

EKOPEMBADIG: DATA-BASED EDUCATION ECOSYSTEM DASHBOARD AS A GOVERNANCE INNOVATION TO INCREASE STUDENT LITERACY IN TULANG BAWANG REGENCY

Ristu Irham^{1*}, Noverman Duadji², and Tina Kartika³

¹Doctoral Student of Development Studies, Faculty of Social and Political Sciences,
Universitas Lampung

²Department of Public Administration, Faculty of Social and Political Sciences, Universitas
Lampung

³Department of Communication, Faculty of Social and Political Sciences, Universitas
Lampung

resturestu01234@gmail.com, noverman.duadji@fisip.unila.ac.id,
tina.kartika@fisip.unila.ac.id

ABSTRACT

Tulang Bawang Regency is a condition which this research defines as a broken policy cycle, a condition in which the data is abundant by means of the Rapor Pendidikan and ANBK system, but perpetually fails to access the actors who need it through a form which can be utilized. This study creates and confirms the EKOPEMBADIG Dashboard model, Ekosistem Komunitas Pembelajaran Berbasis Digital, as an management reconstruction intervention that is not only presenting data but converting data into predictive and prescriptive intervention recommendations at the school level. The article implemented a case study methodology using a single instrument with a critical framework and NVivo Project Map analysis, engaging 25 informants from diverse levels of the ecosystem to trace the design logic of EKOPEMBADIG and its discernible impacts on actor capability. The findings indicate that EKOPEMBADIG's four-layer architecture, from data sources to ETL and validation, analytics, and decision and recommendation, produces measurable changes in the way actors operate in the ecosystem. School principals are transforming from passive administrative executors to evidence-based leaders; teachers are transforming from routine-driven instruction to strategy adjustment based on student profiles; and supervisors are transforming to indicator-based supervision with predictive early warning capacity. The model operationalizes a six-stage data-driven policy cycle and recommends a Regent's Regulation as the regulatory foundation without which the ecosystem remains dependent on individual leadership continuity rather than institutional architecture. Theoretically, this study adds to the glocal model of human-centered development, theory of change, and distributed leadership in the context of the specific limitations of an Indonesian regency. In practice, EKOPEMBADIG provides a reproducible blueprint for regencies with the same paradox of data abundance without policy consequence.

Keywords: *Digital Education Dashboard, EKOPEMBADIG, Human-Centered Development, Theory of Change, Data-Based Policy Cycle, Ecosystem Governance*

INTRODUCTION

Data-driven education governance has emerged as the most common topic in global public policy change, and the explanation is fairly clear. When government systems and administrators have sufficient precision to measure what transpires in classrooms,

they can more accurately direct interventions, more efficiently allocate resources, and then close the disparity among evidence and policy action in a manner that traditional administrative routines could not (Ozga, 2009; Williamson, 2016). This reasoning was growing institutionalized by governments from OECD member states to the Asia-Pacific region to national education systems, reinforced by international frameworks that situate data infrastructure as a condition for the enhancement of educational quality and accountability, rather than a technical supplement (Lingard et al., 2013; OECD, 2013). Moreover, the World Bank and UNESCO have both invested heavily in the development of educational information systems in low-income countries, considering the availability of reliable data as a prerequisite for any reliable reform effort (UNESCO, 2016; World Bank, 2018).

However the reality in numerous developing countries including Indonesia is quite distinct from this promise. Data has been gathered, reported and archived across systems: Dapodik, BPS and ANBK but this cycle rarely gets to the last stage from documentation to concrete action that students and teachers truly encounter in schools. The problem is not a lack of data but the institutional inability to convert data that are available into a basis for decisions that may alter circumstances at the school level. This research relates to this as a data utilization gap, a situation where technical availability fails to translate into similar improvement in government policy quality or educational results, and one that Coburn & Turner (2011) identify among the most persistent failures in evidence informed governance across public education systems. The distinction is mainly institutional, not technical, a pattern that Chang et al. (2014) noted as well in their study of education reform implementation across the Indonesian archipelago and that Mandinach & Gummer (2016) attributed to a lack of organizational routines that convert unstructured administrative data into decision-relevant information.

Kabupaten Tulang Bawang in Lampung province is a common case of this paradox. Through student literacy scores at the SD level and SMP only reaching 1.66 with a national target of 3.00, the district has plenty of access to quality data through Rapor Pendidikan and ANBK, but that data has rather than flowed into precise policy decisions at the school level (Ministry of Education, Culture, Research, and Technology, 2023). What occurs here is what this research refers to as a broken policy cycle, a situation in which data exists at the system level, district leadership is aware of it, however teachers as primary implementers do not receive knowledge in a form they are able to act on, and as a consequence, systematic learning intervention never occurs (Datnow & Hubbard, 2015; Pressman & Wildavsky, 1984). This failure is not a failure of information at the top of the hierarchy, but of converting that information down into actionable guidance for practitioners in classrooms. Furthermore, Wayman & Stringfield (2006) demonstrate that data systems will result in meaningful instructional change only when all teachers, not solely administrators, take an active role in examining and interpreting data. This prerequisite has not yet been established in any systematic form across the schools of Tulang Bawang.

The study focuses on a research question on how to design an education dashboard model that does not just visualize data but additionally strengthens the abilities of local actors and operationalizes an Evidence-Based Policy in the context of Indonesian districts. The answer to this issue is the establishment of the Digital-Based Learning Community Ecosystem (EKOPEMBADIG Dashboard) a model that defines technology as a tool to support human development, not simply a tool for digital reporting.

This study provides a contribution in two forms. First, in theory, a glocal model structure that incorporates the concepts of Human-Centered Development, Theory of Change and Distributed Leadership into designing an education information system. Practically, it acts as a comparable blueprint that can be copied by other cities and districts with similar characteristics all over Indonesia.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Human-Centered Development and Capability Approach

EKOPEMBADIG is developed based on Human-Centered Development (HCD) and Capability Approach developed by Amartya Sen (1999). The idea is that development has to be judged by the extent to which it expands real capabilities of human beings, by which I mean the real ability to choose and lead a life that one has reason to value, rather than by the availability of material instruments. In this context, an education dashboard is not an information technology project but a human development project that uses technology as one of its tools.

Sen differentiates between capacity, meaning potential ability, and functioning, which means the ability which is actually exercised. The distinction is important in the context of EKOPEMBADIG in which a school principal who is granted access to a Rapor Pendidikan but is unable to comprehend it is a capability without function. EKOPEMBADIG is meant to bridge the gap between the two, turning capability into functioning. This constitutes the fundamental conceptual distinction between a traditional system of information and one that is designed for capability empowerment.

Theory of Change in Data-Driven Education Reform

The Theory of Change (ToC) developed by Weiss (1995) and Anderson (2005) shows that systemic change is not necessarily straight-line from policy to implementation but occurs through a variety of interdependent causal mechanisms in which the success of any intervention depends on an explicit understanding of the underlying logic of change. ToC depends on a clearly defined mapping of the current condition, the desired state, the mechanisms connecting both of them, and the assumptions required for those mechanisms to work.

In the context of Tulang Bawang's literacy problem, the EKOPEMBADIG ToC works through a clear causal chain: repair of digital connectivity infrastructure creates the conditions for equal participation capacity across schools, which in turn produces more valid and representative data quality, from which a trustworthy data ecosystem can be

built, and from which more precise and targeted literacy interventions can finally be designed and deployed. Each stage is a necessary condition for the next, and intervening at a single point without first ensuring its preconditions are met will not produce change that holds. Every connection in this chain is a prerequisite for the following, and to intervene at one point without first ensuring that its prerequisites are met will not result in a change that holds.

Ecological Systems Theory

Ecological Systems Theory Bronfenbrenner (1979) views individual development, which includes student literacy capacity, as a consequence of dynamic interactions across several interconnected layers of system rather than as the outcome of one factor functioning independently. EKOPEMBADIG is deliberately designed to capture and respond to these cross-layer interactions, centred on: Classroom-level data including formative assessment scores on the Microsystem level. School-level data such as Rapor Pendidikan and RKAS at the Mesosystem level. Community-level data such as attendance of students and parental engagement at the Exosystem level. National policies and standards at the Macrosystem level.

The environmentally friendly benefit of EKOPEMBADIG in conventional information systems is not in its capacity to read the ecosystem, but in the ability to assist actors strategically influence the ecosystem. If a school principal sees that at the Microsystem level, student attendance indicators are correlated to falling literacy scores observed at the Mesosystem level, that principal can create a measure targeted at the point where it will actually make a difference, as opposed to reacting with a generic program that does not address the ecological root of the problem. This is precisely the kind of cross-layer diagnostic reasoning which conventional data systems in Tulang Bawang have traditionally been unable to support.

Distributed Leadership

Distributed Leadership, as conceived by Spillane (2006) and Harris (2014), is the notion which successful leadership in educational organisations is not found in a single individual but instead is distributed via collaborative practices that involve multiple actors across the system. Distributed leadership in data-based education indicates that data is not the monopoly of operators or school principals, yet is distributed to provide a shared cognitive foundation for collective decision-making at every stage of the ecosystem.

EKOPEMBADIG facilitates distributed leadership by offering a multi-level design for layered access to all ecosystem actors: teachers receive a dashboard displaying their class and individual student profile; school principals receive a comprehensive school overview along with intervention guidance; administrators receive inter-school comparisons to support indicator-based supervision; and the education office and Regional Development Planning Agency (Bappeda) along receive district-level data aggregates for planning and budget allocation.

Furthermore, this layered architecture does not constitute an error of the design, it is the design. Which the Tulang Bawang data consistently demonstrates is that, regardless of professional competence, when access to data is restricted to one administrative level, the capacity of actors at other levels to arrive at informed choices is structurally disabled. However when data grows a common language across all tiers, it flows not only vertically, through reporting chains, but horizontally, as common ground for coordinated action. This is precisely the condition that distributed leadership theory identifies as necessary for genuine institutional learning to occur.

Evidence-Based Policy and Global Comparison

Davies (1999) and Nutley et al. (2007) indicate that Evidence-Based Policy (EBP) requires three elements being in place at the same time: the presence of valid evidence, sufficient interpreting capacity of users, and an institutional culture that is genuinely receptive to the use of evidence. The current global dashboard models including IADB, ME&A and SMILE more or less prioritise the first element with an acceptable level of sophistication, however pay far less attention to the second and third components, especially in the context of developing regions in which interpretive capacity cannot be taken for granted.

EKOPEMBADIG fills this gap through the principle of complexity hiding, the design logic in which analytical complexity hides behind a user-friendly interface so that users are not required to possess statistics competency to understand school conditions. The familiar red-yellow-green coding speaks directly to the intuition of practitioners without the need for methodological translation. This is a particular manner to operationalise EBP, taking very seriously the argument that interpretive accessibility is not related to data quality but equally necessary for the evidence to actually influence decisions.

METHODS

Research Design and Paradigm

This research uses a qualitative method with a single instrumental case study approach (Creswell & Poth, 2018; Stake, 1995). The critical paradigm was selected not just to define the phenomenon as it is, but to formulate transformative recommendations with direct practical consequences. The instrumental case study approach allows an in-depth exploration of the function of EKOPEMBADIG as a driver for governance improvement in the specific context of Tulang Bawang, but also produces lessons that are applicable to other districts in similar situations.

Location and Source Data

Research informants were purposively sampled in order to ensure representation across all levels of the education ecosystem. The twenty-five informants include the following: Education Office and Bappeda with Regional Financial and Asset Management Agency (BPKAD) officials, principals from SD and SMP schools with six schools selected

with a variance in Rapor Pendidikan performance, classroom teachers and dashboard operators, school supervisors, school committee members together with learning community representatives. The data gathering is done through semi-structured in-depth interviews on April 2, 2026, supported by field observation and document analysis of Rapor Pendidikan, RKAS and Renja Disdik. All data was analysed using NVivo Project Map techniques and were validated by triangulation of sources and member checking.

Data Collection and Data Analysis

The data collection of this research relied on three main techniques, which were: 1) semi-structured in-depth interviews with all informants, 2) field observations in schools with varying literacy performances, and 3) document analysis on Rapor Pendidikan Kabupaten Tulang Bawang 2023 and 2025, the Dinas Pendidikan work strategy, and the RKAS of each school that comprised the sample. These three sources were triangulated in a way that allowed the analysis to move between what actors claim, what conditions on the ground actually show, and what the formal planning records documents, a triangulation that is especially important given the central argument that the problem in Tulang Bawang is not a lack of available data, but instead the failure to translate that data into actual policy decisions.

Data analysis was carried out through the Project Map technique in NVivo, which supports systematic mapping of patterns across informants and data sources and facilitates the detection of not only common themes but also structural relationships between them. Validity was determined through three layers of verification: source triangulation, method triangulation, and member checking. These types of layers guard against the risk of any one informant's account or document distorting the entire picture.

RESULTS AND DISCUSSIONS

Actor Needs: Beyond Descriptive Data Toward Actionable Indicators

A single the most significant results of the in-depth interviews indicates that field actors are cognisant of the importance of data and are not blind to the urgency of enhancing data-based literacy. Which they require is not a lack of awareness around why data matters, it is a lack for a tangible instrument that provides them clear and practical advice. Alternatively, a willingness to change is already present at the cognitive and motivational level, which in the context of DIDM is also known as data readiness, a condition in which actors understand the necessity for transformation however necessity facilitative infrastructure to actually act on it.

The NVivo analysis showed four types of data needs that are organised in a sequence from descriptive to prescriptive, each of which addresses a different question and is targeted at a different actor within the environment:

Table 1. Hierarchy of Data Needs for Stakeholders in the Tulang Bawang Education Ecosystem

Data Type	Core Question Addressed	Primary Users	EKOPEMBADIG Output Examples
Descriptive	What is currently happening?	All ecosystem stakeholders	Literacy scores by school/district, 3-year trends, and regional red-yellow-green distribution maps.
Diagnostic	Why is this happening?	Supervisors, School Principals	Root causes of decline: high absenteeism, gaps in teacher competency, lack of relevant reading materials, and low parental engagement.
Predictive	What will happen if these conditions persist?	Education Agency (Dinas Pendidikan), Bappeda	Projections of schools at risk of dropping into the "red zone" over the next semester, based on current indicator trends.
Prescriptive	What actions should be taken?	School Principals, Supervisors, Education Agency	Tailored intervention plans per school: teacher training, pedagogical coaching, procurement of graded reading books, and community parenting programs.

Source: Derived from field interview results, 2026.

The need for prescriptive data, understood here as specific action recommendations generated from individual school profiles, emerged most strongly from interviews with school principals and supervisors. The principal of SMPN 3 Banjar Agung illustrated how data prescription has already been applied manually in her own practice:

“It is very influential. When the data shows that our numeracy scores are low, we direct the budget toward procuring teaching aids or mathematics teacher training. Data keeps us from budgeting without any real basis.” (Nining, Principal of SMPN 3 Banjar Agung)

In addition this corresponds to precisely what EKOPEMBADIG automates, which Nining does manually, reading the data, locating the weaknesses and allocating the resources accordingly. However that automation matters for more than just efficiency. This implies that any principal, no matter how limited their analytical capacity, can have access to recommendations of the same quality as those produced by the most experienced among them. This is in practice a democratisation of the capacity for data-based decision-making and arguably the clearest institutional manifestation of Amartya Sen’s Capability Approach in the EKOPEMBADIG design logic.

The EKOPEMBADIG Architecture: Four Integrated Data Layers

From an architectural point of view, the EKOPEMBADIG Dashboard is based on a cross-source integrating principle, in which all actors throughout the education ecosystem can see the same map at the same time. This architecture possesses four layers, which

operate cyclically. The result of the decision layer flows back for the validation process that the transformation layer and fails to go linearly from one layer to another.

Table 2. Four-Layer of EKOPEMBADIG Dashboard

No	Layer	Core Function	Input	Output	Technology
1	Data Sources	Collection & integration of cross-source data that was previously fragmented	Rapor Pendidikan, Dapodik, ANBK/TKA, BPS data (socio-demographics), internal school assessments	Integrated & structured datasets	API Integration, Google Sheets, Kemendikdasmen server connection
2	ETL & Validation	Data cleaning, verification, and normalization; automated detection of GIGO (Garbage In, Garbage Out) anomalies	Multi-source, non-standardized raw data	Clean, valid, and consistent data	Automated validation rules, anomaly detection, system alerts
3	Analytics Layer	Meaningful visualization & pattern analysis; turning valid data into insights accessible to all stakeholders	Clean data from the ETL layer	Red-yellow-green mapping, trend graphs, school clustering, risk identification	Google Looker Studio, chart libraries, intuitive color-coding systems
4	Decision & Recommendation Layer	Automated, tailored intervention recommendations per school profile—not generic programs	Weak performance indicators per school from the analytics layer	Tailored program guidelines per school based on a combination of weak indicators	Rule-based engine & basic machine learning; multi-layered recommendation system

Source: Derived from the design and implementation of EKOPEMBADIG (s.id/ekopembadig), 2026.

The fourth layer, decision and recommendation, is the most innovative part as well as the one that most clearly separates EKOPEMBADIG from standard information systems. The idea of personalised recommendations implemented here corresponds to what the

literature calls precision teaching or precision policy, an approach where policy is not designed for the average recipient, but for the specific needs of each individual beneficiary. This is, perhaps, the most direct operationalisation of Becker's Human Capital Theory (1964) which states that precise educational investment targeted at specific areas of weakness will produce significantly more optimal returns than broadly distributed investment that does not reach the actual source of the problem.

From School Profiles to Targeted Interventions: The Recommendation Mechanism

In order to understand better the working of EKOPEMBADIG, we consider an applicative scenario based on real field conditions. A primary school in Kecamatan Dente Teladas, a subdistrict at the far edge of the district where infrastructure access is considerably more limited, displays the following data profile in the dashboard: Literacy Capacity in the red zone at a score of 1.2 on a scale of 3, Numeracy Capacity in the yellow zone at 1.7, Student Character in the green zone, Teacher Competency in the yellow zone, and an average student attendance rate of only 78 percent, falling below the minimum standard of 85 percent.

Based on this multifaceted assessment, EKOPEMBADIG proactively generates a structured and layered set of treatment recommendations: (1) subject teacher training in multidimensional literacy strategies covering scientific, social, and argumentative text literacy, given that yellow-zone teacher competence paired with red-zone literacy assessment ratings corresponds to a challenge at the instructional level; (2) enhancing the reading collection through a graded reading strategy, not simply by adding more books, however from altering the level and kind of reading materials to match actual student capacity so that literacy scaffolds can work successfully; (3) cross-sector intervention focusing on health and attendance by collaborating with the Dinas Kesehatan and local Puskesmas, since low attendance issues metrics usually correlate with nutritional or health problems, which is specific in which EKOPEMBADIG's holistic function extends a beyond the boundaries of the education system itself; and (4) school managerial assistance, which includes a data-based revision of the RKAS, systematic use of Rapor Pendidikan in monthly teacher council meetings, and indicator-based monitoring with supervisor support.

These four recommendations are not produced from general assumptions, but from a direct reading of that school's specific data profile. This is the essence of precision policy, through intervention calibrated to what a particular school's indicators actually show.

Dashboards as Collaboration Mechanisms: Data as a Shared Institutional Language

The deepest advantage of EKOPEMBADIG is its social function, by creating a collaborative space among actors who have historically worked in separate institutional silos. When the Regional Office of Education (Dinas Pendidikan), Bappeda, Regional Office of Communication and Informatics (Kominfo), supervisors and school principals see the

same map at the same time, policy discussions shift away from perception and assumption toward indicators that all actors can verify and interrogate together.

“I want a broader digital innovation, like an integrated dashboard that all leaders can access to monitor literacy progress in real-time. Bappeda acts as a conductor so that literacy programs in the villages connect with the district budget.” (Dicky Serachman, Head of Bappeda)

The conductor metaphor is precisely likely for the role that is needed: a single entity that holds the score, that is, the integrated data, and guarantees that all instruments, the different sectoral offices, are performing in the exact same harmony. The result is EKOPEMBADIG, a living document that can be accessed, updated and read together by all actors in the ecosystem.

This collaborative function additionally involves the democratisation of data at the community level. The school committee chair of SMPN 3 Banjar Agung described the change in the complexities of parental involvement generated by the data openness of the school:

“Yes, the principal is open. We were informed that the children's literacy scores needed to be improved, which is why we supported the additional programs at school.” (Maryadi, Chair of School Committee, SMPN 3 Banjar Agung)

This statement confirms an important principle within Distributed Leadership: when information flows from leadership to all stakeholders including the community, the support generated is far more organic and durable. Data transparency is not simply an administrative obligation, but an effective strategy for social mobilization, and this is precisely something that global dashboard systems were not designed to facilitate.

Actor Capacity in Practice: EKOPEMBADIG from a Human-Centered Design Perspective

The main proposition of a Human-Centered Development perspective that EKOPEMBADIG produces an ontological shift in the way actors understand their own position within the ecosystem, not only a technical change in the way they access data. The table below maps the capability transformation at each actor level in the ecosystem.

Table 3. Transformation of Stakeholder Capabilities through EKOPEMBADIG

Stakeholder	Before EKOPEMBADIG (Capability Deprivation)	After EKOPEMBADIG (Capability Enhancement)	Empirical Evidence
School Principals	Passive administrators: Merely 'inputting data' and 'waiting for directives from the agency.' Lacked a strategic compass for evidence-based decision-making.	Informed leaders: Objectively understand their school's standing, pinpoint specific weaknesses, receive contextualized intervention guides, and advocate for school needs using data.	<i>“If the data shows our numeracy is low, we direct our budget toward procuring learning aids.”</i> —Nining, Principal of SMPN 3 Banjar Agung

Stakeholder	Before EKOPEMBADIG (Capability Deprivation)	After EKOPEMBADIG (Capability Enhancement)	Empirical Evidence
Teachers	Teaching by routine and intuition: Data was seen as the sole monopoly of data operators and principals. Unable to take action without explicit, top-down directives.	Adaptive educators: Adjust strategies based on profiles; understand classroom and student conditions, identify specific gaps to address, and collaborate through data-driven teacher communities (<i>Kombel</i>).	<i>“Teachers can't move if there's no guidance on the school's report card condition... If we aren't informed, we're stuck.”</i> — Usep, Teacher
Supervisors	Routine visits without indicator-based guides: Monitoring was entirely reactive, waiting for school performance reports to drop before identifying which schools needed intervention.	Indicator-driven supervisors: Conduct predictive supervision with early-warning alerts before a school slips into the 'red zone'; prioritize field visits based on actual data.	<i>“I monitor them periodically. Now that it's digital, it's much easier to see school progress without having to visit the site every single day.”</i> — Sri Hartono, Elementary School Supervisor
Education Agency & Bappeda	Routine-heavy, siloed planning: Driven by sector habits and political pressures. Evidence-Based Planning (EBP) was treated as a formal compliance procedure rather than a substantive practice.	Evidence-based planners: Allocate budgets based on the district's actual needs profile, monitor progress in real-time, and run adaptive evaluations based on evolving data.	<i>“Without a focused budget, data just becomes a pile of useless paper.”</i> — Dicky Serachman, Head of Bappeda
School Committees & Parents	Performative participation: Data was never shared, leaving parents with no baseline or clear direction to offer meaningful support.	Informed partners: Understand children's actual literacy levels, comprehend school program priorities, and provide highly targeted parental support.	<i>“The principal is transparent. We are informed if the children's literacy scores need a boost, so we support the supplementary programs.”</i> — Maryadi, School Committee Member

Source: Derived from field interviews and the Capability Approach framework (Sen, 1999), 2026.

The transformation pattern demonstrated by the table above confirms the primary proposition of this journal that EKOPEMBADIG is not just a technology instrument, however a capability empowerment infrastructure that alters the way actors view their position in the ecosystem. Sen’s (1999) formulation of this shift is from a condition in which actor capacity is structurally constrained by the lack of meaningful information (capability

deprivation) to a condition in that capacity is expanded through access to data that is interpretable and actionable (capability enhancement).

The Gap Between Design Assumptions and Field Realities

This research is against to fall into technological optimism. The field provided plenty evidence that the distinction between what a digital system is designed to do and what happens at the level of implementation (although not an idealized model of how data systems are supposed to work) impacted the particular design characteristics of EKOPEMBADIG. Every gap that was identified in the domain became a problem the structure was built to address directly

Table 4. Map of Ideal and Practical EKOPEMBADIG Response

Gap Dimension	Actual Condition (Obstacles)	Empirical Quotes	EKOPEMBADIG Design Response
Network Infrastructure	Internet signals are highly unstable and frequently drop in swampy and waterfront areas. Around 30% of schools experience data synchronization issues.	<i>"In the Banjar Agung area, the signal constantly drops. It is incredibly frustrating when data operators want to upload data."</i> (Nining, Principal)	Offline-first design: the dashboard can be accessed and recommendations can be read without an internet connection. Data syncs automatically once a stable signal is available.
Stakeholder Data Literacy	Teachers do not understand the columns within the Education Report Card (<i>Rapor Pendidikan</i>). Complex dashboards become a major barrier to adoption.	<i>"The Education Report Card has so many columns, and the phrasing is not something all teachers can instantly grasp."</i> (Hariati Oktavera, Teacher)	Complexity hiding: all analytical complexities are hidden behind a simple interface. It only displays takeaways and recommendations rather than raw data.
Generational Resistance	The majority of senior teachers in many Tulang Bawang schools show resistance to adopting digital technology.	<i>"Younger teachers pick up digital tools quickly, but the senior ones, who make up the majority here, are a bit slow."</i> (Monalisa, Teacher)	A highly intuitive interface featuring familiar color coding that requires no specialized technical training. It integrates naturally into teacher community (<i>Kombel</i>) sessions.
Motivational Obstacles	Teachers are not motivated to look up data independently. They require external push and encouragement from	<i>"If teachers have to find data on their own, honestly, not everyone will do it. It needs to be driven by the school"</i>	Integration of EKOPEMBADIG as a natural tech partner within Learning Communities (<i>Kombel</i>). It provides automated summary

Gap Dimension	Actual Condition (Obstacles)	Empirical Quotes	EKOPEMBADIG Design Response
	the leadership ecosystem.	<i>through the Kombel program."</i> (Siswati, Teacher)	reports that can be shared right before discussion sessions.
Broken Policy Cycle	Data stops at the operator or principal level and does not flow down to the teachers who actually execute classroom learning.	<i>"The principal already knows the data but does not communicate it down to us. If we are not informed, we cannot take action."</i> (Usep, Teacher)	Multi-level dashboard: principals are required to share classroom profiles with teachers. It includes automated notifications for indicators that fall below thresholds.

Source: Derived from field findings and the EKOPEMBADIG system design, 2026.

The disparity map demonstrates that EKOPEMBADIG is not a solution for creating an ecosystem entirely from scratch, but a catalyst to enhance and optimize the current ecosystem by carefully addressing the real barriers identified in all research areas in Tulang Bawang. This distinction matters, since a framework built around field-identified obstacles exhibits a fundamentally different logic compared to a system developed based on an idealized model of how data governance ought to look like in a theoretical framework.

EKOPEMBADIG and the Global Dashboard Models: A Comparative Assessment

The following is a systematic comparative analysis to determine the unique position of EKOPEMBADIG in the global education information systems context.

Table 5. Comparison of Global Dashboard Models versus EKOPEMBADIG (Local)

Comparison Aspect	Global Model (IADB, ME&A, SMILE)	EKOPEMBADIG (Tulang Bawang)
Primary Objective	Systemic policy, national or international monitoring, and cross-country benchmarking.	Improving local literacy, data-driven district policy, and empowering the capabilities of field stakeholders.
Data Sources	Complex multi-source data: education, social, GIS, health surveys, and economic data.	<i>Rapor Pendidikan</i> , Dapodik, ANBK/TKA, BPS, and internal school assessments; targeted cross-sector integration.
Primary Users	Central government, international donor agencies, and policy researchers.	Teachers, school principals, supervisors, Education Agency (<i>Dinas Pendidikan</i>), Bappeda; all levels of the district ecosystem.
Policy Approach	Top-down based on global analytics; implementation is driven by central technical expertise.	Participatory bottom-up based on local communities; design is responsive to needs expressed by field stakeholders.

Comparison Aspect	Global Model (IADB, ME&A, SMILE)	EKOPEMBADIG (Tulang Bawang)
Visualization Language	Technical indicators and complex statistics; requires interpretation by expert personnel.	Intuitive red-yellow-green color coding; can be read directly without statistical training.
Accessibility	Requires high technical expertise and a stable digital infrastructure.	User-friendly and offline-first; accessible to all stakeholders without special training, including in connectivity blank spots.
Recommendation Function	Descriptive and diagnostic analysis; policies are recommended at the national or sectoral level.	Tailored prescriptive recommendations per school; specific interventions based on combinations of weak indicators.
Regulatory Foundation	Relies on mandates from international agencies or national regulations.	Supported by Regent Regulation (<i>Peraturan Bupati</i>) recommendations as a binding legal foundation for all local government agencies (<i>OPD</i>) in the ecosystem.

Source: Derived from Gardanegaschi et al. (2025); Arias Ortiz et al. (2025); research findings, 2026.

This gap map confirms that EKOPEMBADIG is not a solution that builds a new ecosystem from scratch, but a catalyst that strengthens and optimizes what already exists by systematically addressing the real barriers identified across all research areas in Tulang Bawang. The distinction matters, because a system designed around field-identified obstacles carries a fundamentally different logic from one built on an idealized model of what data governance ought to look like in theory.

6-Stage Data-Driven Policy Cycle

The central core of all recommendations in the study converges on a single basic structure, an ongoing and adaptive data-driven policy cycle. The EKOPEMBADIG cycle differs from the traditional PDCA model in that it is adapted to the regional education context where constraints on resources are real, assessment cannot be delayed until the conclusion of the fiscal year, and organizational learning, here called policy learning, is an essential part of the cycle, as opposed to an optional addition.

The process was not a preference in theory but an empirical diagnosis of what the Tulang Bawang data continuously shows as a broken policy cycle: data exists, the leadership is aware of it, but teachers as the main recipients never receive information they can actually act upon. Teacher Usep explained the real-world implications of this illness directly:

Table 6. Iterative and Adaptive Data-Driven Policy Cycle

No.	Stage	Core Activities	Key Stakeholders	Output	Role of EKOPEMBADIG
------------	--------------	------------------------	-------------------------	---------------	----------------------------

1	DIAGNOSIS	Reviewing the Education Report Card (<i>Rapor Pendidikan</i>) within learning community (<i>Kombel</i>) forums; mapping specific problem profiles per school by all teachers, rather than just the principal and operator.	School Principals, Teachers, Dashboard Operators	School-specific problem profiles: red-yellow-green school maps with indicator breakdowns.	Multi-indicator profile visualization per school; automated identification of root causes.
2	PRIORITY SETTING	Determining the sequence of interventions based on urgency and vulnerability levels; schools that are deep in the red zone and in the most remote areas are prioritized.	Education Agency (<i>Dinas Pendidikan</i>), Supervisors, Bappeda	Structured and measurable priority list of schools and intervention programs.	Automated ranking system based on urgency levels; cross-school priority scale feature.
3	PRECISION INTERVENTION	Implementing specific programs designed to address identified issues: intensive teacher training, mentoring, textbook procurement, or community parenting programs.	All ecosystem stakeholders: schools, communities, Education Agency, Bappeda	Programs running according to plan based on valid and representative data.	Multi-layered intervention recommendations per school profile; program implementation monitoring.

4	MONITORING	Periodic tracking of indicators using the dashboard (digital monitoring) combined with physical field visits by supervisors for verification.	Supervisors, Operators, Education Agency	Real-time progress reports; early detection of deviations before they turn into critical issues.	Real-time dashboard; automated alerts if indicators cross critical thresholds.
5	POLICY LEARNING	Periodic reflection forums (not just at the end of the year) to formulate what worked and why, what failed and its causes, and what needs adjustment.	Education Agency, School Principals, Supervisors, Teachers, Bappeda	Best practice documentation; evidence-based systemic improvement recommendations from the field.	Comparative analytical reports; impact visualization of implemented programs.
6	ADAPTIVE ADJUSTMENT	Adapting ongoing programs based on the latest evidence without waiting for the annual planning cycle; reallocating budgets if necessary.	Education Agency, School Principals, BPKAD	Updated programs; a new cycle starts with a more accurate and reliable baseline.	Policy option impact simulation; cycle documentation options for institutional memory.

Source: Derived from field findings and the Data-Informed Decision Making (DIDM) framework, 2026.

The fifth stage, Policy Learning, is the stage most consistently skipped in conventional policy cycles, and arguably the most important for driving adaptive innovation. The Komunitas Belajar, or Kombel, already operating routinely across many schools in Tulang Bawang, is precisely the proto-mechanism that can fill this stage, as teachers in practice already gather every two weeks to discuss literacy indicators,

exchange strategies across subjects, and collectively review the Rapor Pendidikan under the principal's direction. EKOPEMBADIG strengthens this existing practice by providing data visualizations that can be used directly within Kombel sessions, so that exchanges are grounded in indicators visible to everyone at the same time rather than in individual teacher perception. In Development Governance Theory terms (Hyden et al., 2004), this movement from compliance-driven toward learning-driven governance is a marker of institutional maturity, where organizations do not merely execute policy, but learn systematically from its execution.

Regulative Foundation: Regent's Regulations As A Hook Ecosystem

This research affirms the principle most frequently overlooked in education innovation: innovation without regulation is a structure without a foundation. The EKOPEMBADIG Dashboard emerged from a genuinely motivated initiative, but without a strong legal framework behind it, its survival depends entirely on the leadership continuity of the individuals who built it, and a change in the head of the education office, a rotation of key officials, or a shift in political priorities can halt the ecosystem without any technical failure occurring at all. Dashboard operator identified the systemic constraints most directly requiring a regulatory solution, describing how internet access remains uneven across Tulang Bawang's wide geography, how power outages disrupt connectivity, and how the absence of an offline version means monitoring remains largely manual. These technical limitations can be resolved through adequate budget allocation, but budget allocation requires legality, and legality requires regulation. Durable change in this kind of ecosystem comes not from goodwill alone, but from regulatory architecture that makes data use a binding institutional obligation rather than a leadership preference.

Development Governance Theory asserts that the quality of governance is not just a function of individual good intentions, but also institutional capacity. A strong institution is one that has clear rules, operational accountability mechanisms, and incentives that systematically encourage positive behaviour throughout the ecosystem. Based on this, this research recommends the issuance of a Regent Regulation on Data-Based Education Ecosystem Integration with seven (7) core provisions:

Table 7. Ideal Regulatory Content for the Regent Regulation on Data-Driven Education Ecosystem Integration in Tulang Bawang District

No.	Regulatory Content	Field-Based Baseline Needs	Responsible Stakeholders	Theoretical Framework
1	Mandatory use of the Education Report Card (<i>Rapor Pendidikan</i>) in every planning cycle,	The Education Report Card is frequently not followed up systemically;	Education Agency, School Principals	Evidence-Based Policy (Davies, 1999); Development Governance

	budget allocation, and program evaluation.	programs are rarely designed based on data diagnostics.		(Hyden et al., 2004)
2	Standards for cross-agency data integration and synchronization across local government bodies including the Education Agency, Bappeda, Kominfo, and the Inspectorate.	Data remains highly siloed by sector and is not synchronized; sectoral egos hinder shared data utilization.	Bappeda, Kominfo, Education Agency	Ecological Systems Theory; Distributed Leadership (Spillane, 2006)
3	Structured feedback mechanisms from the Education Agency to schools, including technical mentoring for schools located in the red zone.	Red-zone schools do not receive systemic mentoring; there is a broken feedback loop between the agency and individual schools.	Education Agency, School Supervisors	Theory of Change (Weiss, 1995); Human-Centered Development (Sen, 1999)
4	Data security governance and access control configurations that ensure sensitive data is protected yet remains accessible to authorized stakeholders.	There is currently no local educational data security standard, which creates a high risk of student data misuse.	Kominfo, Education Agency	Development Governance; DIDM (Schildkamp, 2019)
5	Clear role distribution among local government agencies (OPD) within the data-driven literacy ecosystem to eliminate overlapping authority.	Role mismatches persist between local government agencies; literacy data has not been integrated into cross-sector thematic planning.	Regent (Bupati), Regional Secretary (Sekda), Bappeda	Development Governance; Theory of Change
6	Minimum budget allocation for ongoing teacher literacy	Teacher training remains highly minimal; data	BPKAD, Education Agency	Human Capital Theory (Becker,

	programs and sustainable data interpretation capacity building.	literacy is not yet treated as a priority competency that requires dedicated budgeting.		1964); DIDM; EBP
7	Reward mechanisms for schools that are progressive in adopting data-driven governance and maintaining reporting honesty.	There are no incentives for innovation and data honesty; a punitive culture drives data distortion.	Regent (Bupati), Education Agency	EBP; Theory of Social Change; Distributed Leadership

Source: Derived from field interviews and policy analysis, 2026.

The seventh provision, a reward mechanism for schools that show measurable progress, is actually the one most consistently absent in education regulation design. SMP Supervisor Susi observed a clear diagnosis for why literacy programs tend to stay episodic rather than sustained:

“The program is only warm for a moment, then gone. And cross-sector collaboration is just formality, sitting together but each agency already has its own draft, just waiting to stamp it.” (Susi, Junior High School Supervisor)

The statement recognises two regulatory pathologies that the Peraturan Bupati recommendation directly addresses. First, the inconsistency of the program that does not arise from the lack of goodwill but the absence of a binding legal obligation to sustain it. Second, the participatory formalism where the collaborative forum, such as Musrenbang, is the legitimisation rather than the genuine deliberation. Both gaps are bridged by one Peraturan Bupati that mandates data use throughout the entire policy cycle.

CONCLUSIONS

All the findings and analysis provided the view that EKOPEMBADIG is best understood not as a digital education dashboard but rather as a shared infrastructure for human development that works simultaneously at three levels: technology, governance and human capability. On the technological level, it consolidates data from previously disconnected sources into a single platform accessible by all actors without specialised technical expertise. At the level of governance, it offers a shared language to actors that have traditionally worked in institutional silos enabling a horizontal coordination on facts and not assumptions. At the human capability level, it changes the way actors see their own position in the ecosystem, moving them from passive administrative executors to informed and empowered decision makers.

In Amartya Sen's Capability Approach terms, EKOPEMBADIG functions as an instrument of freedom, releasing actors from the informational constraints that have historically limited what they could do. Principals who previously waited for instructions can now initiate data-based interventions. Teachers who taught from routine can now adjust strategies to actual student profiles. Supervisors who arrived at schools without clear guidance can now conduct structured, indicator-based supervision. This transformation, however, does not occur spontaneously, and requires four enabling conditions working together: the right technological infrastructure, a designed six-stage policy cycle, a binding Peraturan Bupati, and consistent leadership across all ecosystem levels.

Theoretically, this research contributes a glocal model of data-driven governance connecting capability theory, distributed leadership, and ecological systems thinking into a single framework. Practically, it offers Tulang Bawang and comparable districts a replicable architecture for shifting educational governance from reactive to proactive, from sectoral to integrative, and from assumption-based to evidence-based, grounded in what the field actually showed rather than what an ideal system is supposed to look like.

REFERENCES

- Anderson, A. A. (2005). *The Community Builder's Approach to Theory of Change: A Practical Guide to Theory Development*. Aspen Institute Roundtable on Community Change.
- Becker, G. S. (1964). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. University of Chicago Press.
- Bronfenbrenner, U. (1979). *The Ecology of Human Development: Experiments by Nature and Design*. Harvard University Press.
- Chang, M. C., Shaeffer, S., Al-Samarrai, S., Ragatz, A. B., de Ree, J., & Stevenson, R. (2014). *Teacher Reform in Indonesia: The Role of Politics and Evidence in Policy Making*. World Bank.
- Coburn, C. E., & Turner, E. O. (2011). Research on Data Use: A Framework and Analysis. *Measurement: Interdisciplinary Research and Perspectives*, 9(4), 173–206. <https://doi.org/10.1080/15366367.2011.627115>
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* (4th ed.). SAGE Publications.
- Datnow, A., & Hubbard, L. (2015). Teachers' Use of Assessment Data to Inform Instruction: Lessons from the Past and Prospects for the Future. *Teachers College Record*, 117(4), 1–26.
- Davies, P. (1999). What is Evidence-Based Education? *British Journal of Educational Studies*, 47(2), 108–121.
- Harris, A. (2014). *Distributed Leadership Matters: Perspectives, Practicalities, and Potential*. Corwin Press.
- Hyden, G., Court, J., & Mease, K. (2004). *Making Sense of Governance: Empirical Evidence from Sixteen Developing Countries*. Lynne Rienner Publishers.
- Lingard, B., Martino, W., & Rezai-Rashti, G. (2013). Testing Regimes, Accountabilities and Education Policy: Commensurate Global and National Developments. *Journal of Education Policy*, 28(5), 539–556. <https://doi.org/10.1080/02680939.2013.820042>

- Mandinach, E. B., & Gummer, E. S. (2016). What Does It Mean for Teachers to Be Data Literate: Laying Out the Skills, Knowledge, and Dispositions. *Teaching and Teacher Education*, 60, 366–376. <https://doi.org/10.1016/j.tate.2016.07.011>
- Ministry of Education, Culture, Research, and Technology. (2023). *Capaian Literasi dan Numerasi Siswa SD dan SMP Kabupaten Tulang Bawang*. Ministry of Education, Culture, Research, and Technology.
- Nutley, S. M., Walter, I., & Davies, H. T. O. (2007). *Using Evidence: How Research Can Inform Public Services*. Policy Press.
- OECD. (2013). *Synergies for Better Learning: An International Perspective on Evaluation and Assessment*. OECD Publishing. <https://doi.org/10.1787/9789264190658-en>
- Ozga, J. (2009). Governing Education through Data in England: From Regulation to Self-Evaluation. *Journal of Education Policy*, 24(2), 149–162. <https://doi.org/10.1080/02680930902733data>
- Pressman, J. L., & Wildavsky, A. (1984). *Implementation* (3rd ed.). University of California Press.
- Sen, A. (1999). *Development as Freedom*. Oxford University Press.
- Spillane, J. P. (2006). *Distributed Leadership*. Jossey-Bass.
- Stake, R. E. (1995). *The Art of Case Study Research*. SAGE Publications.
- UNESCO. (2016). *Education for People and Planet: Creating Sustainable Futures for All*. UNESCO.
- Wayman, J. C., & Stringfield, S. (2006). Technology-Supported Involvement of Entire Faculties in Examination of Student Data for Instructional Improvement. *American Journal of Education*, 112(4), 549–571. <https://doi.org/10.1086/505057>
- Weiss, C. H. (1995). Nothing as Practical as Good Theory: Exploring Theory-Based Evaluation for Comprehensive Community Initiatives for Children and Families. In J. Connell, A. Kubisch, L. Schorr, & C. Weiss (Eds.), *New Approaches to Evaluating Community Initiatives* (pp. 65–92). Aspen Institute.
- Williamson, B. (2016). Digital Education Governance: Data Visualization, Predictive Analytics, and ‘Real-Time’ Policy Instruments. *Journal of Education Policy*, 31(2), 123–141. <https://doi.org/10.1080/02680939.2015.1035758>
- World Bank. (2018). *World Development Report 2018: Learning to Realize Education’s Promise*. World Bank. <https://doi.org/10.1596/978-1-4648-1096-1>