Leveraging Indonesia's One Map and One Data Initiatives to Assess Livelihood Resilience after Compulsory Land Acquisition

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Key words: compulsory land acquisition, geospatial data integration, one map policy, one data policy, social impact assessment

1. SUMMARY

Despite the uptake of Indonesia's One Map Policy (OMP) and One Data Governance (ODG), the impact on evidence-based decision-making remains limited, particularly in the land governance sector. Persistent challenges – including weak institutionalization, heterogeneous data quality, interoperability issues, capacity constraints, and limited integration into policy processes – continue to hinder effective policy outcomes. These limitations are especially evident during compulsory land acquisition processes, as effectors tend to prioritize procedural efficiency and legal compliance over systematic social impact assessments. Although Land Acquisition Planning Documents (DPPTs) are intended to provide transparency and inform decisions before project implementation, there is inadequate use of integrated data to assess social and livelihood vulnerability. Using the Yogyakarta – Bawen toll road project as case study, this paper analyzes how OMP and OGD can support the calculation of Livelihood Vulnerability Index (LVI) within compulsory land acquisition. The study assesses the availability, accessibility, and temporal coverage of openly available spatial and socio-economic data for 27 LVI indicators across four project-affected villages located in different regencies and city administrations. The results reveal substantial variation in data readiness across administrative areas, with no locality providing complete coverage for all indicators. Several key LVI components cannot be derived directly from open data and require the use of proxies, highlighting persistent gaps in data provision, particularly to calculate LVI for social impact of compulsory land acquisition. The findings underscore the importance of integrated and operational data governance under Indonesia's One Data and One Map initiatives. While relevant datasets exist across multiple institutions, the fragmentation of data storage, inconsistent accessibility, and limited interoperability constrain comprehensive social impact analysis. Strengthening data standardization, inter-agency coordination, and sustained data updating is essential to enable systematic assessment of indirect and non-physical impacts, thereby supporting more inclusive, livelihood-oriented, and sustainable compulsory land acquisition practices.

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1. INTRODUCTION

Since the launch of the United States Open Data Initiative in 2009, Open Government Data (OGD) has gained global prominence as a key instrument for transparency and evidence-based policymaking (Alexopoulos et al., 2024; Attard et al., 2015; Matheus & Janssen, 2020). In the Asia-Pacific region, Indonesia emerged as an early adopter, formally initiating its open data agenda in 2011 alongside several other countries (Bernot et al., 2024; Tjondronegoro et al., 2022). In parallel, Indonesia introduced the One Map Policy (OMP), initially conceptualized in 2010 and institutionalized through Presidential Regulation No.9/2016 and reinforced by Presidential Regulation No.39/2019, to address long-standing inconsistencies in spatial data and improve cross-sectoral governance. Together, OGD and OMP form the foundation of Indonesia's broader One Data and One Map Governance, which aims to provide integrated, standardized, and accessible data to support evidence-based decision-making across policy domains. In land governance, such a data infrastructure is particularly critical, as decisions related to land management involve complex spatial, social, and economic considerations (Sommer & de Vries, 2023).

Despite this potential, substantial evidence indicates that the benefit of OGD does not arise automatically from data publication alone (Bernot et al., 2024; Janssen et al., 2012). Previous studies identify persistent political-administrative, social, technological, legal, and organizational challenges that limit effective implementation, including weak institutionalization, data quality and interoperability issues, capacity constraints, and limited integration of data into the policy process (Alexopoulos et al., 2024; Algemili, 2016; Zuiderwijk & Reuver, 2021). In Indonesia, these challenges are particularly evident in compulsory land acquisition practice, where planning processes tend to prioritize procedural efficiency and legal compliance, often at the expense of systematic social impact assessment. Although Land Acquisition Planning Documents (DPPTs) are intended to inform decision-making prior to land acquisition, the use of integrated, high-quality data to assess social vulnerability remains limited. This creates a gap between the availability of open and spatial data and their effective use in evaluating the potential livelihood impacts of infrastructure projects on affected communities.

To address this gap, this study analyses how OGD and OMP can support the calculation of a Livelihood Vulnerability Index (LVI) as an analytical tool within compulsory land acquisition planning. By drawing on openly available spatial and socio-economic data, LVI provides a structured and comparable measure of community vulnerability that complements existing planning instruments. Integrating LVI into the DPPT process offers a means to move beyond compensation-focused approaches and toward more inclusive and sustainable land acquisition practices that explicitly account for livelihood risks. Accordingly, this research addresses the following questions: (1) How can OGD and OMP support inclusive and sustainable compulsory land acquisition in the Indonesian context through the calculation of livelihood vulnerability? (2) To what extent are data availability, accessibility, interoperability, and quality sufficient to support the computation of LVI for evidence-based land acquisition planning?

This paper contributes to the discourses on spatial data infrastructure requirements and land information management as it provides an empirical assessment of how open data and spatial data governance frameworks operate in practice within land governance, particularly in the context of compulsory land acquisition. By examining this, the study bridges the gap between OGD principles and their operational use in land acquisition planning. This contributes to sustainable land information management in Indonesia and beyond.

2. METHOD

This study adopts a data readiness assessment approach to examine how much existing datasets can support the assessment of social impacts and livelihood vulnerability associated with compulsory land acquisition. The analysis builds on a previously developed and validated set of vulnerability indicators related to compulsory land acquisition (Pinuji & de Vries, 2025). These indicators comprise of 27 variables (Table 2). Rather than recalculating vulnerability scores, this study evaluates the availability, accessibility, and interoperability of data required to operationalize these indicators across different institutional and spatial contexts.

2.1 Data Searching

For each indicator, data sources were identified and traced to the responsible data-producing institutions, including land administration agencies, statistical offices, sectoral ministries, and local governments. Data availability and accessibility were assessed based on whether the datasets exist, can be accessed through formal or open-data mechanisms, and are usable for analytical purposes. For indicators where village-level data were not directly available, values were derived from higher-level datasets using proportional allocation or proxy-based methods. All assumptions, scaling procedures, and derivation methods were explicitly documented to ensure transparency and reproducibility.

When required data were not provided by the designated government data custodians, or when available datasets did not meet the necessary criteria in terms of spatial resolution, temporal

coverage, or analytical suitability, we complemented official sources with open-access geospatial data, accompanied by appropriate processing and validation steps.

Finally, for indicators where direct data were unavailable or incomplete, proxies or substitute variables were employed. The proxy selection was guided by conceptual relevance, empirical support from previous studies, and data availability within the One Data framework. Each proxy was selected to capture the most accurate measurable representation of the intended indicator, while acknowledging its limitations. The use of proxy variables and their underlying assumptions were explicitly documented to maintain analytical transparency and to inform interpretation of the results.

2.2 Data Readiness Assessment

Data readiness for each indicator was evaluated using five analytical dimensions: (1) availability, (2) accessibility, (3) granularity or spatial scale, (4) temporal coverage, and (5) reliability and data quality (Table 1). These dimensions were adapted from established data readiness and data governance frameworks and tailored to the context of this research. The assessment was conducted as a comparative, qualitative evaluation across indicators, villages, and data custodians. This approach enables a nuanced understanding of data gaps, mismatches, and interoperability challenges, and highlights instances where proxy methods or open-source data were necessary to complement official datasets.

Table 1 Components of data readiness assessment used in the study

Dimension	What it measures	Criteria	Reference(s)
Availability	Whether data exists for each indicator in each region	Not available/ Partially available/ Fully available	(Austin, 2018; Douthit et al., 2021; Klievink et al., 2017; United Nations Office for Disaster Risk Reduction, 2017)
Accessibility	Ease of access (legal, institutional, technical)	Not accessible/ Accessible with restriction/ Open access	(United Nations Office for Disaster Risk Reduction, 2017)
Granularity/ scale	Spatial or administrative resolution of the data (village/ district/ regency/ regional)	Only higher administrative level/ Partial village-level/ Full village-level	(United Nations Office for Disaster Risk Reduction, 2017)
Temporal coverage	Whether data are current and match analysis period	Outdated/ Partial coverage/ Up-to-date	(United Nations Office for Disaster Risk Reduction, 2017)
Interoperability/ standardization	Ability to integrate datasets across institutions/ system	No standard/ Partially standardized/ Fully standardized	(De Lusignan et al., 2011; Douthit et al., 2021; Lawrence, 2017)
Reliability/ quality	Completeness, accuracy, consistency of datasets	Poor/ Medium/ High (official sources, verification)	(De Lusignan et al., 2011; Douthit et al., 2021)

2.3 Data Harmonization

Following the data readiness assessment, a data harmonization process was undertaken to ensure that datasets from multiple sources could be consistently integrated and aligned with the requirements of the livelihood vulnerability indicators. Data from multiple sources were

subsequently harmonized by standardizing spatial reference systems, administrative boundaries, temporal reference periods, and attribute definitions to ensure cross-regional and cross-institutional comparability. The primary objective of this step was to prepare heterogeneous spatial and non-spatial datasets for comparative analysis and potential LVI calculation by addressing differences in administrative boundaries, attribute definitions, spatial scale, and temporal reference periods.

3. RESULTS AND DISCUSSION

3.1. Data Sources, Proxy Handling, and Harmonization

Our primary data sources were official datasets released by government institutions. Most indicators within the livelihood asset cluster were obtained from publications by Statistics Indonesia (BPS), including Sub-District in Figures (published annually), the Agriculture Census at Sub-District Level (published every five years, latest update 2023), and Gross Regional Domestic Product at Regency Level by Industry (available annually, latest update 2020-2024). This data is reported at the regency level.

During data collection and inspection, we observed substantial variation, particularly in data completeness and spatial granularity across regencies. For example, for Indicator I01 (total number of households), Bawen Sub-District (Semarang Regency) explicitly reports the number of households for each village, including Kandangan. In contrast, other regencies do not provide village-level figures in BPS publications for this indicator, requiring us to obtain data from alternative sources.

We also found that duplicated data exists across multiple platforms. For instance, the One Data Portal of Magelang City hosts datasets that are also available on the BPS website and in certain village information systems. In such cases, we identified the primary data custodian responsible for each dataset and prioritized their version.

Two indicators, I22 and I26, were excluded due to the lack of reliable and accessible data. I22 could not be comprehensively quantified, as official records document only land parcels that were directly acquired. Direct impacts were obtained from the DPPT, which provides legally recognized land acquisition data. However, indirect impacts – including changes in accessibility, land fragmentation, or broader environmental effects - remain unmeasured due to the lack of standardized or interoperable datasets. Furthermore, Environmental and Social Impact Assessment (ESIA) reports for this project were unavailable, which limited the formal evaluation of its social and environmental consequences. This absence reflects a broader institutional constraint in Indonesia's compulsory land acquisition framework. ESIA requirements are typically mandatory only for projects financed by international development partners. For projects fully funded through the state budget (APBN), ESIA obligations are not explicitly mandated under prevailing land acquisition laws and regulations. Consequently, social and environmental considerations tend to be marginal in project preparation, reinforcing

critiques that compulsory land acquisition practices often prioritize speed of execution and procedural efficiency, largely to avoid delays and associated economic losses rather than adopting a sustainably-oriented and socially-responsive approach (Babatunde et al., 2017; Rowan, 2017).

Despite these constraints, indirect impacts could potentially be estimated using spatial proxies, such as buffer zones around toll road alignment, catchment analysis, or remote sensing-based assessments of land-use change. Similarly, I26 could not be directly assessed as no accessible and harmonized datasets exist. While Land Valuation Reports may contain partial information on livelihood impacts and income-generating activities, these documents are generally restricted and cannot be integrated analytically across sectors due to confidentiality and data restriction policies and are usually produced after the DPPT has been prepared. On the other hand, publicly available land acquisition documents, including the DPPT, focus primarily on physical asset valuation, providing insufficient information to evaluate potential economic disruptions or impacts on livelihoods. This limitation highlights a significant gap in current land acquisition planning, where data coverage is primarily physical and parcel-based, and broader socio-economic and environmental effects are underrepresented.

In addition to official statistical and administrative datasets, we utilized open-source satellite imagery (Sentinel-2) to derive land-use information through classification, as no time-series data with sufficient spatial and temporal resolutions were available at the village level. While the land-cover maps provided by the Ministry of Environment and Forestry (KLHK) offer time-series datasets, their 30 x 30 – meter spatial resolution limits their applicability for fine-scale, village-level analysis. Similarly, land-use maps from the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN) exist, but these are not updated for Central Java, further limiting their use for current land-use assessment.

We also observed substantial variation in the availability, accessibility, and completeness of datasets across regency and city-level open data portals. Although all study areas formally maintain open data platforms, many datasets were inaccessible, incomplete, or outdated, and therefore did not align with the temporal scope of the analysis. Similar inconsistencies were found in data published by BPS at the regency level. While BPS provides online data portals, the scope, granularity, and completeness of published datasets vary considerably across regencies, particularly for village-level and socio-economic indicators.

Comparable challenges were also identified among other data custodians, such as the Department of Population and Civil Registration. Although several of the datasets managed by these institutions – such as labour force statistics and population characteristics by education or occupation – are formally classified as public information, they were not always accessible through online platforms and often required formal permission requests, especially for data not routinely published.

In contrast, more consistent and reliable data were obtained from datasets managed at the provincial or national (ministerial) level, including indicators I17, I20, and I21. These datasets exhibited higher levels of standardization, temporal continuity, and institutional interoperability, reflecting stronger data governance mechanisms and clearer implementation of the One Data Principles. This contrast highlights the persistent asymmetry between national and subnational data readiness in Indonesia, underscoring the critical role of coordinated data governance frameworks in enhancing the usability of subnational data for evidence-based decision-making in land acquisition and social impact assessment.

A notable issue was also observed for indicators I11 and I12, which relied on datasets accessed through provincial and ministerial level data portals (the Ministry of Home Affairs and the Provincial Government of Central Java). During data collection, both platforms provided village-level information, including the number of poor households and IDM data. However, both portals became inaccessible during the paper writing process, and the websites were no longer available at the time of manuscript preparation. This situation highlights a broader challenge in Indonesia's data governance framework, particularly regarding the sustainability of data platforms and continuity of public data access. Such discontinuity constrains data traceability, reproducibility of analysis, and longitudinal assessment, and undermines the objectives of One Data Policy.

Table 2 presents the results of this step.

Table 2 Indicators and data sources

No	Indicator	Sources
1	Overall number of households (I01)	**Kandangan Village, Bawen Sub-District:** Publication: "Sub-District in figures year 2024", available for all villages. Published by Statistics Indonesia at City/ Regency level (BPS Kabupaten/ Kota) **Banyusari Village, Grabag Sub-District:** Accessed from https://magelangkab;.bps.go.id/id/statistics-table/2/MTE5MyMy/number-of-family-and-head-of-household-by-sex-and-village-in-grabag-district.html (year 2024, accessed at 25.10.2025). "Sub-District in figures year 2024" for Grabag district is available but does not mention the number of households. **Kebumen Village, Pringsurat Sub-District:** Two data sources are available: Webiste smartcity Kabupaten temanggung https://smartcity.temanggungkab.go.id/assets/dok_file/223_03-jumlah-kk-kepemilikan-kk-kel-1-.pdf , accessed at 25.10.2025 (in form of pdf file, without any information of the year). Village website: https://kebumen-pringsurat.temanggungkab.go.id/frontend/profil/422 , accessed at 25.10.2025 Both data show different results of the number of household in Kebumen village. Data from "Sub-District in Figure 2024" for Pringsurat district is available but does not mention the number of households.

		Tidar Utara Village, Magelang Selatan Sub-District: Data accessed from Satu Data Portal (one data portal) of Magelang Regency: https://datago.magelangkota.go.id/frontend/item-dda?item=971 (accessed at 25.12.2025) Data from "Sub-District in Figure 2024" for Magelang Selatan district is available but does not mention the number of households.
2	Average household size (I02)	For all villages, data was derived from the total population number divided by the number of households. Population numbers were obtained from "Sub-District in Figure 2024" published by Statistics Indonesia at Regency/ City level. For **Tidar Utara village,** average household size is explicitly presented in https://datago.magelangkota.go.id/frontend/item-dda?item=971 , and the number is consistent with the calculation mentioned.
3	Population ratio by productive age (I03)	This indicator was defined following the classification used by Statistics Indonesia (BPS), encompassing individuals aged 15-65 years. The data was available only at the district level. To estimate the number of productive-age residents at village scale, a proportional allocation approach was applied.
4	Population ratio by gender (I04)	The data is available for all villages in "Sub-District in Figure 2024" by Statistics Indonesia at City/ Regency level.
5	Population ration by level of education (I05)	**Kandangan Village, Bawen Sub-District and Kebumen Village, Pringsurat Sub-District** The required data were not available in any publications released by BPS, nor were they accessible through the official website of the Department of Population and Civil Registration. Consequently, the data were obtained through a formal data request submitted directly to the relevant institution, in accordance with established administrative procedures. **Banyusari Village, Grabag Sub-District:** Data is available in *"Sub-District in Figure 2024"* by Statistics Indonesia at City/ Regency level. **Tidar Utara Village, Magelang Selatan Sub-District:** Data were not available in publications released by BPS, but can be accessed through One Data Portal through the link: https://datago.magelangkota.go.id/frontend/item-dda?item=6167 .
6	Population ration engaged in land or natural resource-related work (I06)	**Kandangan Village, Bawen Sub-District and Tidar Utara Village, Magelang Selatan Sub-District** The data is available in "Agriculture Sensus 2023" by Statistics Indonesia, available for all sub-district level. **Banyusari Village, Grabag Sub-District:** Data is available in *"Sub-District in Figure 2024"* by Statistics Indonesia at City/ Regency level. Data also available in *"Agriculture Sensus 2023"* by Statistics Indonesia, available for all sub-district level. **Kebumen Village, Pringsurat Sub-District:** Data available in "Agriculture Sensus 2023" by Statistics Indonesia, available for all sub-district level. The data can also be accessed through website of Statistic Indonesia at Temanggung Regency: https://temanggungkab.bps.go.id/id/statistics-table/1/MTUzOCMx/jumlah-petani-pengguna-lahan-pertanian-dan-petani-gurem-menurut-desa-kelurahan-di-kecamatan-pringsurat--orang---2023.html
7	Population percentage employed in non-	**Banyusari Village, Grabag Sub-District:** Data is available in "Sub-District in Figure 2024" by Statistics Indonesia at City/ Regency level.

	agricultural and non-natural resource sectors (I07)	**Other villages:** Estimated by subtracting the number of agricultural workers (Agricultural Sensus) from the total labor force (Sub-District in Figures), due to the absence of disaggregated employment data at village level.
8	Regional capacity in non-agricultural sector (I08)	The data were sourced from "Gross Regional Domestic Product at regency level by Industry 2020-2024", publicly available through BPS portal on each regency/ city. This indicator was operationalized as the proportion of non-agricultural GDRP to total GDRP, calculated by dividing the combined value added of all non-agricultural sectors by total GDRP. This ratio was used as a proxy for regional economic capacity and diversification beyond agriculture.
9	Total annual agriculture production (I09)	This indicator was estimated using agricultural production data at the sub-district level, obtained from the Sub-District in Figures publication 2024, which is consistently available across all sub-districts in the study area. As village-level production data were not reported, values were downscaled from the sub-district level using a proportional allocation approach based on agricultural land area. This approach assumes that agricultural productivity is spatially homogenous within each sub-district.
10	Total annual non-agriculture production (I10)	Due to data availability constraints, non-agricultural production was measured at the regency level and applied uniformly to villages within the same administrative unit. This limitation is acknowledged and considered in the interpretation of results. The data was gathered from *Regency in Figure year 2024.*
11	Percentage of identifiable vulnerable groups, minorities, or indigenous communities within the area (I11)	The indicator was derived from several data: Number of smallholder and marginal farmers derived from the Agricultural Census 2023 at the sub-district level (available for all villages) The number of poor households, accessed from https://prodeskel.binapemdes.kemendagri.go.id/mpublik/ , managed by The Ministry of Internal Affairs, available at village level (accessed 10.10.2025) . At the time of data collection, the platform provided village level IDM scores that were used in this study. However, during the manuscript preparation, the portal became inaccessible, and the website was no longer available.
12	Access to city center/ economic center/ job (I12)	Access to city and economic centers was partially approximated using the Village Development Index (IDM), which incorporates village-level indicators of infrastructure, connectivity, and development relevant to economic accessibility. IDM provides a standardized proxy for comparing access across villages, although it does not directly measure travel distance or time. Access to the IDM data was initially obtained through the official provincial portal https://sidesa.jatengprov.go.id/, accessed 10.11.2025. However, during manuscript preparation, the portal became inaccessible, and the website was no longer available at the time of manuscript preparation. IDM data for Kandangan village, Bawen sub-district is available in *Sub-District in Figure 2023.* To complement IDM and capture actual spatial accessibility, GIS-based measures of distance and travel time to the nearest city or economic hub were calculated using road network data.
13	The extent of agriculture (I13)	This indicator was derived from Sentinel-2 satellite imagery , which provides high-resolution (10-20 m) optical data suitable for land use/ land cover mapping. The imagery was processed and classified using a Random Forest supervised classification algorithm. Training samples for each land cover class were collected from field knowledge, high-resolution imagery, and existing land use maps. The classified map was validated using available reference data.

14	The extent of non-agriculture/ built-up area (I14)	Same method with I13
15	Land use change rate index over the last 5 years (I15)	This indicator was calculated to quantify the temporal dynamics of land use changes in the study area. Land cover maps for 2020 and 2025 were derived from Sentinel-2 imagery using Random Forest classification for the main classes: agriculture, built-up/non-agricultural, vegetation, and open land. The change rate index was computed using the formula : Change Rate (%) = ((Area 2025 – Area 2020)/ Area 2020 x 100 .
16	Water scarcity for agricultural purposes in the last 5 years (I16)	This indicator utilized data from several sources. Primary secondary data consisted of official drought disaster records and climate-related statistics derived from Sub-District in Figure. These were complemented by information from news outlets and publicly available reports. Triangulation across data sources was employed to ensure data consistency and robustness.
17	Percentage of registered land parcels in relation to the estimated total number of land plots (I17)	The data was estimated through visual interpretation by dividing the number of land parcels registered in the national land administration system by the estimated total number of land parcels at the village level, using spatial information available from the official ATR/BPN geoportal (accessed through http://bhumi.atrbpn.go.id)
18	Number of sharecroppers and subsistence farmers (I18)	The data is available at village level in “Agriculture Sensus year 2023 at Sub-District Level” published by Statistics Indonesia at Regency/ City level.
19	Increase in operational costs of agricultural production in the last 5 years (I19)	This indicator was approximated using the rise in fertilizer and rice seeds prices between 2020 – 2025. Fertilizer and rice seeds were selected as proxies because they constitute the major recurring inputs in paddy cultivation, which dominates the study area, and have a direct impact on crop yields and production expenses. No formal or comprehensive database exists for total operational cost at the village or regency level, and other cost components such as labor, irrigation, or machinery could not be consistently quantified due to lack of standardized data. Prices were derived from publicly available sources, including news reports and website publications. While this proxy does not capture all aspects of production costs, it provides a representative and quantifiable measure of the trend in agricultural operational expenses over time.
20	The rise in the cost of essential food items over the past 5 years (I20)	This indicator was calculated using data from the Central Java Food Price Information Portal (https://hargajateng.org) , based on the Consumer Price Index (CPI) for essential food commodities. The indicator was measured as the percentage changes in food prices between 2020 and 2024 at the regency/ city level. These values were then applied to villages within the corresponding administrative units to reflect temporal changes in household food expenditure.
21	Stability of agricultural commodity prices in the last 5 years (I21)	This indicator was assessed using data from the Central Java Food Price Information Portal (https://hargajateng.org/) . The indicator was calculated at the regency/ city level by measuring the coefficient of variation (CV) of monthly process for key agricultural commodities between 2020 and 2024. A lower CV indicates more stable prices, while a higher CV reflects greater fluctuations and potential market volatility. These regency-level values were then applied to villages within the corresponding administrative units to approximate local exposure to agricultural price instability.
22	The area being affected, directly or	This indicator could not be reliably quantified in full, as official records only document directly acquired land parcels. Nonetheless, such indirect impacts

	indirectly, by land acquisition and toll road infrastructure projects (I22)	could potentially be estimated using spatial proxies, including buffers around toll road alignments, catchment analyses, or remote sensing-derived land-use change data.
23	The number of households eligible for compensation (I23)	The data was obtained from Land Acquisition Planning Document *(DPPT),* which contains official land acquisition planning record for the project. Access to these documents is restricted and requires formal permission from the relevant authorities.
24	Total area affected by land acquisition (I24)	The data was obtained from the DPPT, which provides official spatial and administrative records of planned compulsory land acquisition. access to the DPPT is restricted and subject to formal authorization from the responsible institutions.
25	Total agriculture area potentially affected by land acquisition (I25)	This indicator was derived from the DPPT. Access to the DPPT is restricted and requires formal authorization. This indicator was calculated as the total area of agricultural land directly affected by compulsory land acquisition. Agricultural land includes parcels classified as cropland, plantations, or other productive agricultural uses within the acquisition boundary. Indirectly affected agricultural areas, such as parcels experiencing reduced accessibility, fragmentation, or hydrological changes due to the project, were not quantified in this study due to data limitations and the absence of standardized criteria in the DPPT for delineating indirect impacts. As such, the indicator represents a conservative estimate of agricultural land exposure, focusing solely on land directly subject to acquisition.
26	Estimation of the number of economic activities likely to be affected by land acquisition (I26)	This indicator could not be quantitatively derived due to the absence of accessible and interoperable datasets. While information related to livelihood impacts and income-generating activities may be partially captured within Land Valuation Reports*,* these documents are subject to confidentiality restrictions and limited access. Existing publicly accessible land acquisition documents, including those in the DPPT, remain focused on physical asset valuation, offering insufficient information to assess the disruption of economic activities and the impacts on livelihoods.
27	Opportunities for employment after project completion (I27)	This indicator was approximated using a spatial proximity-based assumption. Villages located within approximately a 5 km buffer of toll road exits were assumed to have greater post-construction employment opportunities, reflecting the likelihood of increased economic activity associated with improved accessibility, logistics, and service development around toll interchanges. This spatial proxy was employed to provide a relative measure of potential employment opportunity, rather than a direct quantification of job creation. This should therefore be interpreted as an estimate of relative opportunity rather than an observed employment outcome.

3.2.Data Readiness Assessment Result

Beyond indicator-level gaps, the study also reveals substantial variation in open data readiness across the four study areas, which are located in different regencies and city administrations. Although all regencies and cities are formally operating Open Data portals, their performance varies considerably in terms of data completeness, update frequency, accessibility, and usability. Magelang City – the only urban administration in the study – exhibits relatively strong

data readiness, with a more comprehensive and regularly updated portal, often refreshed on a semi-annual basis. A similar pattern was observed in Magelang Regency. Nevertheless, data overlaps and inconsistencies remain pervasive. Multiple government agencies frequently publish similar datasets to duplication and conflicting values. In addition, several data portals suffer from irregular maintenance, resulting in outdated datasets – a common challenge in sustaining information systems over time. Data format inconsistency further compounds these issues; BPS offices across regencies often present comparable indicators at different levels of granularity and completeness, while One Data portals frequently publish datasets in non-machine-readable formats (e.g., PDF or unstructured spreadsheets), which limits interoperability and reuse.

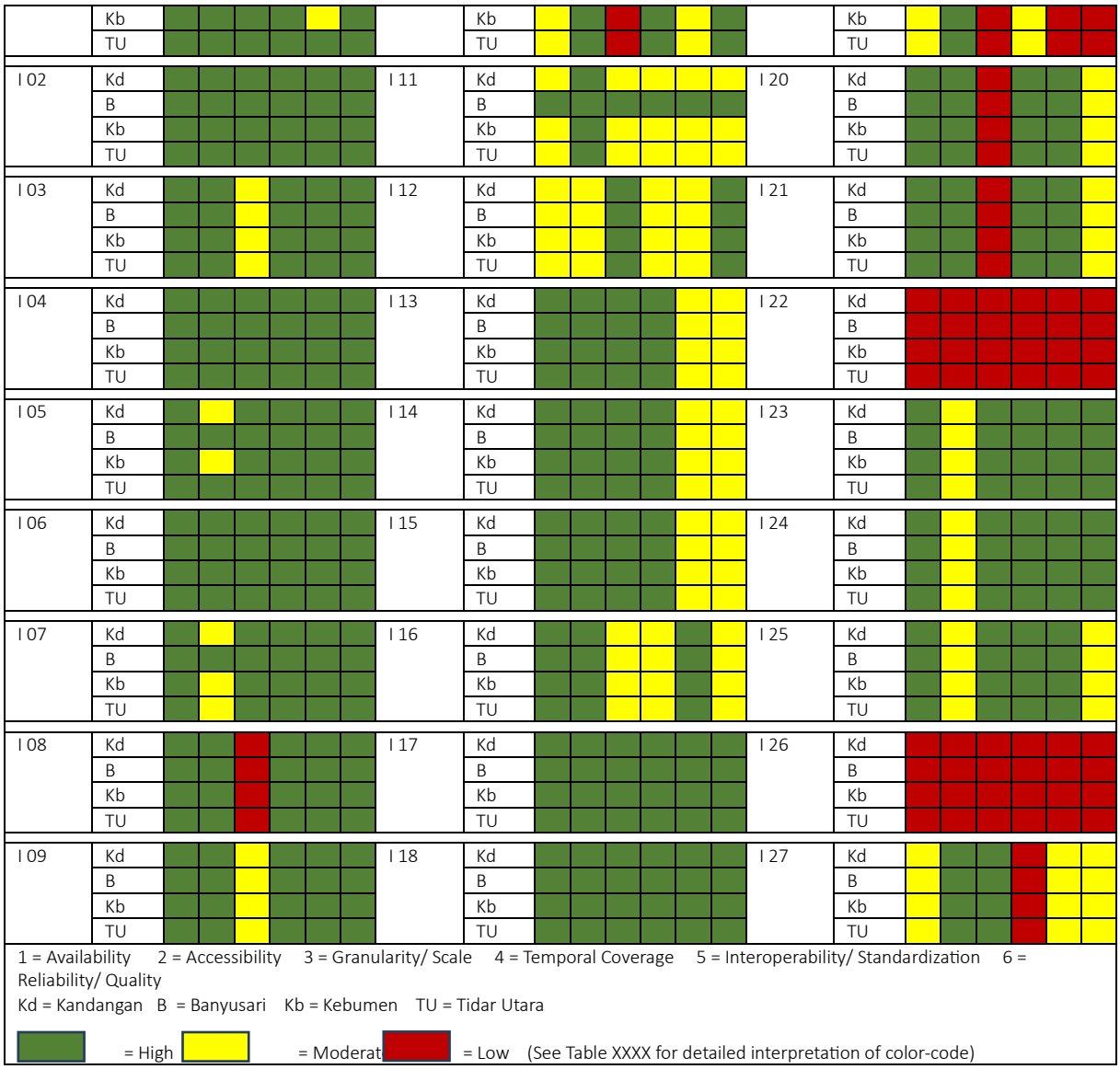
These challenges are not unique to Indonesia. Similar issues have been widely documented in developing-country context, despite the global expansion of Open Government Data (OGD) initiatives (Alexopoulos et al., 2024; Bernot et al., 2024; Matheus & Janssen, 2020) identify political-administrative and social factors as some of the key barriers to OGD effectiveness, noting that many initiatives remain one-off pilot projects, lack long-term sustainability, and generate frustration due to overlapping data programs. In the Indonesian context, Bernot et al., (2024) observe that mandatory data submission to the Spatial Data Infrastructure (SDI) portal for planning and budgeting has acted as a strong driver of OGD adoption. However, this progress has been constrained by limited central technical guidance, sectoral resistance to data interoperability, fragmented legal frameworks, and top-down implementation models that lack recursive feedback mechanisms.

As Sayogo et al., (2024) emphasize, effective data-driven governance depends not only on expanding data availability, but also on the development of robust data architectures, the cultivation of institutional data cultures, and the strengthening of analytical capacity across administrative levels. Without these foundational elements, initiatives such as One Data and One Map risk remaining procedural compliance exercises rather than transformative instruments for evidence-based decision-making. In the context of compulsory land acquisition, addressing these systemic constraints is essential to enable the meaningful integration of social and environmental considerations, support longitudinal impact assessment, and advance more sustainable and socially responsive development outcomes.

Furthermore, Table 3 summarizes the results of the data readiness assessment, using a color-coded scheme to visually represent variations in availability, accessibility, granularity, temporal coverage, interoperability, and reliability across indicators and study locations.

Table 3 Color-coded result of data readiness assessment result

Indicator	Village	1	2	3	4	5	6	Indicator	Village	1	2	3	4	5	6	Indicator	Village	1	2	3	4	5	6
I 01	Kd							I 10	Kd							I 19	Kd						
	B								B								B						



4. CONCLUSION

This study emphasises the crucial role of integrated data governance in Indonesia's One Data and One Map policies. Although multiple institutions produce relevant datasets, the fragmented storage, inconsistent accessibility, and limited operability continue to constrain any kind of comprehensive analysis, particularly at the village level where land acquisition impacts are most pronounced. Strengthening the operationalization of these national data initiatives – through standardized data structures, sustained portal maintenance, and improved cross-institutional coordination – would enhance evidence-based planning and enable more systematic assessment of indirect and non-physical impacts. Such improvements are essential for shifting compulsory land acquisition practices beyond a narrow focus on physical

compensation toward more sustainable, inclusive, and livelihood-oriented development outcomes.

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