Analysis of the expected effects of implementing ERP, GIS and DMS systems in a public enterprise

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Abstract: Integrated information systems represent a key element of the digital transformation of public enterprises, enabling data integration, improvement of business process control, and an increase in transparency. This paper analyzes the effects of implementing an integrated information system in the Public Forestry Enterprise "Forests of the Republic of Srpska" JSC Sokolac, which integrates SAP ERP, a Geographic Information System (GIS), and a Document Management System (DMS).
Preliminary implementation results indicate concrete operational improvements, including the elimination of a 24-hour data synchronization delay, reduction of the field data collection cycle from 48 hours to near-real-time, instant document retrieval through the DMS, and automatic invoice generation upon mobile application synchronization. Once fully operational, the system is expected to further improve efficiency, control, transparency, and analytical management.
Special focus is placed on the identification of effects in the areas of operational efficiency, work organization, control and transparency of business operations, as well as the improvement of analytical capacities through the application of BI and OLAP technologies.
The research results indicate that the implementation of an integrated information system creates the preconditions for data centralization, standardization of business processes, and the establishment of a unified information environment. The integration of SAP ERP and GIS enables more comprehensive monitoring of the forest timber assortment production process and the improvement of analytical capacities through the application of BI tools.
A particularly significant contribution of the system is reflected in the possibility of linking planned and realized activities, thereby creating the preconditions for more efficient business monitoring and decision-making based on reliable data.
The integrated information system represents an important tool for improving efficiency and data-driven decision-making, while the achieved implementation results indicate significant potential for further development through advanced analytical methods and digital resource management.

Keywords: integrated information system, SAP, ERP, GIS, DMS, public enterprises

Introduction

Modern business systems are characterized by a high level of complexity, a large amount of data, and the need for fast and reliable decision-making. In such an environment, information systems represent a key factor in the efficient management of organizations, especially in the public sector, where the requirements for transparency, control, and rational use of resources are particularly pronounced [1], [4]. The integrated information system in the Public Forestry Enterprise "Forests of the Republic of Srpska" is currently in the final phase of implementation, and the system is expected to achieve full operational capacity and provide complete support for business process management, control, transparency, and analytical decision-making.

Public enterprises that manage natural resources, such as the Public Forestry Enterprise "Forests of the Republic of Srpska," face specific challenges that include the management of spatially distributed resources, coordination of a large number of activities,

and processing of heterogeneous data. Under such conditions, traditional decentralized information systems often cannot provide an adequate level of integration and reliability of data, which leads to reduced business efficiency and more difficult decision-making [4], [5].

Modern forestry management is increasingly influenced by concepts of digital transformation and Industry 4.0, including the application of ERP systems, GIS technologies, mobile platforms, cloud infrastructure, and advanced analytical tools. In contemporary forestry systems, digital technologies enable more efficient resource management, improved monitoring of field activities, real-time data collection, and data-driven decision-making processes. The integration of spatial and business data through unified information systems represents one of the key directions in the modernization of forestry organizations and public enterprises managing natural resources [6], [13].

The earlier information system in the Public Forestry Enterprise "Forests of the Republic of Srpska" was based on a decentralized approach, whereby organizational units used different databases and their own coding systems. This approach led to data fragmentation, inconsistency of information, and limited possibilities for analysis. As a consequence, it was difficult to monitor business processes and establish a unified control system [8]–[10].

The introduction of an integrated information system represents a strategic step toward improving business operations and the digital transformation of the enterprise. The new system is based on the integration of an ERP system, a Geographic Information System (GIS), and a Document Management System (DMS), thereby creating conditions for the integration of business, spatial, and documentary data into a unified information environment [1], [4], [5]. Since the system is still in the final phase of implementation, the full effects of this integration are expected after its complete functional completion.

The aim of this paper is to examine the role of the integrated information system and its implementation in the Public Forestry Enterprise "Forests of the Republic of Srpska," with particular focus on improving the efficiency of business processes, increasing the level of control and transparency, and developing analytical capacities through the integration of different information components. Special attention is devoted to the role of the BI system as an analytical layer that enables the integration and interpretation of data from different sources [3], [12].

The paper is structured so that, after the introductory part and methodology, a description of the integrated information system follows, while the central part of the paper analyzes the effects of its implementation. The final part of the paper includes conclusions and recommendations for the further development of the system.

Research Methodology

The methodological framework of this paper is based on the application of the case study method, which enables a detailed analysis of the implementation of an integrated information system in a real organizational environment. This approach is particularly suitable for the study of complex information systems, as it enables consideration of the technical, organizational, and process aspects of their application in practice [1], [4].

The subject of the research is the integrated information system implemented in the Public Forestry Enterprise "Forests of the Republic of Srpska", which consists of three basic components: the ERP system, GIS, and DMS. Together, these components form a unified information framework that enables the integration of data and business processes at the level of the entire enterprise [8]–[10].

A combined methodological approach was applied in the paper, including qualitative and descriptive-analytical analysis. The qualitative aspect of the research is reflected in the analysis of the system implementation process, organizational changes, and the challenges that arise during the transition from a decentralized to a centralized system. The descriptive-analytical approach is used to identify and interpret the effects of system implementation on the enterprise's operations.

The research methodology includes three key phases. The first phase relates to the analysis of the situation before the implementation of the integrated information system, during which the basic problems of the decentralized approach were identified, including data fragmentation, inconsistency of coding systems, and different working methods among organizational units. The second phase includes the analysis of the system implementation process, with

particular focus on the integration of the SAP ERP, GIS, and DMS components, as well as on challenges in the area of data migration and standardization. The third phase relates to the evaluation of the effects of system implementation, during which changes in business efficiency, the level of control and transparency, and the analytical capacities of the organization are analyzed [8]–[10].

For the purposes of the research, internal enterprise documents, project documentation, and operational data generated during system implementation were used. In addition, an important source of information consists of practical experience gained through work on the implementation and use of the system, which enables a realistic and detailed insight into the functioning of the integrated information system.

A special aspect of the methodology relates to the analysis of the integration of different information components. The SAP ERP system is observed as the central operational system that generates and processes business data, GIS as the system that provides the spatial context of those data, while DMS enables document management and records of business processes. The analysis of their mutual integration enables an understanding of the way in which the integrated information system contributes to business improvement [1], [5].

For the purpose of a comprehensive evaluation of the effects of implementation, the results were analyzed through several dimensions, including operational efficiency, data quality, the level of process standardization, and the possibilities of analytical data processing [3], [12]. Such an approach enables an objective assessment of the impact of the integrated information system on the enterprise's operations.

The research was conducted during the implementation phase of the integrated information system between 2020 and 2025. The analysis included data and observations collected throughout different implementation stages, including system design, data migration, integration, testing, and operational deployment.

Data collection methods included:

- analysis of internal project documentation,
- analysis of conceptual designs and user manuals,
- operational reports and system records,
- direct observation during implementation activities,
- consultations and interviews with employees involved in implementation and operational processes.

Such an approach enabled a more comprehensive understanding of both technical and organizational aspects of the implementation process.

The methodological approach applied in this paper enables the identification of the key advantages and limitations of the implemented system and represents a basis for further research in the field of the application of integrated information systems in the public sector.

Integrated Information System Architecture

The integrated information system in the Public Forestry Enterprise "Forests of the Republic of Srpska" represents a complex and integrated information framework that includes three key components: the SAP ERP system as the central business system, the Geographic Information System (GIS) for the management of spatial data, and the Document Management System (DMS) for document management. Together, these components enable the integration of data and business processes at the level of the entire enterprise, thereby achieving a high level of integration, control, and efficiency [8]–[10].

The introduction of the integrated information system represents a significant step forward compared to the previous decentralized model of work, in which organizational units used different databases and their own coding systems. Such an approach led to data fragmentation, inconsistency in work, and more difficult monitoring of business operations. By implementing the new system, a unified information framework was established, enabling data centralization and standardization of business processes (Figure 1).

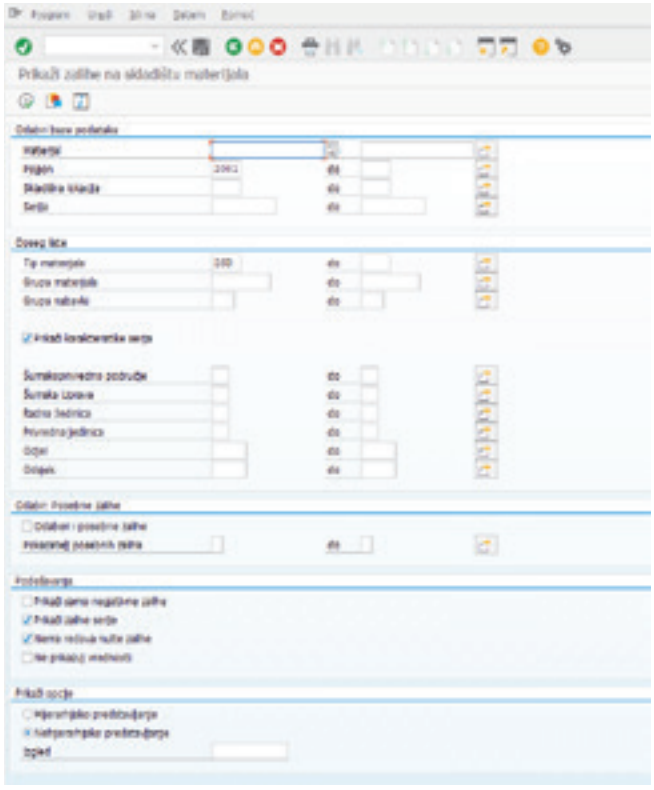

Figure 1. *User interface of the SAP ERP system*

The central role in the system is played by the ERP platform, which represents the basis for managing all key business functions. Through the implementation of the ERP system, the integration of procurement, sales, finance, payroll calculation, and project management processes was enabled. The MM (Materials Management) module is used for the procurement of goods and services, including specific processes in the field of forestry, while the SD (Sales and Distribution) module supports the sales processes of forest timber assortments. The FICO module enables the management of financial flows and controlling, while FICO/PY covers payroll and labor cost calculation [1], [7].

Of particular importance are PS (Project System), that is, WBS elements, which enable the planning, monitoring, and control of activities through projects, including silvicultural works, exploitation, and other operational processes. The PM (Plant Maintenance) module is used for fleet management and equipment maintenance, thereby further improving operational efficiency and resource availability [1], [7].

The DMS component of the system is used for electronic recording and document management, including electronic protocol records, electronic document exchange, and records of court cases (Figure 2). By introducing the DMS system, the digitization of business documentation was enabled, thereby improving data availability, reducing the use of paper documentation, and increasing efficiency in the management of administrative processes [8]–[10].

The GIS component of the system represents a key element for the management of spatial data and

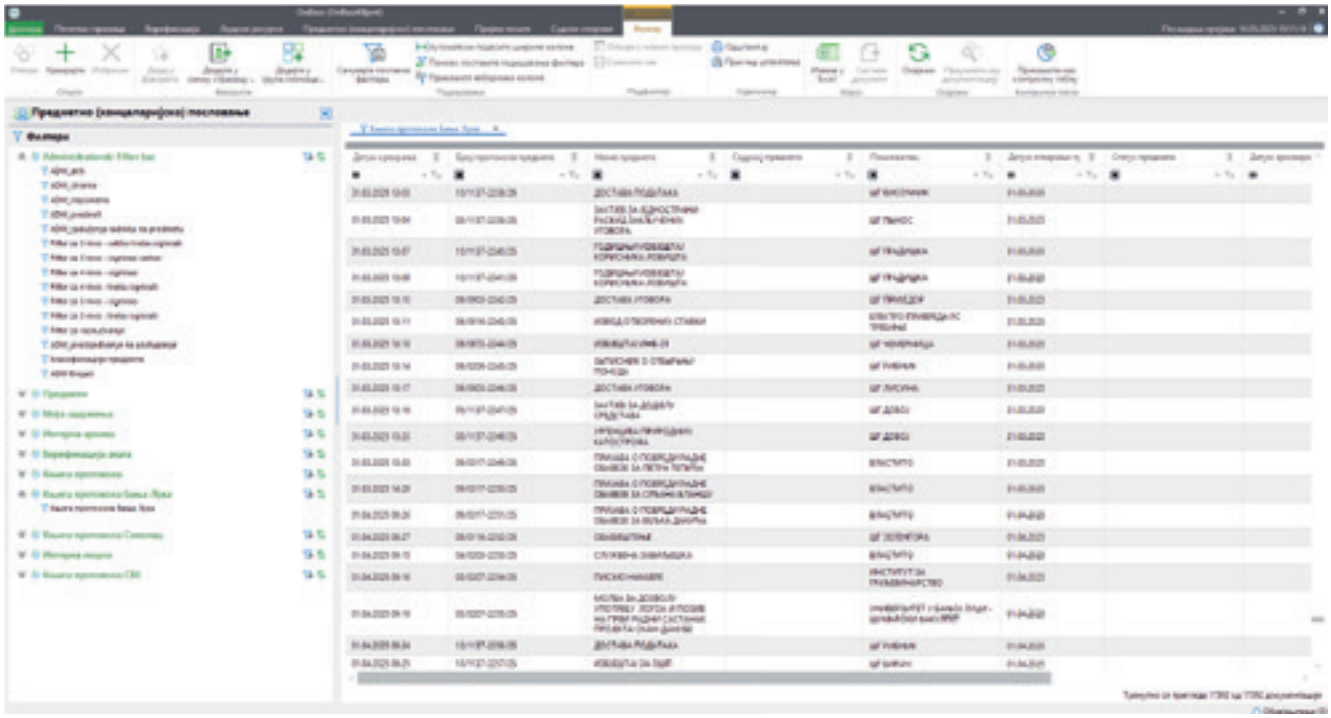

Figure 2. *DMS system interface*

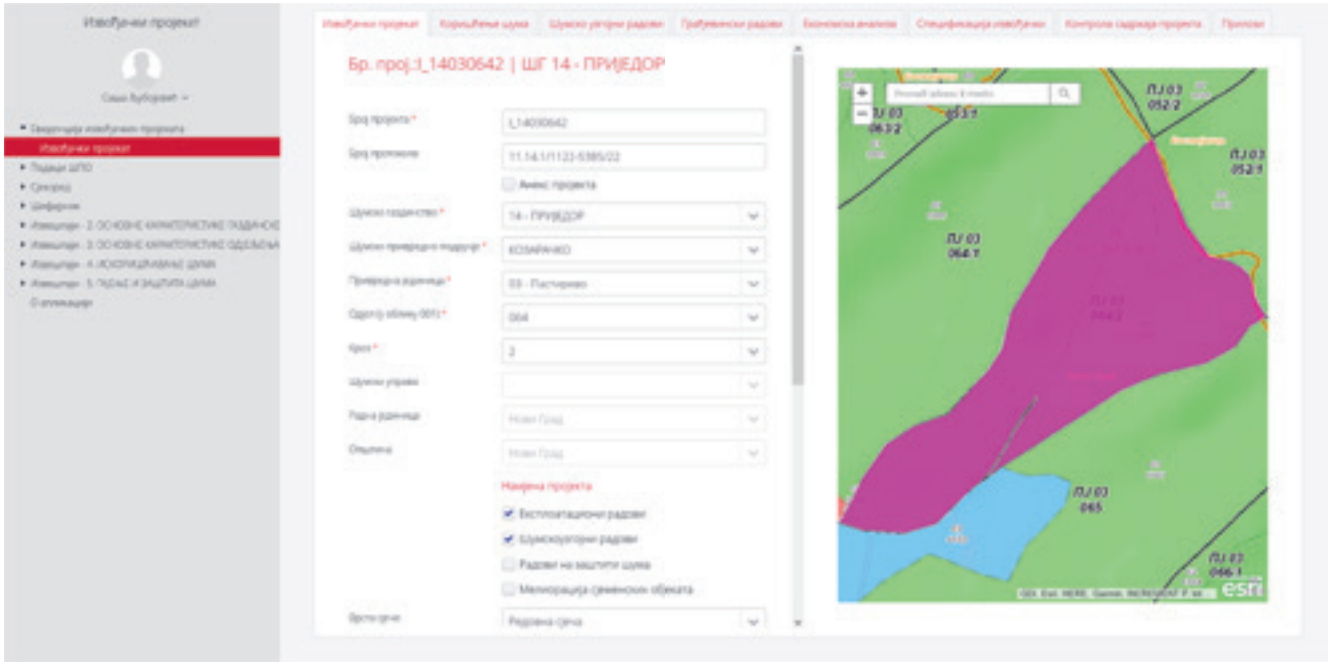

Figure 3. *GIS system interface*

their integration with business processes (Figure 3). Through the establishment of a unified GIS database, all spatial data that had previously been distributed across several different databases were integrated. This process was accompanied by significant challenges, especially with regard to overlapping polygons, inconsistencies in boundaries, and different ways of naming spatial objects, which required detailed data standardization and harmonization [5], [8]–[10].

The GIS system includes several thematic units, including forest management plans, operational projects, forest cadastre and felling schedules, forest communications, private forests, and forest protection. In this way, detailed planning and monitoring of field activities are enabled with a high level of precision and data reliability.

A particularly significant role within the integrated information system is played by mobile applications, which represent the link between field activities and the central information system. Two key mobile applications have been implemented: the GIS mobile application and the SAP mobile application.

The GIS mobile application enables spatial and attribute data to be collected directly in the field. Through this application, it is envisaged that data will be collected for the preparation of forest management plans (forest inventory), as well as data for operational projects, that is, the marking of trees. In addition, the GIS mobile application is also used in the forest protection segment, where it enables the recording of locations of illegal logging, pheromone traps, and polygons of burned areas [13].

An important aspect of this application is the possibility of electronic completion of forms that were previously in paper form. In this way, automatic centralization and availability of data are enabled, whereas previously such data remained in written form in archives and were not easily available for analysis and control.

Figure 4. *SAP mobile application integrated with a portable printer*

The SAP mobile application serves to record the movement of forest timber assortments through all

phases of the production process. This application enables the recording of felled trees, their extraction to truck roads, and the dispatch of forest timber assortments. This process envisages the recording of detailed data on each tree, as well as information on the type of felling and the method of carrying out the work (Figure 4).

The system enables precise recording of whether the works were performed by the enterprise's own workforce, in which case data on the executors are recorded (felling and extraction groups), or whether external contractors were engaged, thereby establishing a direct link with work performance contracts. In the dispatch phase, a connection is established with the buyer and sales contracts, whereby the system automatically checks whether all contractual and financial obligations have been fulfilled. If the buyer has outstanding obligations, it is not possible to issue a dispatch order, which provides an additional level of control.

One of the key characteristics of the system is the complete monitoring of all activities. Each phase of the process records data on completed works, including information on who performed a given activity, when, and in what manner. In this way, a clear and reliable trace is provided for all phases of work, which will significantly contribute to transparency and control of operations.

The integration of ERP, GIS, and DMS systems, supported by mobile applications, enables the consolidation of operational, spatial, and documentary data into a unified whole. Such an approach provides the basis for improving efficiency, increasing transparency, and developing advanced analytical capabilities, thereby positioning the integrated information system as a key tool for managing enterprise operations.

An important segment of the integrated information system is the BI (Business Intelligence) component, which enables the integration and analysis of data from ERP, GIS, and DMS systems. The BI system takes over data from the GIS component related to felling plans and planned activities and links them with data from the ERP system covering the realization of felling, extraction, and dispatch of forest timber assortments. In this way, the integration of planned and realization data is enabled, thereby providing a complete insight into production and realization flows [2], [3], [12].

Through such an integrated approach, the BI system enables the generation of reporting documentation that links planned and realized activities, thereby enabling continuous monitoring of deviations and the efficiency of plan realization. A particularly important aspect of this approach is reflected in the possibility of analyzing the entire process, from planning, through work execution, to final realization and sale.

In addition, the BI system enables the generation of a large number of standard and customized reports, including reports on work monitoring, stock levels, movement of forest timber assortments, realization of contracts, as well as monitoring of planning documents. These reports enable a detailed insight into the enterprise's operations through different dimensions, thereby significantly improving control and support to the decision-making process [2], [3], [12].

By integrating data from different sources and analyzing them through the BI system, a unified and reliable source of information is provided, which represents the basis for efficient management of business processes and strategic planning.

RESULTS AND DISCUSSION

Preliminary implementation results and operational observations indicate several important organizational and technological improvements. The implementation of the integrated information system in the Public Forestry Enterprise "Forests of the Republic of Srpska" has already led to certain changes in the way the enterprise functions. The effects of implementation can be observed through several interrelated dimensions, including operational efficiency, work organization, business control, and the development of analytical capacities.

One of the most significant observed and expected effects of system implementation is reflected in the improvement of operational efficiency. By introducing the ERP system and integrating it with GIS and DMS components, the automation of a large number of business processes has been enabled. This reduces the need for multiple data entries, decreases the possibility of errors, and accelerates information processing. Mobile applications contribute to improved data timeliness, as they enable data entry directly in the field and its availability in the central system [8]–[10].

At the organizational level, the implementation of the integrated information system has contributed

to the standardization of business processes and the unification of work methods across organizational units. The previously decentralized system, in which different parts of the enterprise used their own procedures and coding systems, is gradually being replaced by a unified work model based on centralized data and standardized rules. In this way, conditions have been created for greater consistency of work, better coordination, and a clearer distribution of responsibilities [1], [4].

A particularly important expected effect of system implementation is reflected in the increase in the level of control and transparency of business operations(Table 1). Through the integration of ERP and GIS systems, more complete monitoring of timber assortments is enabled through all phases of the process, from planning and felling to transport and sale. Each activity is recorded with relevant data on time, location, and executor, thereby creating conditions for more efficient supervision and more reliable business control.

Data centralization represents one of the key expected effects of system implementation. The previous system was characterized by data fragmentation and the existence of different material coding systems, which made integration and analysis more difficult. By introducing a unified database and standardizing coding systems, data consistency, easier accessibility, and a stronger basis for reporting and management have been established [8]–[11].

A significant expected effect of the implementation of the integrated information system relates to the improvement of the organization's analytical capacities. The BI component of the system enables the integration of data from the ERP and GIS systems and their analysis through different dimensions. Particularly important is the linking of planning data from the GIS system with realization data from the ERP system, thereby creating the preconditions for more precise monitoring of plan implementation and the identification of deviations [2], [3], [12].

Through the BI system, it is possible to generate a large number of reports that cover different aspects of operations, including work monitoring, stock levels, movement of forest timber assortments, realization of contracts, and execution of planning documents. These reports enable a more detailed insight into operations and represent the basis for more efficient resource management and decision-making.

The special value of the BI system is reflected in the possibility of integration with the GIS component, thereby enabling spatial data analysis. This approach enables business activities to be viewed in their geographical context, which is of particular importance in forestry. In this way, it would be possible to identify the spatial distribution of activities more precisely, monitor the execution of works, and analyze resource utilization [5].

Several concrete operational improvements have already been observed during the implementation process. In the area of data availability, the previous system relied on nightly synchronization between decentralized organizational units, which meant that all data in the system were at least 24 hours old at

Table 1. *Preliminary indicators and expected operational improvements*

Business Process	Previous State	Current / Expected State	Expected Improvement
Document processing	Paper-based workflow	Digital DMS workflow	Faster document availability
Field data collection	Manual paper forms	Mobile GIS data collection	Real-time data availability (48h reduction)
Timber tracking	Partial traceability	Integrated SAP-GIS tracking	Increased transparency
Reporting generation	Manual report preparation	Automated BI reporting	Reduced reporting time
Data storage	Decentralized databases	Centralized database	Improved data consistency (24h nightly sync eliminated)
Monitoring of contracts	Manual verification	ERP-based control mechanisms	Improved operational control
Planning and realization analysis	Separate systems	Integrated BI analysis	Better decision-making support
Document retrieval (DMS)	Physical archive search (minutes to hours)	Instant electronic search by protocol no., date, or sender	Near-instant retrieval (search time eliminated)
Invoice generation	Handwritten dispatch note → manual re-entry (next day) → invoice: min. 24h delay	Mobile app sync → automatic invoice generation and delivery to buyer	24h reduction in billing cycle

any given point. The new integrated system eliminates this delay, providing near-real-time data availability across all organizational units. In the case of field data collection, the previous workflow required field workers to complete handwritten forms on-site, manually re-enter the data into the system the following day, and then wait for an additional synchronization cycle — resulting in a total data delay of up to 48 hours. The integrated mobile application eliminates this entirely by capturing data directly in the field and synchronizing it with the central system immediately. In the domain of document management, the DMS enables instant retrieval of any document by protocol number, date, or sender, replacing a process that previously required physical archive searches lasting from several minutes to several hours. A particularly significant operational improvement relates to the invoicing process: previously, dispatch notes for timber assortments were handwritten in the field, manually re-entered into the system the following day, and only then could an invoice be generated — resulting in a minimum 24-hour delay in the billing cycle. The new system generates and delivers invoices to buyers automatically upon mobile application synchronization, eliminating this delay entirely and contributing to faster revenue collection. Finally, whereas year-over-year data comparisons previously required manual extraction from separate annual databases, the integrated system now supports cumulative multi-year analysis directly through the BI component.

In addition to the expected positive effects, the implementation of the integrated information system has also been accompanied by certain challenges. The most significant challenges relate to data migration, standardization of coding systems, and adaptation of employees to a new way of working. Particularly complex is the process of integrating spatial and business data, as well as the need to harmonize different work practices across organizational units [8]–[10].

Viewed as a whole, the implementation of the integrated information system has a potentially transformational impact on the enterprise's operations. By integrating operational, spatial, and analytical components, a unified information framework is being established that enables more efficient resource management, increases transparency, and provides a better basis for strategic and operational decision-making, especially after the system begins to operate at full capacity.

LIMITATIONS OF THE RESEARCH

The integrated information system analyzed in this paper is still in the final phase of implementation, which represents one of the main limitations of the research. As a result, certain effects described in the paper are based on preliminary operational observations and expected long-term benefits rather than fully measurable empirical indicators.

In addition, some organizational units are still undergoing the process of adaptation to standardized workflows and centralized data management. Therefore, a complete quantitative evaluation of all system effects will be possible only after full operational stabilization and long-term use of all implemented functionalities.

Future research should include detailed quantitative analysis of operational indicators, comparative efficiency measurements, and long-term evaluation of the impact of integrated information systems on forestry management processes.

CONCLUSION

The results of the analysis indicate that the implementation of the integrated information system in the Public Forestry Enterprise "Forests of the Republic of Srpska" represents a significant step toward the modernization and digital transformation of business operations. Since the system is still in the final phase of implementation, it is possible to speak primarily of the establishment of a unified information framework that should integrate business, spatial, and documentary data, while the full effects are expected after its complete functional completion.

One of the key expected effects of system implementation is reflected in the increase in operational efficiency, through process automation and the reduction of the need for manual data entry. The introduction of mobile applications further improves the accuracy and timeliness of data, enabling their collection directly at the point of origin.

At the organizational level, the system contributes to the unification of business processes and the increase in employee responsibility, while at the management level it should enable a higher degree of control and transparency. A particularly important aspect is that the system enables more complete monitoring of timber assortments through all phases of the process, which contributes to more efficient su-

pervision and more rational use of resources.

The development of the BI component of the system enables the improvement of analytical capacities through the integration of data from ERP and GIS systems, as well as their processing through different analytical models. In this way, data-driven decision-making should be enabled, which represents a key element of modern organizational management [2], [3], [12].

Although the implementation of the system has been accompanied by significant challenges, particularly in the areas of data migration and standardization, as well as the adaptation of employees to a new way of working, the results achieved so far and the functionalities established indicate the justification of investing in the integrated information system and its potential benefits.

The further development of the system can be directed toward the completion of all planned functionalities, the improvement of analytical capabilities, greater integration with advanced technologies, including artificial intelligence, as well as the continuous improvement of data quality and business processes. This would further increase management efficiency and enable the development of a modern model of digital resource management.

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Branko Latinović was born on April 28, 1956 in Prijedor, Bosnia and Herzegovina. He graduated from the Faculty of Economics in Banja Luka in 1980. At the same faculty he enrolls a master's degree that ends in 1994, and in 1997 successfully defended his doctoral dissertation. He worked as a dean of the Dean of the Faculty of Information Technologies of Pan-European University "Apeiron" in Banja Luka.

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