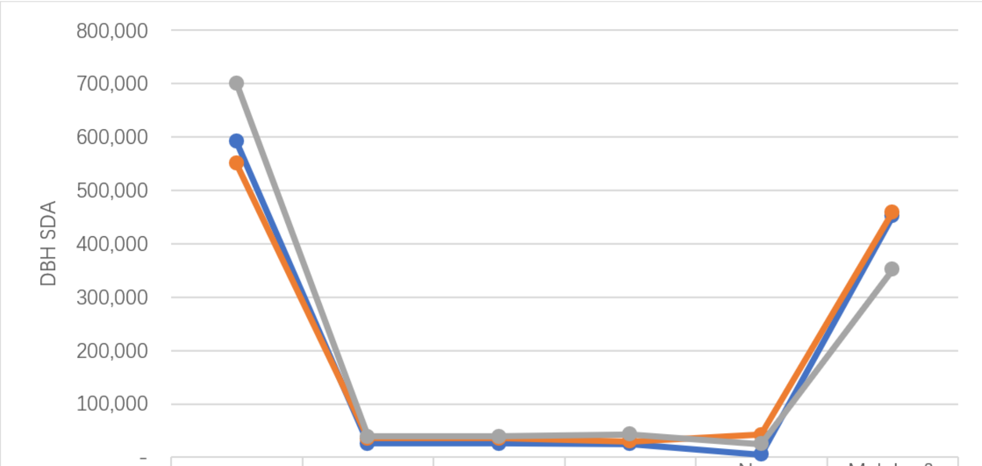
As shown in **Figure 1**, the Maluku and Papua regions are areas with the highest average realization of infrastructure spending allocation, where at the beginning of the period, the average was Rp 1,171,080 per capita, increasing to an average of Rp 1,643,367 per capita by the end of the period. This is followed by the Kalimantan, Sulawesi, Sumatera, and Nusa Tenggara regions. Meanwhile, the Java and Bali region is the area with the lowest average realization of infrastructure spending allocation during that period.



	Sumatera	Jawa & Bali	Kalimantan	Sulawesi	Nusa Tenggara	Maluku & Papua
2010	384,709	122,433	988,830	445,844	310,467	1,171,080
2011	509,947	318,804	1,215,991	471,066	372,912	1,559,438
2012	565,503	181,400	1,495,190	369,543	299,795	1,643,367

Figure 1. Average infrastructure investment expenditure per capita by region Indonesia in 2010–2012 (Rupiah/Person).

Source: Processed from Regional Financial Statistics, Ministry of Finance of the Republic of Indonesia (2024).



	Sumatera	Jawa & Bali	Kalimantan	Sulawesi	Nusa Tenggara	Maluku & Papua
2010	591,525	25,634	25,634	24,552	5,190	451,813
2011	550,862	35,265	35,265	29,788	41,766	459,373
2012	700,669	38,853	38,852	43,348	24,466	351,879

Figure 2. Average DBH SDA revenue per capita of regency/city governments in Indonesia by region in 2010–2012 (Rupiah/Person).

Source: Processed from regional financial statistics, ministry of finance of the republic of Indonesia (2024).

As shown in **Figure 2**, the regency and city governments in the Sumatera region are the largest recipients of DBH SDA per capita, increasing from an average of Rp 591,525 to Rp 700,669. The same trend is observed in the regency and city governments in the Maluku and Papua, Kalimantan, Jawa and Bali, and Sulawesi regions. Meanwhile, the regency and city governments in the Nusa Tenggara region are the lowest recipients of DBH SDA per capita, with an average of Rp 51,190 and experiencing a decrease to Rp 24,466.

Looking at the revenue of regency/city governments from DBH SDA and the expenditure allocated to infrastructure spending in each region reflects a phenomenon of interdependence between DBH SDA receipts and the allocation of expenditure by local government regencies and cities in the infrastructure sector. This positive trend depicts the behavior of local government officials, where the increase in DBH SDA receipts is responded to with an increase in investment spending in the infrastructure sector.

3.1. Regression equation

The following are the results of panel regression calculations using the help of the Eviews 9 program.

Table 1. Model estimation results of infrastructure expenditure per capita.

Variable	Coefficient	*z*-statistic	Prob.
C	−0.12	−0.55	0.58
LOGDBHSDAKAP	0.05***	5.81	0.00
LOGDAUKAP	0.33***	10.93	0.00
LOGDAKKAP	0.24***	9.70	0.00
LOGPADKAP	0.21***	7.80	0.00
LOGPDRBKAP	0.15***	4.97	0.00

* Significant at 10%;
** Significant at 5%, 10%;
*** Significant at 1%, 5%, 10%;
Source: Data processing results (2024).

The panel data regression results, from **Table 1**, are explained by the following equation:

$$\text{LogZInfraKap}_{it} = -0.12 + 0.05\ \text{LogDBH\_SDAKap}_{it} + 0.33\ \text{LogDAUKap}_{it} + 0.24\ \text{LogDAKKap}_{it} + 0.21\ \text{LogPADKap}_{it} + 0.15\ \text{LogPDRBKap}_{it} \quad (2)$$

The above equation can be interpreted as follows:

1) The coefficient γ_0 is −0.12, which means that if DBH SDAKap, DAUKap, DAKKap, PADKap, and PDRBKap are all zero, then ZINFRAKap will decrease by 0.12 percent.
2) The coefficient of DBH SDAKap is 0.05, indicating that if there is a 1 percent increase in DBH_SDAKap (assuming other variables are constant), ZINFRAKap will increase by 0.05 percent.
3) The coefficient of DAUKap is 0.33, indicating that if there is a 1 percent increase in DAUKap (assuming other variables are constant), ZINFRAKap will increase by 0.33 percent.
4) The coefficient of DAKKap is 0.24, indicating that if there is a 1 percent increase

in DAKKap (assuming other variables are constant), ZINFRAKap will increase by 0.24 percent.

5) The coefficient of PADKap is 0.21, indicating that if there is a 1 percent increase in PADKap (assuming other variables are constant), ZINFRAKap will increase by 0.21 percent.
6) The coefficient of PDRBKap is 0.15, indicating that if there is a 1 percent increase in PDRBKap (assuming other variables are constant), ZINFRAKap will increase by 0.15 percent.

3.2. Statistical hypothesis testing

3.2.1. F-test

Based on the model testing that has been carried out, the model used in the panel data regression analysis in this study is the Fixed Effect model using the Robust method. The following are the simultaneous test results using the Fixed Effect model:

Table 2. Results of simultaneous effect of infrastructure expenditure model per capita.

***R*-squared**	**0.51**	**Adjusted *R*-squared**	**0.51**
Rw-squared	0.67	Adjust Rw-squared	0.67
Akaike info criterion	1149.10	Schwarz criterion	1182.11
Deviance	77.21	Scale	0.26
Rn-squared statistic	1910.33***	Prob (Rn-squared stat.)	0.00

* Significant at 10%;
** Significant at 5%, 10%;
*** Significant at 1%, 5%, 10%;
Source: Processed secondary data (2024).

Based on **Table 2**, the probability value (Rn-squared stat.) is 0.00 < 0.05; therefore, H_0 is rejected, meaning that DBH_SDAKap, DAUKap, DAKKap, PADKap, and PDRBKap together are able to significantly explain ZINFRAKap, or in other words, the model formed fits.

3.2.2. *T*-test

The partial test is carried out to determine the value of the regression coefficient individually on the dependent variable whether it is significant or not. The provisions for making partial test decisions are if the prob. (*p*-value) < 0.05 (5% significance level), then H_0 is rejected, which means that the independent variable has a significant effect on the dependent variable partially. However, if the prob. (*p*-value) > 0.05 (5% significance level), then H_0 is accepted, which means that the independent variable has no significant effect on the dependent variable partially. The following are the partial test results using the Fixed Effect model:

Based on **Table 3**, it can be concluded that:

- Variable DBH_SDAKap. The *p*-value of the DBH_SDAKap variable is 0.00, with a positive direction of influence, thus H_0 is rejected, and the conclusion is that partially, the DBH_SDAKap variable has a significant positive effect on ZINFRAKap.
- Variable DAUKap. The *p*-value of the DAUKap variable is 0.00, with a positive

direction of influence, thus H_0 is rejected, and the conclusion is that partially, the DAUKap variable has a significant positive effect on ZINFRAKap.

- Variable DAKKap. The *p*-value of the DAKKap variable is 0.00, with a positive direction of influence, thus H_0 is rejected, and the conclusion is that partially, the DAKKap variable has a significant positive effect on ZINFRAKap.
- Variable PADKap. The *p*-value of the PADKap variable is 0.00, with a positive direction of influence, thus H_0 is rejected, and the conclusion is that partially, the PADKap variable has a significant positive effect on ZINFRAKap.
- Variable PDRBKap. The *p*-value of the PDRBKap variable is 0.00, with a positive direction of influence, thus H_0 is rejected, and the conclusion is that partially, the PDRBKap variable has a significant positive effect on ZINFRAKap.

Table 3. Results of partial effect of infrastructure expenditure model per capita.

Variable	Coefficient	Std. Error	*z*-statistic	Prob.
C	−0.12	0.21	−0.55	0.58
LOGDBHSDAKAP	0.05***	0.01	5.80	0.00
LOGDAUKAP	0.33***	0.03	10.93	0.00
LOGDAKKAP	0.24***	0.02	9.70	0.00
LOGPADKAP	0.21***	0.027	7.80	0.00
LOGPDRBKAP	0.15***	0.031	4.97	0.00

* Significant at 10%;
** Significant at 5%, 10%;
*** Significant at 1%, 5%, 10%;
Source: Processed secondary data (2024).

4. Discussion

From the existing analysis, the role of the natural resource revenue sharing fund in government investment in infrastructure can be assessed from the magnitude of the regression coefficients. When there is a change/increase in per capita DBH SDA receipts by 1 percent, it results in an increase in government expenditure on infrastructure by 0.05 percent. However, despite the positive and significant influence of DBH SDA, regional spending on infrastructure tends to be more influenced by General Allocation Fund (DAU), Special Allocation Fund (DAK), and Local Own-source Revenue (PAD) (**Tables 1** and **3**). In such a situation, it implies the dominant role of the central government as a source of financing. Natural resource management is often criticized for being suboptimal, whereas attention should instead be directed toward policies and actions that can enhance resource management, considering that resource exploitation tends to have insignificant impacts on certain sustainable development aspects such as infrastructure, especially in developing countries (Aguirre Unceta, 2021; Yao et al., 2019).

The abundance of natural resources presents two contradictory views. Natural resources (NR) are often seen as a blessing and a curse, depending on how they are managed (Eisenmenger et al., 2020). Firstly, natural resources as a blessing. This perspective suggests that the abundance of natural resources has a positive impact on the political and economic life of a country/region (Guo et al., 2023; Mohamed, 2020). The assumption is that the revenue from the sale and extraction taxes of natural resources will increase regional income and promote prosperity (Wong, 2021). Income from natural resources can be used to build public infrastructure necessary to improve the welfare of local communities (Moti, 2019). For example, investing natural gas revenue in infrastructure development can create construction and service jobs, as well as provide economic benefits to local communities (Irarrazaval and Viale, 2022).

Secondly, natural resources as a curse. This group perceives that the abundance of natural resources brings environmental damage (disasters), political turmoil, authoritarianism, wars, conflicts, corruption, and poverty. For instance, the allocation of natural resource funds for infrastructure can become a target for corrupt practices at the local level, which can hinder development and the welfare of communities (Irarrazaval and Viale, 2022).

The relationship between natural resources (NR) and infrastructure is closely intertwined in the context of resource development and exploitation (Polyzos and Arabatzis, 2008). The abundance of natural resources in a country can be a significant source of income to build the necessary infrastructure to support economic growth (Sun et al., 2020; Zhang and Teng, 2023). Infrastructure is essential for extracting, processing, and transporting natural resources from mining or production locations to markets or end consumers (Tienhaara and Walker, 2021). Efficient and reliable infrastructure development is crucial to maximize the economic potential of exploited natural resources (Plank et al., 2022). Good infrastructure can also enhance accessibility, efficiency, and sustainability in natural resource management (Shi et al., 2024). Quality infrastructure is required to access, manage, and develop NR such as mines, forests, and other natural resources (Ahmed et al., 2020). Good infrastructure, including healthcare, education, and public facilities, can enhance the quality of life for residents, which in turn increases labor productivity and attracts more skilled workers to the area (Aman et al., 2022; Han and Lee, 2020). Roads, ports, and other transportation networks play a vital role in connecting NR locations with markets and production centers (Zhou et al., 2023). However, in some countries with abundant natural resource supplies, economic development rates may be slow because abundant natural resources do not always directly correlate with strong infrastructure development (Liang et al., 2024).

A study conducted in 40 resource-rich developing countries generally indicates that the abundance of natural resources in a country can influence infrastructure development (Wang et al., 2022). Countries rich in natural resources often have the opportunity to use revenue from resource exploitation to build the necessary infrastructure for sustainable economic growth (Fu and Liu, 2023; Li et al., 2022). Natural resources often serve as the foundation for infrastructure development, such as hydroelectric power plants, roads, and other transportation facilities (Álvarez and Vergara, 2022; Du et al., 2023). For example, in China, infrastructure investment has played a positive role in regional economic growth through various types of infrastructure such as electricity, roads, railways, and telecommunications (Shi et al., 2017). This infrastructure enables the optimal exploitation and use of natural resources to support economic growth and societal well-being (Appiah et al., 2022; Kyriakopoulos et al., 2023).

Similarly, this study finds that Indonesia utilizes its natural resource revenue sharing funds (DBH SDA) for investment in infrastructure. The increased income from DBH SDA in Indonesia is accompanied by an increase in infrastructure investment (Hidayat et al., 2024). This is done to ensure that the exploitation of natural resources contributes to improving societal well-being (Olagboye et al., 2023; Teng, 2023). Infrastructure development supported by DBH SDA revenue will also help improve community access to basic services such as education and healthcare (Liang et al., 2020). For example, building schools and health centers in remote or underdeveloped areas will enhance community access to quality education and healthcare services (Momon et al., 2022).

Good infrastructure, such as smooth transportation networks and other supporting facilities, can enhance accessibility and connectivity to regions abundant in natural resources (An et al., 2021; Song et al., 2018). Investment in infrastructure in areas with potential natural resources can accelerate local industrial and economic development (Saksono et al., 2022). By sustainably utilizing natural resources and diversifying their use, countries can redirect income from the natural resource sector to the infrastructure sector (Zhong et al., 2024). This can help reduce dependence on natural resources and strengthen infrastructure development to support long-term economic growth (Magazzino and Mele, 2021).

The sustainable use of natural resources, such as renewable energy, can support the development of clean infrastructure (Duque et al., 2016). Investment in clean energy infrastructure can help reduce carbon emissions and enhance environmental sustainability while also supporting sustainable economic growth (Ramey, 2021). However, infrastructure development for natural resource exploitation can also have negative environmental impacts (Kumari and Sharma, 2017). Infrastructure planning should consider the environmental impacts of natural resource exploitation and efforts to mitigate these impacts (Sebos et al., 2023). Infrastructure development is considered a key factor in transforming natural resource wealth into a boost for export growth (Liu and Lan, 2024). Strategic investments in infrastructure sectors such as transportation, banking, digitalization, and telecommunications can create an environment conducive to increased exports (Xu et al., 2022).

The underlying philosophy or implicit intention of this research is to examine the impact (share) of local government bureaucrats in responding to the amount of transfer funds (grants) from the central government, specifically DBH SDA (Revenue Sharing Fund from Natural Resources). This is measured by comparing local government revenue and expenditure, which is proxied by the realization of local government spending allocated to basic services, particularly infrastructure spending (ZINFRA). Furthermore, local government revenue and expenditure are calculated using panel data methods to determine whether the development of transfer funds received by each local government has a positive impact on the provision of basic infrastructure services for improving the living standards of the community in the region, or even the opposite.

Infrastructure development funding is a key factor influencing the speed and quality of development results, especially in regions with varying economic and natural resource conditions. In Indonesia, one of the funding schemes used to support regional development is the Revenue Sharing Fund from Natural Resources (DBH SDA). DBH SDA is granted to regions that produce natural resources as part of state revenues distributed to these regions.

However, regions receiving DBH SDA do not show a faster pace of infrastructure development compared to non-resource-producing regions. This is due to the fact that the development process is not solely dependent on the amount of funding, but also on the quality of governance and effective project management. Regions with poor governance tend to experience delays in development despite having greater access to funds (Crook, 2003).

In terms of quality, regions receiving DBH SDA (Revenue Sharing Fund from Natural Resources) tend to have better-quality infrastructure, especially in terms of highways, transportation facilities, and other public amenities. This occurs because resource-producing regions have more flexible access to funds, allowing local governments to allocate more resources to projects they deem important (Ivanyna and Salerno, 2021).

However, several studies indicate that infrastructure quality does not always correspond directly to the size of DBH SDA allocations. In some cases, regions with poor resource management end up having low-quality infrastructure despite receiving DBH SDA. This is due to corruption, managerial incompetence, and ineffective fund allocation (Chapman, 2002). The role of DBH SDA in infrastructure spending remains low, suggesting that regions with minimal DBH SDA tend to rely more on other sectors for infrastructure investment, which slows the pace of development (Hidayat et al., 2024).

Another interesting finding is the lack of a significant development gap between resource-producing and non-resource-producing regions. Despite receiving minimal DBH SDA, non-producing regions are still able to carry out infrastructure development, particularly in the transportation, energy, and telecommunications sectors. Infrastructure development in non-producing regions is supported by other funding sources, such as the General Allocation Fund (DAU), Special Allocation Fund (DAK), and locally generated revenue (PAD). By leveraging these funding sources, non-producing regions can compete with producing regions that have the advantage of additional funding from DBH SDA.

Non-resource-producing regions with minimal DBH SDA (Revenue Sharing Fund from Natural Resources) tend to exhibit slower development growth. These regions may experience higher disparities and slower economic growth due to reduced funding for development projects (Daulay et al., 2021). Dependence on DBH SDA can exacerbate development gaps between regions, necessitating more equitable policies to address this issue.

Based on the analysis, the policy of redistributing revenue from natural resources needs to be optimized, especially for non-producing regions so that they can catch up in infrastructure development. This aligns with recommendations proposing additional policies, such as infrastructure incentive funds for non-resource-producing regions, to narrow the development gap (Arellano-Yanguas, 2019; Morgandi, 2008).

The management of natural resource revenue and digital transformation are closely linked in efforts to reduce regional development disparities. Optimizing the revenue redistribution policy, especially for non-producing regions, requires a more innovative and efficient approach. This is where the role of digital transformation, particularly e-government, becomes crucial. By utilizing information technology in the management of natural resources, the government can monitor the use of funds more transparently and accurately, while improving infrastructure budget allocations in non-producing regions. This digital innovation not only helps achieve more equitable distribution but also supports the efficient management of natural resources, ultimately contributing to sustainable development and reducing interregional disparities.

The ongoing digital transformation in various countries, particularly in the government sector, has opened up significant opportunities for improving efficiency in various fields, including the utilization of natural resources (SDA). Digital government, or e-government, which refers to the use of information and communication technology (ICT) in public service delivery, creates opportunities to improve the management and oversight of natural resources (Chen et al., 2024; Ellalee and Al-Qaysi, 2023; Martinez-Vazquez, 2011). This can reduce waste, increase transparency, and minimize the environmental impact of extraction and exploitation activities.

International studies show that the adoption of digital government has several positive impacts on the efficiency of natural resource utilization. Digital government plays a role in increasing transparency in natural resource management. Technologies such as blockchain and digital reporting systems allow tracking of resources from extraction to distribution, significantly reducing opportunities for fraud and corrupt practices. With greater transparency, governments can more efficiently monitor the allocation and use of natural resources.

Digital technology allows governments to collect and analyze real-time data on the use and status of natural resources. For example, the use of big data and artificial intelligence (AI) enables continuous monitoring of ecosystems as well as mining and forestry operations (Raihan, 2023; Shivaprakash et al., 2022). With more data-driven management, decision-making related to resource exploitation and conservation can be made more quickly and accurately, ultimately minimizing resource waste. Countries that have adopted digital government technology in water and forest resource management have successfully increased utilization efficiency, especially due to automated monitoring and management systems (Njue et al., 2019).

In addition to improving efficiency, digital government also plays a role in reducing the negative environmental impacts of natural resource utilization. ICT-based technology enables early detection of environmental pollution caused by natural resource exploitation activities and allows for quicker corrective action. This is particularly important in sectors such as mining, oil, gas, and forestry, which often leave significant impacts on ecosystems. The use of IoT (Internet of Things)-based sensors in the mining sector allows for real-time monitoring of carbon emissions. This helps mining companies and local governments take immediate action when violations of environmental standards occur (Cacciuttolo et al., 2024).

The implementation of digital government systems also speeds up the permitting process for natural resource exploitation. Online systems for submitting mining permits, oil drilling permits, and forestry activities reduce bureaucracy, which previously slowed these processes (Duek and Rusli, 2010). This not only speeds up completion times but also allows the government to more efficiently track issued permits and ensure companies' compliance with regulations.

The digitalization of mining permit management has reduced the time required for permit processing (Jang and Topal, 2020). With digital systems, monitoring and evaluating compliance with environmental and social standards have also become more effective. Digital government opens up greater opportunities for public participation in overseeing natural resource utilization. Digital applications that allow citizens to report environmental violations or illegal natural resource exploitation increase the efficiency of oversight and law enforcement. This technology helps the government detect violations more quickly that may have been missed by traditional monitoring systems. E-government platforms allow public participation in reporting illegal logging activities in certain areas (Gonzales et al., 2019). This system has proven effective in accelerating government response and reducing illegal deforestation in those regions.

5. Conclusion

Indonesia has allocated its Natural Resource Revenue Sharing Fund (DBH SDA) for investment in the infrastructure sector. The increase in revenue from Indonesia’s DBH SDA, along with increased infrastructure investment, indicates efforts to utilize natural resource exploitation to improve societal well-being. Infrastructure development supported by revenue from natural resources can help enhance community access to basic services. The income from natural resources is used for infrastructure investment such as building schools and health centers in remote areas, aiming to expand community access to quality education and healthcare services. Well-planned infrastructure development can be a key factor in transforming natural resource wealth into a catalyst for sustainable economic growth. Natural resource exploitation must consider environmental impacts and focus on sustainability.

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References

Adomako, S., Danso, A., & Boateng, A. (2023). Corporate Sustainability in Africa. In: Palgrave Studies in African Leadership. Springer International Publishing. https://doi.org/10.1007/978-3-031-29273-6

Aguirre Unceta, R. (2021). The economic and social impact of mining-resources exploitation in Zambia. Resources Policy, 74, 102242. https://doi.org/10.1016/j.resourpol.2021.102242

Ahmed, Z., Asghar, M. M., Malik, M. N., et al. (2020). Moving towards a sustainable environment: The dynamic linkage between natural resources, human capital, urbanization, economic growth, and ecological footprint in China. Resources Policy, 67, 101677. https://doi.org/10.1016/j.resourpol.2020.101677

Álvarez, R., & Vergara, D. (2022). Natural resources and educational attainment: Evidence from Chile. Resources Policy, 76, 102573. https://doi.org/10.1016/j.resourpol.2022.102573

Aman, J., Abbas, J., Shi, G., et al. (2022). Community Wellbeing Under China-Pakistan Economic Corridor: Role of Social, Economic, Cultural, and Educational Factors in Improving Residents’ Quality of Life. Frontiers in Psychology, 12. https://doi.org/10.3389/fpsyg.2021.816592

An, H., Razzaq, A., Nawaz, A., et al. (2021). Nexus between green logistic operations and triple bottom line: evidence from infrastructure-led Chinese outward foreign direct investment in Belt and Road host countries. Environmental Science and Pollution Research, 28(37), 51022–51045. https://doi.org/10.1007/s11356-021-12470-3

Appiah, M., Onifade, S. T., & Gyamfi, B. A. (2022). Building Critical Infrastructures: Evaluating the Roles of Governance and Institutions in Infrastructural Developments in Sub-Sahara African Countries. Evaluation Review, 46(4), 391–415. https://doi.org/10.1177/0193841x221100370

Arellano-Yanguas, J. (2018). Extractive industries and regional development: Lessons from Peru on the limitations of revenue devolution to producing regions. Regional and Federal Studies, 29(2), 249–273. https://doi.org/10.1080/13597566.2018.1493461

Azolibe, C. B., & Okonkwo, J. J. (2020). Infrastructure development and industrial sector productivity in Sub-Saharan Africa. Journal of Economics and Development, 22(1), 91–109. https://doi.org/10.1108/jed-11-2019-0062

Cacciuttolo, C., Guzmán, V., Catriñir, P., et al. (2024). Sensor Technologies for Safety Monitoring in Mine Tailings Storage Facilities: Solutions in the Industry 4.0 Era. Minerals, 14(5), 446. https://doi.org/10.3390/min14050446

Chapman, D. (2002), Corruption and the Education Sector. USAID. pp. 1-25.

Chen, K., Li, Q., Shoaib, M., et al. (2024). Does improved digital governance in government promote natural resource management? Quasi-natural experiments based on smart city pilots. Resources Policy, 90, 104721. https://doi.org/10.1016/j.resourpol.2024.104721

Chile, N. I., Uzoechina, B. I., Eze, M. A., et al. (2021). Does the Abundance of Natural Resources Crowd-Out the Manufacturing Sector? Evidence from Nigeria. Asian Development Policy Review, 9(3), 108–126. https://doi.org/10.18488/journal.107.2021.93.108.126

Crook, R. C. (2003). Decentralisation and poverty reduction in Africa: the politics of local–central relations. Public Administration and Development, 23(1), 77–88. Portico. https://doi.org/10.1002/pad.261

Daulay, A., Yusuf, M., & Maipita, I. (2021). Analysis of Regional Disparity Among Regencies/Cities and the Correlation with Economic Growth North Sumatera in 2010-2019. In: Proceedings of the International Conference on Strategic Issues of Economics, Business and, Education (ICoSIEBE 2020). https://doi.org/10.2991/aebmr.k.210220.009

Dinga, G. D., Mama, N., & Achuo, E. D. (2024). Resource abundance: Blessing or curse? Comparative analyses of point and diffuse resources. Heliyon, 10(3), e25078. https://doi.org/10.1016/j.heliyon.2024.e25078

Du, Y., Zhou, J., Bai, J., et al. (2023). Breaking the resource curse: The perspective of improving carbon emission efficiency based on digital infrastructure construction. Resources Policy, 85, 103842. https://doi.org/10.1016/j.resourpol.2023.103842

Duek, A. and Rusli, R. (2010). The natural resources industry in decentralised Indonesia: how has decentralisation impacted the mining, oil and gas industries? Available online: http://fdef.uni.lu/index.php/fdef_FR/economie/crea (accessed on 1 August 2024).

Duque, E. A., González, J. D., & Restrepo, J. C. (2016). Developing Sustainable Infrastructure for Small Hydro Power Plants through Clean Development Mechanisms in Colombia. Procedia Engineering, 145, 224–233. https://doi.org/10.1016/j.proeng.2016.04.066

Eisenmenger, N., Pichler, M., Krenmayr, N., et al. (2020). The Sustainable Development Goals prioritize economic growth over sustainable resource use: a critical reflection on the SDGs from a socio-ecological perspective. Sustainability Science, 15(4), 1101–1110. https://doi.org/10.1007/s11625-020-00813-x

Ellalee, H., & Al-Qaysi, I. I. (2023). Digital Government a Pathway to Sustainable Development. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4508819

Fu, R., & Liu, J. (2023). Revenue sources of natural resources rents and its impact on sustainable development: Evidence from global data. Resources Policy, 80, 103226. https://doi.org/10.1016/j.resourpol.2022.103226

Guo, W., Yang, B., Ji, J., et al. (2023). Abundance of natural resources, government scale and green economic growth: An empirical study on urban resource curse. Resources Policy, 87, 104303. https://doi.org/10.1016/j.resourpol.2023.104303

Han, J.-S., & Lee, J.-W. (2020). Demographic change, human capital, and economic growth in Korea. Japan and the World Economy, 53, 100984. https://doi.org/10.1016/j.japwor.2019.100984

Hidayat, B. A., Supartoyo, Y. H., Setiawan, S., et al. (2024). Government infrastructure investment stimulation through booming natural resources: Evidence from a lower-middle-income country. PLOS ONE, 19(5), e0301710. https://doi.org/10.1371/journal.pone.0301710

Hidayat, B. A., Yuliana, E., Wicaksono, B., et al. (2021). Objectives of Sustainable Development and Analysis of People’s

Economy Improvement. In: Proceedings of the International Conference on Sustainable Innovation Track Humanities Education and Social Sciences (ICSIHESS 2021). https://doi.org/10.2991/assehr.k.211227.030

Hidayat, B., Fatoni, A., Saksono, H., et al. (2022). Integrated River Transport Development to Support Smart City. Jurnal Bina Praja, 14(1), 1–15. https://doi.org/10.21787/jbp.14.2022.1-15

Irarrazaval, F., & Viale, C. (2022). Natural gas revenues, subnational politics, and agrarian change in Peru and Bolivia. The Extractive Industries and Society, 11, 101093. https://doi.org/10.1016/j.exis.2022.101093

Ivanyna, M., & Salerno, A. (2021). Governance for Inclusive Growth. IMF Working Papers, 2021(098), 1. https://doi.org/10.5089/9781513582467.001

Jang, H., & Topal, E. (2020). Transformation of the Australian mining industry and future prospects. Mining Technology, 129(3), 120–134. https://doi.org/10.1080/25726668.2020.1786298

Kumari, A., & Sharma, A. K. (2017). Infrastructure financing and development: A bibliometric review. International Journal of Critical Infrastructure Protection, 16, 49–65. https://doi.org/10.1016/j.ijcip.2016.11.005

Kwakwa, P. A., Dankwah, J. B., Adu Boahen, E., et al. (2023). Financial development in South Africa: The role of natural resources, IT infrastructure, and government size. Cogent Economics and Finance, 11(2). https://doi.org/10.1080/23322039.2023.2281844

Kyriakopoulos, G. L., Sebos, I., Triantafyllou, E., et al. (2023). Benefits and Synergies in Addressing Climate Change via the Implementation of the Common Agricultural Policy in Greece. Applied Sciences, 13(4), 2216. https://doi.org/10.3390/app13042216

Le Clech, N., & Guevara-Pérez, J. C. (2023). Latin America and the Caribbean's Productivity: The Role of Pro-Market Policies, Institutions, Infrastructure, and Natural Resource Endowments. Economies, 11(5), 142. https://doi.org/10.3390/economies11050142

Leigh, A., & Neill, C. (2011). Can national infrastructure spending reduce local unemployment? Evidence from an Australian roads program. Economics Letters, 113(2), 150–153. https://doi.org/10.1016/j.econlet.2011.05.037

Li, Y., Mehmood, N., & Iqbal, N. (2022). Natural resource abundance and financial development: A case study of emerging (E−15) economies. Resources Policy, 79, 103018. https://doi.org/10.1016/j.resourpol.2022.103018

Liang, Y., Zhou, H., Zeng, J., et al. (2024). Do natural resources rent increase green finance in developing countries? The role of education. Resources Policy, 91, 104838. https://doi.org/10.1016/j.resourpol.2024.104838

Liang, Y., Zhou, K., Li, X., et al. (2020). Effectiveness of high-speed railway on regional economic growth for less developed areas. Journal of Transport Geography, 82, 102621. https://doi.org/10.1016/j.jtrangeo.2019.102621

Liu, T., & Lan, B. (2024). On the conflict of natural resources abundance and export upgrading in upper-middle and high-income countries. Resources Policy, 89, 104633. https://doi.org/10.1016/j.resourpol.2023.104633

Magazzino, C., & Mele, M. (2021). On the relationship between transportation infrastructure and economic development in China. Research in Transportation Economics, 88, 100947. https://doi.org/10.1016/j.retrec.2020.100947

Martinez-Vazquez, J. (2011). The Impact of Fiscal Decentralization: Issues in Theory and Challenges in Practice. Asian Development Bank.

Mohamed, E. S. E. (2020). Resource Rents, Human Development and Economic Growth in Sudan. Economies, 8(4), 99. https://doi.org/10.3390/economies8040099

Morgandi, M. (2008). Extractive Industries Revenues Distribution at the Sub-National Level. Revenue Watch Inst.

Moti, U. G. (2019). Africa's Natural Resource Wealth: A Paradox of Plenty and Poverty. Advances in Social Sciences Research Journal. https://doi.org/10.14738/assrj.67.6814

Mutiarin, D., Nurmandi, A., Paksi, A. K., et al. (editors). (2022). Proceedings of the International Conference on Sustainable Innovation on Humanities, Education, and Social Sciences (ICOSI-HESS 2022). Atlantis Press SARL. https://doi.org/10.2991/978-2-494069-65-7

Njue, N., Stenfert Kroese, J., Gräf, J., et al. (2019). Citizen science in hydrological monitoring and ecosystem services management: State of the art and future prospects. Science of The Total Environment, 693, 133531. https://doi.org/10.1016/j.scitotenv.2019.07.337

Plank, B., Streeck, J., Virág, D., et al. (2022). From resource extraction to manufacturing and construction: flows of stock-building materials in 177 countries from 1900 to 2016. Resources, Conservation and Recycling, 179, 106122. https://doi.org/10.1016/j.resconrec.2021.106122

Polyzos, S., & Arabatzis, G. (2008). Spatial distribution of natural resources and their contribution to regional development in

Greece. Discover the world's research, 9(1), 183-199.

Poudineh, R., Sen, A., & Fattouh, B. (2018). Advancing renewable energy in resource-rich economies of the MENA. Renewable Energy, 123, 135–149. https://doi.org/10.1016/j.renene.2018.02.015

Raihan, A. (2023). Artificial intelligence and machine learning applications in forest management and biodiversity conservation. Natural Resources Conservation and Research, 6(2), 3825. https://doi.org/10.24294/nrcr.v6i2.3825

Ramey, V. (2020). The Macroeconomic Consequences of Infrastructure Investment. National Bureau of Economic Research. https://doi.org/10.3386/w27625

Saksono, H., Hidayat, B. A., Yuliana, E., et al. (2022). The Impact of Tourism and The Creative Industry on The Economy of The Community. In: Proceedings of the International Conference on Sustainable Innovation Track Accounting and Management Sciences (ICOSIAMS 2021). https://doi.org/10.2991/aebmr.k.211225.004

Salite, D., Kirshner, J., Cotton, M., et al. (2021). Electricity access in Mozambique: A critical policy analysis of investment, service reliability and social sustainability. Energy Research and Social Science, 78, 102123. https://doi.org/10.1016/j.erss.2021.102123

Savoia, A., & Sen, K. (2021). The Political Economy of the Resource Curse: A Development Perspective. Annual Review of Resource Economics, 13(1), 203–223. https://doi.org/10.1146/annurev-resource-100820-092612

Sebos, I., Kitsara, G., Karali, A., et al. (2023). Climate-Resilient Urban Regeneration: Transforming School Yards for a Sustainable and Adaptive Future. https://doi.org/10.5194/ems2023-73

Shahbaz, M., Siddiqui, A., Ahmad, S., et al. (2023). Financial development as a new determinant of energy diversification: The role of natural capital and structural changes in Australia. Energy Economics, 126, 106926. https://doi.org/10.1016/j.eneco.2023.106926

Shi, Y., Guo, S., & Sun, P. (2017). The role of infrastructure in China's regional economic growth. Journal of Asian Economics, 49, 26–41. https://doi.org/10.1016/j.asieco.2017.02.004

Shi, Z., Loh, L., Wu, H., et al. (2024). Smarter and cleaner: How does energy digitalization affect carbon productivity? Energy Strategy Reviews, 52, 101347. https://doi.org/10.1016/j.esr.2024.101347

Shivaprakash, K. N., Swami, N., Mysorekar, S., et al. (2022). Potential for Artificial Intelligence (AI) and Machine Learning (ML) Applications in Biodiversity Conservation, Managing Forests, and Related Services in India. Sustainability, 14(12), 7154. https://doi.org/10.3390/su14127154

Song, M., Wang, J., & Zhao, J. (2018). Coal endowment, resource curse, and high coal-consuming industries location: Analysis based on large-scale data. Resources, Conservation and Recycling, 129, 333–344. https://doi.org/10.1016/j.resconrec.2016.08.005

Sun, Y., Ak, A., Serener, B., et al. (2020). Natural resource abundance and financial development: A case study of emerging seven (E−7) economies. Resources Policy, 67, 101660. https://doi.org/10.1016/j.resourpol.2020.101660

Teng, Y.-P. (2023). Natural resources extraction and sustainable development: Linear and non-linear resources curse hypothesis perspective for high income countries. Resources Policy, 83, 103685. https://doi.org/10.1016/j.resourpol.2023.103685

Tienhaara, K., & Walker, J. (2021). Fossil capital, 'unquantifiable risk' and neoliberal nationalizations: The case of the Trans Mountain Pipeline in Canada. Geoforum, 124, 120–131. https://doi.org/10.1016/j.geoforum.2021.06.005

Turan, T., & Yanıkkaya, H. (2020). Natural resource rents and capital accumulation nexus: do resource rents raise public human and physical capital expenditures? Environmental Economics and Policy Studies, 22(3), 449–466. https://doi.org/10.1007/s10018-020-00264-9

Villena Gonzales, W., Mobashsher, A., & Abbosh, A. (2019). The Progress of Glucose Monitoring—A Review of Invasive to Minimally and Non-Invasive Techniques, Devices and Sensors. Sensors, 19(4), 800. https://doi.org/10.3390/s19040800

Wang, S., Wang, X., & Lu, B. (2022). Is resource abundance a curse for green economic growth? Evidence from developing countries. Resources Policy, 75, 102533. https://doi.org/10.1016/j.resourpol.2021.102533

Wong, C.-S. (2021). Science Mapping: A Scientometric Review on Resource Curses, Dutch Diseases, and Conflict Resources during 1993–2020. Energies, 14(15), 4573. https://doi.org/10.3390/en14154573

Xu, G., Jiang, J., & Wang, R. (2022). The impact of natural resource endowment and transportation infrastructure on China's regional green economic performance in the context of COP26. Resources Policy, 79, 103099. https://doi.org/10.1016/j.resourpol.2022.103099

Yao, H., Tian, M., Ma, J., et al. (2019). Study on "Resource Curse" Based on the Panel Data in Coal Resource-Rich Districts of Inner Mongolia. E3S Web of Conferences, 118, 01015. https://doi.org/10.1051/e3sconf/201911801015

Zhang, C., & Teng, W. (2023). Natural resources led financing of investment: A prospect of China's provincial data. Resources Policy, 86, 104164. https://doi.org/10.1016/j.resourpol.2023.104164

Zhong, Y., Chen, X., Yao, X., et al. (2024). Natural resources and the trilemma of financial development, institutions, and markets: Sustainable development pathway via natural resources for China. Resources Policy, 90, 104759. https://doi.org/10.1016/j.resourpol.2024.104759

Zhou, M., Jiang, K., & Chen, Z. (2023). The side effects of local government debt: Evidence from urban investment bonds and corporate pollution in China. Journal of Environmental Management, 344, 118739. https://doi.org/10.1016/j.jenvman.2023.118739