

## **Optimizing School Management Information Systems for Data-Driven Decision Making: The Strategic Role of School Operators**

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### **Abstract**

Ineffectiveness in handling educational information results in decision-making failures at schools, for instance, erroneous planning and improper allocation of resources. In this regard, the importance of school administration in the context of Management Information System (MIS) is emphasized as an issue that has not yet been considered in its systematic form. Thus, the purpose of this paper is to examine and suggest approaches to improve the role of school administration in MIS implementation in order to facilitate decision-making based on collected data. The study used a literature review. The sources included articles from authoritative national and international journals, conference papers and academic books. The data were analyzed using thematic analysis. The results indicate that there are seven strategically integrated roles of school operators, including data quality guardian, efficiency driver, data mediator, ICT integration agent, system sustainability manager, bridge between technology, data, and management, and holistic competency implementer. These seven roles were then synthesized into a conceptual model of four competency dimensions (technical, analytical, managerial, and data communication) as a foundation for strengthening the Educational Information System (SIM). Thus, the effectiveness of data-driven decision-making heavily depends on the capacity of school operators and the shift in their roles from technical-operational to strategic-managerial. This study contributes to strengthening the educational information management framework to support the achievement of Sustainable Development Goal (SDG) 4 quality education through effective data-driven school governance.

Keywords: Management Information System (MIS), School Administrators, Data-Driven Decision-Making, School Administrator Competencies, Digital Transformation in Education

### **INTRODUCTION**

Errors in record-keeping and delays in information processing remain the most common challenges in managing Management Information Systems (MIS) in schools (Sa'diyah et al., 2025; Ilmi An-Nabhani et al., 2026; Wandik & Murniati, 2026). This situation directly impacts the quality of decision-making by school principals, leading to inaccurate strategic planning, inefficient resource allocation, and reduced institutional accountability (Sahriah & Arismunandar, 2025; Adisa, 2026). This is why school administrators are both the most affected and the most critical stakeholders (Agustina et al., 2026; Winarsih et al., 2026). The underutilization of MIS prevents school administrators from fully fulfilling their strategic role in supporting a data-driven management ecosystem (Gatama et al., 2023). There is a need to look into this problem because schools are now expected to process information in an accurate, timely, and holistic way, especially through national MIS such as Basic Education Data (Dapodik), School Activity and Budget Plan Application (ARKAS), and the Education Management Information System (EMIS), making school

operators the primary intermediary between schools and the government (Nurdiansyah et al., 2026).

Some of the previous research papers related to MIS implementation in educational environments have focused on different areas of this process. For example, Du (2023) studied the design of the web-based student management information system and found out that data automation could increase the accuracy of information processing and decrease the workload of schools. Fan (2025) designed the university educational administration information system with the help of the deep learning approach and showed how this system could perform predictive analytics and make personalized recommendations for decision makers. Furthermore, Zhang (2023) built the university personnel management system based on browser/server (B/S) architecture and confirmed that a relational database-based system could ensure scalability of institutional data management. In terms of management issues, Hidayat & Wahab (2019) concluded that real-time availability of data enhances the effectiveness of managerial planning. At the same time, Manduku et al. (2012) identified lack of technical skills and infrastructure as the main obstacles of MIS implementation in secondary schools.

Overall, the results obtained by the researchers show that MIS effectiveness depends on not only technical possibilities of a certain institution but also on the capabilities of people who manage the system. Nevertheless, much of the existing research has focused on the technical development of information systems or their implementation in higher education. Consequently, the strategic role of school administrators in managing MIS at the elementary and secondary education levels has not been extensively synthesized conceptually. More specifically, existing studies have not primarily positioned the human resource dimension, particularly the role of school administrators, as a central component of successful data-driven MIS implementation at these educational levels.

To address this gap, the present study positions school administrators as strategic actors and synthesizes empirical evidence concerning the relationships among their capacity, the quality of MIS data, and the quality of institutional decision-making. This synthesis is subsequently used to formulate a conceptual framework for optimizing MIS implementation in schools. Accordingly, this study addresses the following research questions: How can the strategic role of school administrators in MIS implementation be optimized to support data-driven decision-making in schools? What competencies should be incorporated into the proposed optimization framework?

**DISCUSSION**

**The Seven Strategic Roles of School Administrators**

The following is a literature synthesis that identifies seven strategic roles of school operators within the Management Information System (MIS) ecosystem. These seven roles are not independent of one another but are interrelated; the absence of one role or a failure to fulfill it tends to undermine the effectiveness of the other roles.

Table 1. Summary of the Seven Strategic Roles of School Operators

| No. | Role                                            | Function                                                                 | Sources                                                               |
|-----|-------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------|
| 1.  | Guardian of Data Quality and Integrity          | Ensuring data accuracy and validation from the input stage onward        | (Laudon & Laudon, 2020; Selvi et al., 2023)                           |
| 2.  | Driver of Administrative Efficiency             | Optimizing the automation of routine school processes                    | (Marakas & O'Brien, 2013; Putri et al., 2025)                         |
| 3.  | Data Mediator for Decision-Making               | Bridging the gap between raw data and the needs of decision-makers       | (Fan, 2025; Sharda et al., 2014)                                      |
| 4.  | ICT Integration Agent                           | Determining the success of ICT integration beyond infrastructure factors | (Amemasor et al., 2025; Fitradi et al., 2025; Timotheou et al., 2022) |
| 5.  | System Sustainability Manager                   | Maintaining system reliability after implementation                      | (Azizah et al., 2024; Stair & Reynolds, 2021)                         |
| 6.  | Bridge Between Technology, Data, and Management | Bridging the three domains of technology, data, and management           | (Sirojuddin et al., 2022; Sutrisnaniati et al., 2024)                 |
| 7.  | Holistic Competency Practitioner                | Integrating technical-operational and strategic-managerial functions     | (Shobri, 2024; Ulva et al., 2023)                                     |

**School Operators as Guardians of Data Quality and Integrity**

Data can serve as the basis for decision-making only after its accuracy has been verified; therefore, the role of school operators is difficult for others to replace. The collection, storage, and processing of data function effectively only when there is a party that validates each entry before it is used for decision-making (Laudon & Laudon, 2020). Schools with high-performing school operators tend to have better institutional performance as well, because consistent data management produces more reliable information (Selvi et al., 2023). These two conclusions have arrived at the same place from two different points of view: one in terms of system mechanics and one in terms of institution impact. They further support the idea that data accuracy is not simply a technical issue but the basis for institutional credibility. In other words, data validation is not simply an administrative activity but a management process that supports the credibility of the whole school decision process; hence, there is a

need to put in place specific standard operating procedures (SOPs) for school operators in terms of data validation.

### **School Administrators as Drivers of Administrative Efficiency**

Technology in itself is not enough for achieving administrative efficiency—a lesson learned repeatedly by the reviewed literature. The automation of repetitive activities such as scheduling and grading can be helpful only when implemented by school operators knowledgeable about the whole chain of administrative procedures, making it possible for them to recognize problems and change system configurations (Marakas & O'Brien, 2013). Proof can be found in the comparison of two schools with the same technology: the school that has better school operators will always have higher administrative efficiency than the other school (Putri et al., 2025). It becomes clear then that what plays a decisive role in the process is the human factor, not technology. Another misconception that the lesson refutes is that of the necessity of purchasing more advanced software to ensure higher administrative efficiency, which is still believed by many school policymakers. In fact, two schools using the same technology can have extremely different outcomes just because of the differences between the schools' operators. As competitive advantage is provided by the human factor, ideal school policies would be those that allow school operators to suggest changes in processes autonomously and not act as executors of administrative orders.

### **School Operators as Data Mediators for Decision-Making**

The importance of school operators is primarily derived from their data mediation role; in other words, the role of converting raw data into decision-making information. Even though a decision support system might have all kinds of advanced techniques for trend analyses and simulation of different scenarios, the efficiency of the system is highly dependent on the quality of interactions between the system and users (Sharda et al., 2014). School operators provide the human link that shows the degree to which information can be extracted and used. The problem is that regardless of the capabilities of a system in analyzing data, the system cannot function properly if there are no competent people to interpret the results (Fan, 2025). This is what separates data-driven schools from merely data-possessing schools. It is not about the quality of the system but the availability of someone who will translate numbers into decisions. The optimization of this role, therefore, entails developing two skills at once—data analytics and data communication. The reason is that operators should not only act as system administrators but also as interpreters of strategic information for school principals.

### **School Administrators as Agents of Information and Communication Technology Integration**

This topic has received the most attention in the literature, highlighting how prominent the topic of ICT competencies of school administrators is in the literature on educational information systems. The success of ICT integration is a multi-participant process wherein the skills of the human resources responsible for managing the system are more important than the existence of technology infrastructure per se (Timotheou et al., 2022). In Indonesia, low ICT competencies of school administrators represent the main impediment to the effective utilization of Dapodik, ARKAS, and EMIS. Limited ICT competencies of school administrators are still present even when the schools possess good technological facilities (Fitradi et al., 2025). It is not surprising that the topic has attracted the most attention from researchers since the gap in ICT competencies of school operators is a constant structural problem rather than an isolated one for some schools or countries. Therefore, context-specific professional development initiatives are necessary. They are more effective in motivating school operators than general ICT training (Amemasor et al., 2025). Hence, it is vital to promote ICT competencies of school administrators by providing them with proper training and certification opportunities.

### **School Administrators as System Sustainability Managers**

Schools often consider the implementation of SIM to be complete when the SIM starts working, while actually, the life cycle of an information system begins to take place during the phases of maintenance, system update, data protection, and modification to suit organizational needs (Stair & Reynolds, 2021). In the absence of regular maintenance, the system gradually loses its efficiency, and the reason is not even budget-related but related to a lack of ability within the organization to manage the sustainability of the system (Azizah et al., 2024). This is the myth that needs to be addressed prior to creating the policy. As long as launching is seen as the end point rather than the beginning point of the process, investments into the MIS will keep getting wasted. School operators must therefore shift from being mere technical implementers to system managers responsible for maintaining the reliability and security of the school's information infrastructure as a strategic asset—not an asset considered “complete” after implementation.

### **School Operators as the Link Between the Technology, Data, and Management Domains**

While the previous five roles were viewed separately, this sixth role synthesizes them into a single position: the school operator as the node connecting three distinct domains—system technology, data and information, and managerial decision-making. The School

Information Management (SIM) system is described as a collaborative system that transforms raw data into meaningful information, with the school operator as the actor managing the entire transformation process (Sirojuddin et al., 2022). Meanwhile, effective data management—from collection through processing—serves as the primary foundation for high-quality decision-making in educational institutions (Sutrisnaniati et al., 2024).

The problem that arises is that this intermediary role becomes the most vulnerable when one domain moves faster than the other. For example, when updates to Dapodik policies at the central level are rolled out without allowing sufficient time for school operators to adjust. This disparity in pace is rarely addressed in studies of educational information systems, even though this situation often leads to school operators being “blamed” for reporting delays—even though the root cause lies in the gap between central policies and on-the-ground readiness, not in the negligence of individual school operators. In Indonesia, this role is increasingly crucial, as school operators serve as the official link between schools and the national data system; thus, the quality of their work directly impacts the validity of education data at both the institutional and national levels. Thus, schools and educational institutions have to make sure that there is enough time given to adapt when changes are introduced in the national framework—for instance, during a transition period for the operators of the schools—to prevent this function from becoming a problem itself.

### **School Administrators as Implementers of Holistic Competencies**

Ultimately, this discussion lies at the heart of all the six roles discussed above since good school administrators cannot merely be seen as technical and operational personnel. The contribution of school operators includes the management of information as a basis of policy and efficient use of school resources (Ulva et al., 2023), hence, information systems managers should be strategic partners in management and not support personnel in order to ensure that SIM can really lead to sustained transparency and accountability (Shobri, 2024). Looking at the six roles discussed above, one can say that these roles are just the different aspects of the same competency; this is about crossing functions without losing sight of the end result, which is better school decision-making. This is about repositioning school operators from technical-operational personnel to strategic managerial personnel. This is therefore not about normative discussion but logic coming out of the seven roles discussed above. Performance evaluation and career development of school administrators will therefore have to be changed to reflect this new level of strategic responsibilities and not to be confused with other administrative personnel who are evaluated only technically and operationally.

### Conceptual Model: Four Dimensions of Competence

The above seven roles were further clustered into four competency dimensions which serve as the foundation of SIM optimization. This clustering is based on grouping of roles that share the same competencies, not on equating all the seven roles to each other. Consequently, it can be said that six out of the seven roles are derived from four core competencies.

Table 2. Mapping of Roles into School Operator Competency Dimensions

| No. | Dimensions                      | Description                                                                                              |
|-----|---------------------------------|----------------------------------------------------------------------------------------------------------|
| 1.  | Technical Competencies          | The role of school operators as guardians of data quality and integrity and as agents of ICT integration |
| 2.  | Analytical Competencies         | The role of school operators as data mediators.                                                          |
| 3.  | Managerial Competencies         | The role of school operators as drivers of efficiency and managers of system sustainability.             |
| 4.  | Data Communication Competencies | The role of school operators as liaisons between the domains of technology, data, and management.        |

Technical competencies act as the basis which must be mastered first by operators in order for them to be able to undertake more strategic tasks in the information value chain of the organization (Sharda et al., 2014). Indeed, such description resonates with the two overlapping roles in the first dimension: data integrity maintenance and ICT integration. Both roles demand a deep understanding of technical aspects of the system, even though the contexts are different. The second dimension is about the fact that regardless of how complex the analytics system of the system is to generate projections and recommendations, the value of the output depends on whether there are operators who can interpret them in relation to the school. Fan (2025) also underscores the need for human interpretation of the processed results of the system; otherwise, regardless of how sophisticated these results may be, they will still be just numbers which do not make any sense in real life.

The third dimension is about proactive planning and coordination of stakeholders. O'Brien & Marakas (2021) prove that a combination of both technical and managerial competencies provides the highest strategic value in the use of information systems by organizations. In fact, efficiency driver and system sustainability manager from the two overlapping roles require more than just reactive planning. Finally, the fourth dimension is the crucial factor that determines the success of the other three dimensions. Laudon & Laudon (2020) note that information becomes valuable only if it is successfully communicated in accordance with the needs of managers. Thus, the data communication competence is what

makes the operator capable of uniting all the three areas into one coherent whole understandable to all stakeholders of the school.

These four dimensions form the hierarchy of interdependencies. Technical competence without analytical competence produces neatly structured but meaningless data. Analytical competence without managerial competence produces insights without implementation. Moreover, all the above chain becomes static if there are no data communication competences to establish communication link between operators and decision-makers. Under these conditions, the role of operators of the school as the users of holistic competences takes place. It means the capacity to unite all four dimensions at once in their practice. Efficient operators of the school do not undertake technical, analytical, managerial and data communication competences separately. They function as a single entity.

The model develops the approach for the study of educational information systems that has been based on technological perspective. In this case, the competence of a person becomes the determining variable, rather than just an addition to the technological one. The unique position of the holistic competency practitioner brings a new theoretical dimension, namely that the integration of competencies is a separate skill rather than a consequence of the development of the four dimensions separately. Moreover, the proposed hierarchical structure could be used as the foundation for creating national assessment tools for the school operator competencies, as well as the national training program for school operators. The order of development of the competencies could be established in accordance with a hierarchical order from the technical competency to the data communication. The integration of all four dimensions should be developed separately as a special competency and not automatically as a result of the development of the four competencies separately.

## **CONCLUSION**

From the findings of the literature review, it is evident that the optimization of MIS of any school cannot be achieved without developing the strategic significance of the school's administrators. In this research, there are seven roles that have been discovered, which are interrelated, implying that inability to assume one role may make it difficult to assume other roles. These seven roles have been combined into four competency dimensions namely technical, analytical, managerial, and data communication competencies, arranged hierarchically in a way that inability to assume one level of competence makes it impossible to achieve higher levels. The research findings indicate that the successful implementation of the School Information System (SIM) in schools—whether in the context of Dapodik, ARKAS, or EMIS—is determined more by the capacity and readiness of the school operators

who manage it than by technological sophistication or the completeness of infrastructure alone. The study also highlights the issue of disparities in progress across domains as a key finding that has long been overlooked in SIM education research. Consequently, school and government policy leaders need to redefine the role of school operators, shifting their focus from technical and operational functions to strategic and managerial functions. This can be achieved through revising performance evaluation schemes and career ladders, developing training curricula based on competency hierarchies, and providing guided transition periods whenever national policies or systems are updated.

## SUGGESTIONS

This study has limitations as a conceptual literature review that has not yet been empirically tested in the field; therefore, future research is recommended to validate this four-dimensional model using a quantitative or mixed-methods approach, including further exploration of the phenomenon of cross-domain speed disparities identified in this study.

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