MFEP-Based Evaluation of Public Information Governance with Socio-Technical and Data Lifecycle Perspectives

Retnowati Retnowati [a,1,*], Eko Nur Wahyudi [a,2], Purwatiningtyas [a,3]

[a] Universitas Stikubank, Jalan Tri Lomba Juang No. 1 Mugas 50249, Semarang, Indonesia
[1] retnowati@edu.unisbank.ac.id*; [2] eko@edu.unisbank.ac.id; [3] purwati@edu.unisbank.ac.id

* corresponding author

ARTICLE INFO

Keywords
Multi-Factor Evaluation Process (MFEP)
Data Lifecycle Management (DLM)
Socio-Technical Systems (STS)
Public Information Governance
Information Systems Management

ABSTRACT

In the era of public information disclosure, effective public information management is crucial for promoting transparency, accountability, and citizen participation. This study assesses eight Public Information Management Officers (PPID) in Central Java, Indonesia, utilizing 21 variables measured by a Multi-Factor Evaluation Process (MFEP) based on Data Lifecycle Management (DLM) and Socio-Technical Systems (STS). Data was collected using Likert-scale questionnaires, and performance was assessed using Evaluation Weight Value (EWV) and Total Evaluation Weight (TEW). The results suggest that technology-related indicators outperformed human competency and regulatory compliance. "Use" and "Disposal" were the DLM phases with the worst performance, demonstrating deficiencies in data accountability and infrastructure. In STS, the "People" dimension lagged, emphasizing the need for capacity building. The findings indicate that, while digital infrastructure is robust, governance and human resource development require strengthening. Strategic improvements in underperforming sectors are suggested to strengthen public information governance.

1. Introduction

In the digital era, public information governance has become a critical element in ensuring transparency, accountability, and public trust in government institutions [1], [2]. The management of public information is not merely about data disclosure. It involves a comprehensive process that includes the creation, storage, processing, dissemination, and disposal of information [3], [4], collectively referred to as the information lifecycle. Failure to govern this lifecycle effectively may result in data silos, inconsistent public communication, and missed opportunities for civic engagement.

The current approaches for evaluating public information practices include qualitative audits, normative compliance checks, and transparency index scores [5]. Data lifecycle methodologies, such as DaLiF [6], provide a comprehensive and systematic framework for evaluating each stage of the government data cycle. However, the tools have not yet been used in the context of public information governance. The management of public information by Information and Document Management Officials (PPID) in Indonesian government entities must be reviewed from both a social and technological standpoint [7], [8].

Previous socio-technical approaches indicated that evaluations based on legal or technical aspects fail to address implementation challenges related to the interconnections of technology, organizations, and people. [9]. Thus, information lifecycle methodologies, such as the DAMA-DMBOK lifecycle [4], [10], [11], provide a comprehensive and systematic framework for evaluating each phase of the government data cycle. However, they have not yet been used in the context of public information governance. The management of public information by Information and Document Management Officials (PPID) in Indonesian government entities must be reviewed from both a social and technological standpoint.

Previous techniques have strengths in their simplicity and standardized application, which allowed for broad-scale benchmarking. Their drawbacks include a narrow focus on legal compliance, a lack of diagnostic insight into lifecycle processes, and little consideration for the socio-technical context in which information governance occurs.

The current issue is that governments lack a formal evaluation methodology that not only examines performance across all lifecycle phases but also helps prioritize which areas need development. Furthermore, governance problems are frequently caused by imbalances between technological capabilities and human or organizational readiness.

To fill this gap, this study proposes a solution by integrating three perspectives into a unified evaluation model: (1) use the Multi-Factor Evaluation Process (MFEP) to quantify and rate governance effectiveness across multiple categories [12]–[15]; (2) the Data Lifecycle Management (DLM) framework [3], [4], [10], [11] to structure governance indicators according to the stages of information flow; and (3) the Socio-Technical Systems (STS) theory to account for the interdependencies between human, organizational, and technological factors in public information management [16]–[20].

MFEP was chosen because of its ability to quantitatively integrate multiple governance indicators, prioritize lifecycle stages, and account for both technical and social factors, making it suitable for studying public information governance in conjunction with STS and DLM perspectives.

The objective of this study is to evaluate public information governance, with a particular focus on how government institutions manage the lifecycle of information classified under public access laws, including periodic, timely, immediate, and exempt categories. A deeper understanding of which phases in this lifecycle are well-managed and which are underperforming is essential for improving transparency and institutional performance.

2. Method

2.1. Research Design

This study takes a quantitative descriptive-evaluative method to analyze public information governance performance at various lifecycle stages. The study ranks governance indicators using principles from Data Lifecycle Management (DLM) and Socio-Technical Systems (STS) as well as the Multi-Factor Evaluation Process (MFEP).

The goal is not only to assess the existing situation, but also to identify areas for improvement based on numerous weighted criteria.

2.2. Object and Units of Analysis

The focus of this research is public information governance as practiced by Public Information and Documentation Officers (PPID) in government organizations. The unit of analysis comprises governance indicators derived from the Digital Lifecycle Management (DLM) phases, namely creation, storage, use, sharing, and disposal, as well as components of Socio-Technical Systems (STS).

2.3. Sample and Respondents

The population of this study encompasses all public documents regulated by government agencies under the supervision of their respective Information and Documentation Management Officers (PPID) in Central Java, Indonesia. These publications contain several categories of public

information as defined by the Public Information Disclosure Statute (UU KIP), including periodic, timely, immediate, and exempt information.

Purposive sampling was used, with a focus on eight (8) public institutions in Central Java Province. These institutions were chosen based on their classification into three tiers of transparency: informative, somewhat Informative, and less informative.

2.4. Evaluation Framework for DLM and STS

The assessment criteria were operationalized according to two primary dimensions:

1. Data Lifecycle Management (DLM) includes five critical stages: creation, storage, use, sharing, and disposal.
2. Socio-Technical Systems (STS): the interaction of human actors, technology, processes, and organizational structure.
3. Multiple-Factor Evaluation Process (MFEP)

   The Multi-Factor Evaluation Process (MFEP) approach was employed to systematically assess and rank the indicators using the following structured procedure:

   (1) Determination of Indicators, Criteria, and Weighting Factors
   The foundational step involves defining indicators, criteria, and their respective weighting factors, which serve as the basis for calculations in the Multi-Factor Evaluation Process (MFEP)

   (2) Calculation of Evaluation Weight Value (EWV)
   The Evaluation Weight Value (EWV) is computed as follows:

   $$EWV = WF * EF \quad \text{.....(1)}$$

   Where:
   EWV = evaluation weight value
   WF = weighting factor
   EF = evaluation factor

   (3) Calculation of Total Evaluation Weight (TEW)
   The Total Evaluation Weight (TEW) is derived using the following formula:

   $$TEW = EWV_1 + EWV_2 + EWV_3 + ... + EWV_n \quad \text{.....(2)}$$

   Where:
   TEW = total evaluation weight
   WF = evaluation weight value

   (4) Ranking Process for Decision-Making

Indicators are applied to this dual framework to ensure a comprehensive study that includes both process and socio-technical factors, as shown in Table 1.

Table 1. Mapping of Governance Indicators to DLM and STS

Code	Indicator	DLM Phase	STS Dimension
I01	Information creation procedure	Creation	Process
I02	Staff competency in handling public data	Creation	People
I03	System support for information input	Creation	Technology
I04	Document classification policy	Storage	Structure
I05	Data security protocols	Storage	Process
I06	Data backup system	Storage	Technology
I07	Access control management	Use	Technology
I08	Employee awareness on data use	Use	People
I09	SOP for internal data use	Use	Process
I10	Transparency regulation adherence	Sharing	Structure
I11	Quality of published information	Sharing	Process
I12	ICT tools for public dissemination	Sharing	Technology
I13	Feedback mechanism from public	Sharing	People

I14	Public training/socialization activities	Sharing	People
I15	Archiving policy	Disposal	Structure
I16	Technical support for data disposal	Disposal	Technology
I17	Compliance with retention schedules	Disposal	Process
I18	Data deletion accountability	Disposal	Structure
I19	Management review on data lifecycle	Use	Structure
I20	Integration with other systems	Sharing	Technology
I21	Periodic evaluation of governance performance	All Phases	Structure

3. Results and Discussion

3.1. Overview of the Evaluation Framework

To assess public information governance performance, a comprehensive set of 21 indicators was created by combining two complementary frameworks: DLM and STS. The DLM architecture divides governance activities into five phases: (1) data production, (2) storage, (3) usage, (4) sharing, and (5) disposal. Concurrently, the STS framework examines four essential characteristics that influence institutional effectiveness: (1) human factors (people), (2) procedural elements (process), (3) technological infrastructure (technology), and (4) organizational structures (structure).

Each indicator was designed to align with both a specific Data Lifecycle Management (DLM) phase and a Socio-Technical Systems (STS) dimension, ensuring comprehensive coverage of governance processes and their contextual determinants. As shown in Figure 1, the resulting matrix reveals a balanced distribution of indicators across these interconnected categories. Figure 1 depicts the distribution of 21 public information governance indicators within the integrated framework of Data Lifecycle Management (DLM) phases and Socio-Technical System (STS) aspects. The matrix displays prominent indicator concentrations in the Sharing phase, particularly across the People and Structure dimensions, whereas significant gaps appear in the Disposal and All Phases categories.

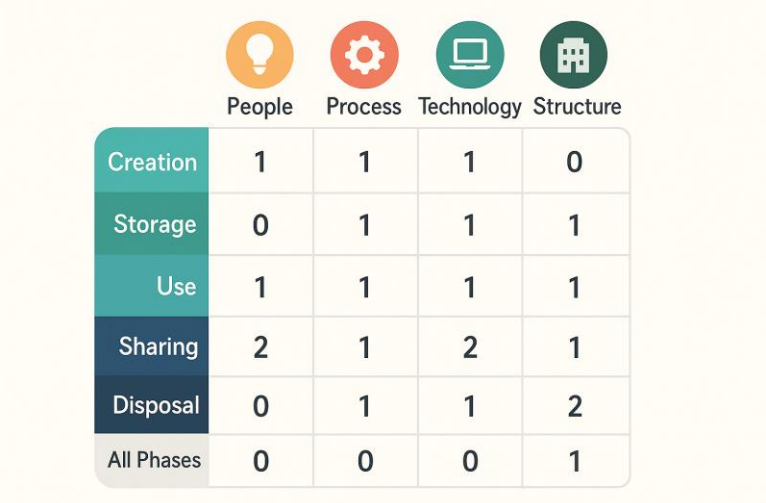

Figure 1. Mapping of Indicators to DLM–STS Matrix

3.2. MFEP-Based Evaluation of Public Information Governance Indicators

This section presents the systematic application of the MFEP to assess public information governance performance. The MFEP methodology integrates both qualitative importance weighting and

quantitative performance measurement across all 21 indicators, enabling comprehensive evaluation through its structured computational approach.

Table 2 summarizes the examination of 21 public information governance indicators across eight Public Information Disclosure Officers. Each indication (coded I01-I21) was scored on a number scale (probably Likert-type, e.g., 1-5), with the last column (Avg NEF) reflecting the Naturalization Evaluation Factor (NEF), which was determined as the arithmetic mean of scores over all PPIDs.

Tabel 2. The Result of the WEF

Code	Indicator Name	PPID-1	PPID-2	PPID-3	PPID-4	PPID-5	PPID-6	PPID-7	PPID-8	Avg NEF
I01	Information creation procedure	4	2	3	2	4	3	3	4	3.13
I02	Staff competency in handling public data	5	3	5	4	4	3	2	2	3.50
I03	System support for information input	2	5	5	3	3	5	5	5	4.13
I04	Document classification policy	4	5	5	5	2	3	5	4	4.13
I05	Data security protocols	4	3	5	2	5	4	5	4	4.00
I06	Data backup system	3	5	3	4	5	2	3	5	3.75
I07	Access control management	5	5	3	4	3	4	5	2	3.88
I08	Employee awareness on data use	4	2	2	4	4	2	2	3	2.88
I09	SOP for internal data use	5	4	4	2	2	2	5	4	3.50
I10	Transparency regulation adherence	2	5	2	3	3	2	3	2	2.75
I11	Quality of published information	2	3	4	4	4	5	4	5	3.88
I12	ICT tools for public dissemination	4	4	3	4	2	3	4	2	3.25
I13	Feedback mechanism from public	3	2	5	3	4	5	5	3	3.75
I14	Public training/socialization activities	4	3	5	4	2	2	5	5	3.75
I15	Archiving policy	2	2	4	4	4	2	3	2	2.88
I16	Technical support for data disposal	3	3	5	4	5	2	3	2	3.38
I17	Compliance with retention schedules	3	4	2	4	5	3	3	3	3.38
I18	Data deletion accountability	2	5	2	5	3	3	4	3	3.38
I19	Management review on data lifecycle	5	2	3	2	3	3	3	5	3.25
I20	Integration with other systems	3	5	5	4	2	3	4	5	3.88

I21	Periodic evaluation of governance performance	3	5	3	5	2	4	4	2	3.50

The following table (Table 3) displays the weighted ranking of governance indicators using the MFEP methodology, combining importance weights (WF) and implementation scores (EF) to generate prioritized Evaluation Weight Values (EWV). Indicators are ordered by their composite EWV, revealing critical strengths and weaknesses in current governance practices. The evaluation identified several critical trends in governance readiness across the Public Information Disclosure units. Among all the criteria evaluated, three indicators clearly rose to the top, exhibiting notably strong operational adoption. System Support for Information Input (I03) and Document Classification Policy (I04) both received Evaluation Weight Values of 0.197, with Data Security Protocols (I05) following closely with an EWV of 0.190. These findings show that the technological infrastructure and procedural frameworks are well-established throughout the tested units.

Table 3. The EWV of Public Information Governance Indicators

Code	WF	Avg NEF	EWV
I01	0,047619048	3,13	0,149047619
I02	0,047619048	3,5	0,166666667
I03	0,047619048	4,13	0,196666667
I04	0,047619048	4,13	0,196666667
I05	0,047619048	4	0,190476190
I06	0,047619048	3,75	0,178571429
I07	0,047619048	3,88	0,184761905
I08	0,047619048	2,88	0,137142857
I09	0,047619048	3,5	0,166666667
I10	0,047619048	2,75	0,130952381
I11	0,047619048	3,88	0,184761905
I12	0,047619048	3,25	0,154761905
I13	0,047619048	3,75	0,178571429
I14	0,047619048	3,75	0,178571429
I15	0,047619048	2,88	0,137142857
I16	0,047619048	3,38	0,160952381
I17	0,047619048	3,38	0,160952381
I18	0,047619048	3,38	0,160952381
I19	0,047619048	3,25	0,154761905
I20	0,047619048	3,88	0,184761905
I21	0,047619048	3,5	0,166666667
TOTAL	1,00		3,52

However, the research highlighted some areas that needed to be improved. Transparency Regulation Adherence (I10) had the lowest EWV of 0.131, followed by Employee Awareness on Data Use (I08) and Archiving Policy (I15), both with 0.137. These lower scores indicate significant room for improvement in regulatory compliance, personnel training, and records management standards.

The Total Evaluation Weight across all categories was 3.52, indicating a complete assessment of overall governance readiness. Because all indicators received equal weighting in this assessment, the results provide an unbiased representation of current performance levels based purely on evaluation scores.

These discoveries have significant strategic consequences. The good performance in technical and procedural areas reflects the successful implementation of systems and policies, which should be preserved and leveraged. However, worse performance in human-centric and regulatory measures suggests that changes are required. To achieve compliance, organizations should focus training programs to raise employee understanding, reinforce the enforcement of transparency requirements, and improve archiving practices.

The findings provide a clear picture of governance strengths and weaknesses. While technical systems have advanced, equal attention must be paid to human elements and regulatory compliance to achieve balanced advancement. Moving forward, decision-makers should build on current technical strengths while addressing behavioral and policy shortcomings with targeted initiatives.

This dual strategy will improve overall governance performance while preserving present advantages in system infrastructure and procedural frameworks. Periodic reviews and additional analysis at the regional level could further refine these strategic priorities.

3.3. Interpretation Based on the DML-STS Framework

The examination reveals significant differences in performance throughout the various stages of the Data Management Lifecycle. During the Creation Phase, which includes indicators I01 through I03, the study yields notably strong results in system support for information input (I03), indicating a well-developed technical infrastructure for data generation. However, this technology strength is not entirely matched by human capabilities, as staff competency in dealing with public data (I02) exhibits only modest performance, emphasizing the need for additional workforce development activities.

Moving on to the Storage Phase (I04-I07), the examination demonstrates consistently excellent performance levels, with notably strong results in document classification policies (I04) and access control management (I07). These findings indicate that policies and infrastructure for safe data storage are effectively implemented throughout the firm. The strong performance in this phase serves as a solid foundation for overall data management.

The Use Phase (I08-I11) provides a more varied picture of organizational success. While the quality of public information (I11) remains excellent, substantial obstacles arise in terms of transparency, regulatory adherence (I10), and staff understanding of correct data use (I08). This disparity between output quality and procedural compliance highlights a significant implementation gap that requires addressing.

In the Sharing Phase (I12-I14), the assessment discovers that, while ICT instruments for public distribution (I12) perform adequately, procedures for public input (I13) and community engagement (I14) require development. These findings indicate that, while the technical capacity for information exchange exists, additional work is required to promote meaningful public contact and participation.

The Disposal Phase (I15-I18) is identified as the most vulnerable link in the data management chain, with specific weaknesses in archiving rules (I15) and technological support for data disposal (I16). These findings underscore the crucial need for improved rules and accountability measures in data retention and erasure operations.

Finally, the cross-cutting phases (I19-I21) show modest effectiveness in system integration (I20), but inconsistent results in periodic governance reviews (I21). This pattern emphasizes the significance of developing more frequent and systematic review methods to ensure the continued efficacy of data management practices throughout the lifetime.

The STS paradigm provides valuable insights into organizational performance across four major areas. The people dimension, which includes staff competency (I02) and public participation (I13), is the most vulnerable, revealing serious flaws that demand quick attention. These human-centric challenges underscore the pressing need for comprehensive training programs and awareness campaigns to enhance both staff capabilities and community engagement.

When studying the process dimension, a clear contradiction emerges. While document classification policies (I04) demonstrate strong execution, significant gaps exist in transparency compliance (I10) and disposal procedures (I15). This disparity shows that while some operational norms are well-

established, others have weak enforcement or design defects, needing both process standardization and more stringent compliance methods.

The Technology dimension shines out as the organization's most valuable dimension, with good performance in data input systems (I03), backup solutions (I06), and access control methods. This technological expertise provides an opportunity to compensate for inadequacies in other areas, through automation tools that can support less robust dimensions.

Structural components provide a varied image of governance performance. While security frameworks (I05) are well implemented, substantial gaps occur in disposal accountability (I18) and evaluation processes (I21).

This STS perspective emphasizes the significance of correcting the mismatch between technological strengths and human/organizational deficiencies. The organization's superior technical infrastructure serves as a solid basis, but its full potential is limited by people-related difficulties and structural inadequacies. A holistic approach that concurrently develops human capital, strengthens processes, and optimizes organizational structures will be required to achieve comprehensive data governance excellence. The findings emphasize the importance of balancing technological investments with workforce development and governance structures in order to build a truly effective socio-technical ecosystem.

4. Conclusion

This study evaluated the performance of 21 public information governance indicators across eight government offices in Central Java using the Multi-Factor Evaluation Process (MFEP). The results were analyzed using the Data Lifecycle Management (DLM) framework and Socio-Technical System (STS) dimensions to identify strengths and weaknesses. The evaluation revealed moderate overall performance, with a Total Evaluation Weight of 3.52. Strong areas included system support for data input and document classification policies, reflecting effective technological and procedural foundations. However, weaknesses emerged in transparency compliance and archiving policies, suggesting gaps in regulatory adherence that require attention. Data creation and storage phases demonstrated solid management, supported by clear policies and functional systems. However, challenges were evident in the usage and disposal phases, particularly regarding staff awareness and technical support for secure data deletion, indicating vulnerabilities in these critical stages. The technology dimension performed well, with efficient systems for data handling, access, and dissemination. In contrast, the people dimension was the weakest, hampered by limited staff competencies and low public participation. Meanwhile, processes and structures showed inconsistency, pointing to the need for stronger compliance mechanisms and more systematic evaluation practices.

Recommendations for Improvement

To improve public information governance, emphasize the following strategic actions: First, human and organizational capacities must be strengthened through thorough training programs and awareness campaigns. These initiatives should focus on data governance principles and regulatory compliance standards to improve staff competencies at all levels. Second, control of the data consumption and disposal stages demands immediate attention. This includes creating strong technical support systems, establishing responsibility frameworks, and guaranteeing strict adherence to defined data handling protocols at these important periods. Finally, implementing regular review mechanisms and increasing public participation will result in more sustainable governance. Regular performance reviews, combined with improved public feedback mechanisms, particularly via digital platforms, can promote increased transparency and stakeholder participation in information management processes.

Acknowledgment

The Directorate of Research, Community Service, and Publications (DPPMP) of Universitas Stikubank provided facilities and financing for this research, which was completed successfully. We gratefully appreciate the exceptional teamwork that permitted the publication of this study product as a scientific article.

Declarations

Author contribution. [RR, ENW, P] conceived and designed the study; [RR, ENW, O] performed the research and analyzed the data; [RR] wrote the paper with input from all authors. All authors reviewed and approved the final manuscript.

Funding statement. This research was funded by the Directorate of Research, Community Service, and Publications (DPPMP), Universitas Stikubank
Conflict of interest. The authors declare no conflict of interest.
Additional information. No additional information is available for this paper.

Data and Software Availability Statements

"No datasets or software were generated or analyzed during this study."

References

[1] R. Retnowati, D. Manongga, and H. Sunarto, "Development of sustainability systems for open government data (OGD) management by combining the shel model and soft systems methodology analysis," *J. Theor. Appl. Inf. Technol.*, vol. 97, no. 12, 2019.

[2] H. Jiang, Q. Shao, J. J. H. Liou, T. Shao, and X. Shi, "Improving the sustainability of open government data," *Sustain.*, vol. 11, no. 8, pp. 1–26, 2019, doi: 10.3390/su11082388.

[3] Prasetyo A, Darmawan M, and Moelyana R, "Analisis dan Perancangan Tata Kelola Data Sistem Pemerintahan Berbasis Elektronik Domain Data Quality Management pada Dama DMBOK V2 (Studi Kasus : Diskominfotik KBB) Analysis and Design of Data Governance System Based on Electronic Domain Quality Data Man," *E-Proceeding Eng.*, vol. 6, no. 2, pp. 7775–7786, 2019.

[4] Felix C Aguboshim, Ifeyinwa N Obiokafor, and Anastasia O Emenike, "Sustainable data governance in the era of global data security challenges in Nigeria: A narrative review," *World J. Adv. Res. Rev.*, vol. 17, no. 2, pp. 378–385, 2023, doi: 10.30574/wjarr.2023.17.2.0154.

[5] R. Gracilla, F. Vigonte, and M. V. Abante, "Evaluating Public Information Systems: Enhancing Transparency, Efficiency, and Citizen Engagement in Digital Governance," *SSRN Electron. J.*, 2025, doi: 10.2139/ssrn.5268520.

[6] S. I. H. Shah, V. Peristeras, and I. Magnisalis, *DaLiF: a data lifecycle framework for data-driven governments*, vol. 8, no. 1. Springer International Publishing, 2021.

[7] R. Retnowati *et al.*, "Pengaruh Pemanfaatan Situs PPIP," in *SINTAK*, 2019, pp. 289–297.

[8] R. Retnowati, H. Listiyono, P. Purwatiningtyas, A. S. Wedaningsih, and L. Rahmaziana, "Analisis Readiness Penerapan Keterbukaan Informasi Publik (Kip) Dengan Pendekatan Soft Systems Methodology (Ssm)," *Dinamik*, vol. 24, no. 1, pp. 41–56, 2019, doi: 10.35315/dinamik.v24i1.7838.

[9] N. Rees, K. Holding, and M. Sujan, "Information governance as a socio-technical process in the development of trustworthy healthcare AI," *Front. Comput. Sci.*, vol. 5, 2023, doi: 10.3389/fcomp.2023.1134818.

[10] A. Yulfitri and Y. F. Achmad, "Analisis Aktivitas Data Governance Pranata Komputer Berdasarkan DAMA-DMBOK 2," *J. Rekayasa Sist. Ind.*, vol. 7, no. 1, p. 50, 2020, [Online]. Available: https://jrsi.sie.telkomuniversity.ac.id/JRSI/article/view/393.

[11] DAMA International, *DAMA-DMBOK: Data Management Body of Knowledge (2nd Edition)*, vol. 44, no. 8. 2017.

[12] W. A. Ramadhani, N. Irawati, and C. Maulana, "Penerapan Metode Multifactor Evaluation Process (MFEP) Untuk Menentukan Kelayakan Penerima Bantuan Pinjaman Modal Usaha Kecil Menengah," *Build. Informatics, Technol. Sci.*, vol. 4, no. 1, pp. 50–59, 2022, doi: 10.47065/bits.v4i1.1490.

[13] R. Retnowati, H. R. Putranti, and D. Danang, "Level Of Work Engagement Of Workers Based On Gamification Of Work Using Multi-Factor Evaluation Process (Mfep) Method," *J. Posit. Sch. Psychol.*, vol. 6, no. 8, pp. 6070–6084, 2022, [Online]. Available:

https://journalppw.com/index.php/jpsp/article/view/10886/7028.

[14] L. Tarifu, M. A. Equatora, Romindo, D. Abdullah, Herianto, and Y. M. Saragih, "Decision Support System Simulation Application with MFEP Method," *J. Phys. Conf. Ser.*, vol. 1845, no. 1, 2021, doi: 10.1088/1742-6596/1845/1/012027.

[15] R. Retnowati, E. N. Wahyudi, and Y. Anis, "Mengukur E-Participation Masyarakat di Era Transformasi Digital dengan Metode Multi Factor Evaluation Process (MFEP)," vol. 8, no. 2, 2022.

[16] Retnowati, S. N. Anwar, and Purwatiningtyas, "Public Information Management Sustainability Priority Model With A Socio-Technical Approach and Analytic Network Process (ANP) Methods (Case Study of Salatiga City PPID)," *Budapest Int. Res. Critics Institute-Journal*, vol. 4, no. 4, pp. 14011–14026, 2021, [Online]. Available: https://www.bircu-journal.com/index.php/birci/article/view/3505.

[17] F. W. Geels, "ScienceDirect Socio-technical transitions to sustainability : a review of criticisms and elaborations of the Multi-Level Perspective," *Curr. Opin. Environ. Sustain.*, 2019, doi: 10.1016/j.cosust.2019.06.009.

[18] J. H. Kim and S. J. Eom, "The managerial dimension of open data success: Focusing on the open data initiatives in Korean local governments," *Sustain.*, vol. 11, no. 23, 2019, doi: 10.3390/su11236758.

[19] M. Gebler, M. Juraschek, S. Thiede, F. Cerdas, and C. Herrmann, "Defining the 'Positive Impact' of socio-technical systems for absolute sustainability: a literature review based on the identification of system design principles and management functions," *Sustain. Sci.*, vol. 17, no. 6, pp. 2597–2613, 2022, doi: 10.1007/s11625-022-01168-1.

[20] J. Heiberg, B. Truffer, and C. Binz, "Assessing transitions through socio-technical configuration analysis – a methodological framework and a case study in the water sector," *Res. Policy*, vol. 51, no. 1, 2022, doi: 10.1016/j.respol.2021.104363.