

Developing Information-Managerial Competence of University Department Heads in the Context of Digitalization of Education: A Conceptual and Technological Framework

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Abstract

The digitalization of higher education is transforming university management practices and increasing the need for integrated digital, information, and managerial competencies among university department heads. This study aims to develop and theoretically substantiate a conceptual and technological model for developing the information-managerial competence of university department heads in the context of educational digitalization. The scope of the study encompasses the structure and indicators of information-managerial competence, the relationships among its key dimensions, and the expert evaluation of the proposed model. The study employed a design-oriented mixed-methods approach with an embedded mixed-method design. The research was conducted through analytical, conceptual, design, and empirical validation stages. A structured literature review and comparative analysis of existing competency frameworks provided the theoretical basis for the model. The quantitative component involved a survey of 125 university department heads and academic administrators. Descriptive statistics, Cronbach's alpha, and correlation analysis were used to examine the perceived importance and interrelationships of digital, information, and managerial competency dimensions. The qualitative component was embedded in the expert evaluation and included thematic analysis of open-ended feedback from 21 experts. The findings indicate that information-managerial competence can be conceptualized as an integrated multidimensional construct encompassing digital, information, and managerial competencies. Significant positive relationships were identified among the three competency dimensions. Expert evaluation provided evidence regarding the relevance, completeness, coherence, clarity, and practical applicability of the proposed model and identified areas for its refinement. The study concludes that the proposed conceptual and technological model provides a structured basis for the systematic development and assessment of information-managerial competence. Its practical implications include the design of professional development programs, competency assessment tools, and institutional strategies supporting digital transformation in higher education, particularly in Kazakhstan.

Keywords: *Digitalization of education, managerial competence, information competence, educational management, digital governance.*

Introduction

Modern society is undergoing profound transformations driven by digital technologies. The digitalization of education requires academic leaders not only to possess professional and

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managerial competencies, but also to develop modern innovative competencies (Alenezi, 2021; Benavides et al., 2020; Cabezas-González et al., 2024; Jameson et al., 2022; Petterson, 2021). In the context of digital transformation, the development of information-managerial competencies among educational leaders has become especially relevant for ensuring the effectiveness of the educational process, improving the quality of institutional governance, and strengthening the competitiveness of educational institutions (Bond et al., 2018; Garcia-Morales et al., 2021; Ifenthaler & Yau, 2020; Imran et al., 2025; Zawacki-Richter et al., 2019;). The development of information-managerial competencies among heads of university structural divisions is one of the most significant scientific and practical issues at the global level, closely linked to digitalization, educational transformation, and the effectiveness of higher education management. In the process of digital transformation within the education system, digital competence is becoming essential not only for teaching staff, but also for administrators and managers (Babalola & Genga, 2025; Yskak et al., 2025).

UNESCO systematizes competency frameworks for educational leaders through a range of internationally recognized models. The ICT Competency Framework for Teachers (ICT CFT) emphasizes institutional development and governance through competencies related to management, planning, and the digitalization of administrative processes. The third version of the ICT Competency Framework for Teachers (ICT CFT) has provided a foundation for defining digital competencies in educational policy, curriculum design, staff training, and professional development programs. It also supports the integration of ICT guidelines and enhances educators' capacity to effectively master and apply technologies in their professional practice (UNESCO, 2023). In addition, UNESCO's International Institute for Education Planning (IIEP) has developed a competency model specifically for educational leaders. This model consists of three key domains: technical competencies (data management, analysis, and planning), relational competencies (communication and leadership), and strategic competencies (forecasting and policy development) (UNESCO, 2024).

Within the framework of the United Nations Sustainable Development Goals – Quality Education (SDG 4), Peace, Justice and Strong Institutions (SDG 16), and Partnerships for the Goals (SDG 17) – information-managerial competency is regarded as a global indicator of educational quality. According to international standards such as ISTE, educational leaders are expected to serve as vision builders, system designers, and agents of change (ISTE, 2024). In this context, the development of information-managerial competencies among heads of

university structural divisions is not only a key prerequisite for digital transformation, but also a strategic factor for ensuring institutional sustainability and long-term effectiveness.

The Importance of Developing Information-Managerial Competence in The Context of Digital Transformation in Universities

The relevance of developing information-managerial competencies among heads of university structural divisions in the context of educational digitalization is determined by several interrelated factors. First, the digital transformation of higher education is fundamentally reshaping the nature and content of managerial activities. In universities, the organization of the educational process, monitoring, strategic planning, and decision-making are increasingly carried out through digital platforms and information systems (Balyer & Oz, 2018; Mahlow & Hediger, 2019; Seitbatkalova et al., 2023; Sharipova et al., 2025). Consequently, heads of structural divisions are required to possess the ability to work with data, analyze and interpret it, and effectively apply it in managerial decision-making processes. Second, the rapid growth and increasing complexity of information flows require managers to possess a high level of information culture and digital literacy (Karakose et al., 2024; Kelder et al., 2025; Olabiyi et al., 2025). Information-managerial competency extends beyond technical skills and also includes components such as information security, digital ethics, and the ability to assess the reliability of data. In this regard, an insufficient level of competency may lead to a decline in management effectiveness. Third, the widespread implementation of data-driven management approaches in educational governance increases the need for leaders to develop analytical thinking, as well as the ability to forecast and manage risks through the use of digital tools (Olabiyi et al., 2025; Strielkowski et al., 2022). This is particularly important in ensuring educational quality, evaluating student achievement, and improving institutional rankings. Fourth, as the management of the digital educational environment is increasingly carried out in remote and blended formats, mastering new forms of communication has become essential. Educational leaders must be capable of effective interaction within digital environments, managing teams remotely, and demonstrating innovative capacities in digital leadership in accordance with the demands of the modern era (Branch et al., 2020; Jackson, 2019).

Problems of Development of Information- Managerial Competence of Heads of Structural Divisions of the University in the context of Kazakhstan

By decree of the President of Kazakhstan, Kassym-Jomart Tokayev, *the year 2026 has been declared the Year of Digitalization and Artificial Intelligence (AI)*. This initiative aims to

accelerate the integration of advanced technologies into the economy and public life – particularly in the fields of energy, education, and infrastructure – while strengthening the country’s potential as a digital power.

The rapid development of the educational digitalization process requires fundamental changes in the management systems of Kazakhstan’s higher education institutions (Kurmanov et al., 2024; Tarman et al., 2026). In this context, identifying the conceptual and technological foundations for developing the information-managerial competencies of heads of university structural divisions has become critically important. On the one hand, this necessity is driven by the need to develop digital infrastructure, implement educational platforms, and transition toward data-driven management models. On the other hand, this is driven by the integration of Kazakhstani universities into the international educational space, the expansion of academic mobility, and the need to enhance competitiveness in global rankings. Moreover, the digitalization of processes within educational quality assurance systems, including the monitoring of academic achievement, the analysis of educational programs, and the management of students’ individual learning trajectories, requires managers to possess advanced analytical thinking skills and the ability to effectively utilize information systems. In addition, regional digital inequality disparities in universities’ resource capacities, insufficient human capital, as well as challenges related to cybersecurity and data privacy, further reinforce the importance of systematically developing information-managerial competencies. From this perspective, the scientific substantiation of the conceptual and technological foundations for the development of these competencies is a crucial condition for enhancing the effectiveness of the national higher education system, ensuring its innovative development, and achieving sustainable progress in the context of digital transformation. Overall, the relevance of developing information-managerial competencies among heads of university structural divisions is driven by the need to improve the quality of governance, ensure the effectiveness of educational processes, and strengthen the competitiveness of higher education institutions in the era of digital transformation. Accordingly, *the purpose of the research* is to develop and theoretically substantiate a conceptual and technological model for developing the information-managerial competence of university department heads in the context of the digitalization of education. To achieve this aim, the study addressed the following research questions:

RQ1: What dimensions and indicators of information-managerial competence are identified as relevant to university department heads in the context of the digitalization of education?

RQ2: How do university department heads perceive the importance of digital, information, and managerial competency dimensions, and what relationships exist among these dimensions?

RQ3: To what extent do experts evaluate the proposed conceptual and technological model in terms of relevance, completeness, coherence, clarity, and practical applicability?

RQ4: What areas for refinement of the proposed conceptual and technological model are identified through experts' qualitative feedback?

In pursuit of the *research objective*, the following tasks were undertaken:

- to conduct a theoretical and comparative analysis of scholarly literature and existing competency frameworks related to managerial, information, and digital competencies in higher education.
- to clarify the essence, structure, dimensions, and indicators of information-managerial competence required by university department heads in the context of the digitalization of education;
- to examine university department heads' perceptions of the importance of digital, information, and managerial competency dimensions and the relationships among these dimensions;
- to develop a conceptual and technological model for the development of information-managerial competence based on the synthesized theoretical and empirical evidence;
- to evaluate the relevance, completeness, coherence, clarity, and practical applicability of the proposed model through expert assessment and to identify areas for its refinement based on experts' qualitative feedback.

Literature review

Management in higher education institutions requires modern approaches to governance. According to the research of Puckett et al., "higher education significantly lags behind most other industries in terms of digitalization" (Puckett et al., 2021). Therefore, the digital transformation of higher education urgently demands digital leadership in areas such as strategic development for online and blended learning, governance, staff management, pedagogy and institutional culture, as well as the organization and classification of technological resources. In this regard contemporary changes in higher education place increasing demands on the development of information- managerial competencies among heads of university structural divisions. Despite extensive professional experience, individuals in leadership positions are expected to continuously acquire new knowledge and engage in ongoing professional growth. Under current conditions of educational digitalization, this

requires managers to master information competencies alongside traditional managerial competencies.

In today's world, where technology, operational efficiency and student satisfaction play a critical role in academic success, the absence of effective digital academic leadership creates a high risk of institutional stagnation and decline (Shrivastava & Shrivastava, 2022). As the global educational ecosystem actively adopts online learning, data analytics, and digital communication, weak academic leadership may hinder institutions from responding effectively to modern educational trends due to inefficient resource utilization (Dyanti & Mkabile-Masebe, 2025; Haddock et al., 2022; Shrivastava & Shrivastava, 2022). According to the study by Antonopoulou et al., since higher education institutions are not immune to such transformations, they must fully recognize the importance of attracting employees with modern knowledge and skills, as well as improving the innovative managerial competencies of traditional academic leaders (Antonopoulou et al., 2020).

Modern employees increasingly work with data and information and are therefore more oriented toward knowledge and innovation than toward physical labor. This tendency was highlighted by the prominent management scholar Peter Drucker, who introduced the concept of the "knowledge worker" and distinguished this type of employee from workers of the industrial era. According to the distinction, rigid management approaches based on Taylorism are no longer suitable for knowledge workers (Regan, 2021).

Under new conditions of scientific and technological production, the primary imperative for employees is innovation and adaptability. Consequently, the modern professional is expected to engage in continuous self-education and contribute to the learning of others. In managerial practice, this responsibility becomes even more significant, as a substantial portion of managerial influence is directed toward the intangible assets of organizations. The innovative nature of modern management therefore requires the continuous development of employees' knowledge and competencies. Overall, management in higher education extends beyond the administration of operational processes. It also encompasses the purposeful formation and development of organizational culture, corporate climate, productive teamwork, the enhancement of innovative capacity within micro-groups, and the adoption of best practices from other organizations. This demonstrates that the boundaries of traditional university management are expanding, while governance systems themselves are undergoing continuous modernization.

Information-managerial Competence Concept

In international scholarly research, the concept of information-managerial competency is increasingly examined within the context of digital leadership. The widespread use of the term “digital leadership” has emerged as a result of the evolution of information and communication technologies (ICTs) and the influence of the new digital era. In particular, the COVID-19 pandemic of 2020-2022 accelerated the transition to online learning, creating a demand for new digital competencies among higher education management personnel (Alqahtani & Rajkhan, 2020). Initially, a high level of proficiency in the use of information and communication technologies by employees was referred to as e-leadership. In the study conducted by Klus and Muller, the concepts of “e-leadership” and “digital leadership” are considered synonymous (Klus & Muller, 2020). However, Eberl and Drews argue that digital leadership is considerably broader concept than e-leadership, encompassing a wider range of organizational and transformational dimensions (Eberl & Drews, 2021). Jameson et al. define digital leadership as “a new interdisciplinary field of research that has evolved from studies related to the concepts of e-leadership and technology management”. This field draws upon research in educational technology, leadership studies, business management, and information sciences, integrating insights from these disciplines to address the challenges of leadership in digitally transformed environments.

With regard to digital leadership in higher education, Brown et al. associate it with digital literacy and inclusion. Their approach adapts a critical perspective on technology implementation to the broader socio-cultural context of higher education. To distinguish it from the business-oriented and educational technology (EdTech) perspectives of e-leadership, they introduce the concept of digital education leadership: “e-leadership is primarily concerned with the successful implementation of technology in teaching and learning practices. It emphasizes leadership in educational technology. Our concern goes beyond this to the fostering of leaders, who have the qualities to lead in a digital culture. They must have not only the means to provide knowledge in the effective use of educational technology, but also the capacity to foster a culture of collaboration, innovation and lifelong learning in evolving, digitally mediated societies. ... To mark this shift in focus, the preferred term is ‘digital education leadership’” (Brown et al., 2016).

Thus, an analysis of the scholarly literature demonstrates that digital leadership extends far beyond the execution of technical functions through ICT, as well as beyond the traditional management of goals, people, and organizational structures (Bresciani, 2021; Ordu & Naiyr,

2021). In the context of the digital transformation of higher education, the need for digital leadership is evident across all areas of university activity, including classrooms, meeting rooms, administrative offices, marketing departments, facilities management, and other institutional functions. The integration of digital leadership into higher education plays a crucial role in enhancing administrative functions by streamlining procedures, accelerating decision-making processes, improving administrative planning for more efficient resource utilization, and ensuring that quality standards remain aligned with ongoing technological developments (Maheshwari et al., 2024). Furthermore, it has facilitated the creation of new communication channels between educational administrators and staff, optimized operational processes, strengthened knowledge management practices, and improved coordination among managers, thereby fostering innovation within higher education institutions (Arham et al., 2023).

The information-managerial competency of heads of university structural divisions is examined in international scholarly literature within the framework of the concept of Digital Academic Leadership (DAL). Digital academic leadership serves as a key element in creating a learning environment enriched with meaningful educational experiences that contribute to the improvement of educational systems and the successful implementation of educational initiatives. It requires the effective performance of managerial functions such as planning, organizing, directing, supervising, and controlling through the application of appropriate and efficient technological methods.

Based on analysis of the scientific literature, the concept of information-managerial competency can be defined as follows: information-managerial competency is an integrative personal quality that encompasses the knowledge, skills, experience, and abilities required for the effective use of information technologies in performing managerial functions, such as planning, organizing, motivating, and controlling, as well as in addressing professional tasks and responsibilities. This competency enables leaders to make informed decisions, manage organizational processes efficiently, and adapt to the challenges of a digitally transformed educational environment.

The Essence of Information Management Competence

Information and managerial competency are widely recognized at the intersection of information competency and managerial competency. The essence of information competency lies in the ability to search for, obtain, analyze, and apply information. According to the

classical definition commonly cited in scholarly literature, information competency encompasses an individual's ability to recognize the need for information, locate it, evaluate its relevance and reliability, and use it effectively (Teixeira & Karim, 2023). Within this perspective, information competency is primarily understood as a set of skills related to working with information. More recent studies, however, view information competency as a broader and more complex capability that extends beyond technical skills alone. In this context, information competency includes the ability to search for information, critically evaluate it, interpret its meaning, and generate new knowledge based on acquired information. Researches argue that this competency is closely linked to an individual's need to bridge and "information gap" in the process of acquiring knowledge. Furthermore, information competency is considered a fundamental component of lifelong learning and critical thinking, enabling individuals to effectively navigate and adapt to rapidly changing information environments (Khanum & Bashir, 2021). According to the works of Teixeira and Karim, information competency is no longer viewed solely as an individual skill but is increasingly understood as a social phenomenon. From this perspective, information competency develops within specific contexts – such as education, professional activities, and everyday life – and is shaped by technological environments and social interactions (Teixeira & Karim, 2023). Furthermore, contemporary research frequently associates information competency with related concepts such as digital competency, media literacy, and computer literacy. Since these concepts have not yet been fully established theoretically, their boundaries remain indistinct and are interpreted differently across various disciplines (Mikhridinova, Wolf & Van, 2024). Based on an analysis of the literature, information competency can be defined as the combination of knowledge, skills, and values necessary for searching, critically evaluating, interpreting information, generating new knowledge, and using information effectively and ethically. Moreover, information competency is a multidimensional and dynamic construct that evolves and develops over time. Examining the evolution of the concept reveals that information competency was initially understood primarily as a set of information – search skills, whereas today it is regarded as a comprehensive competency encompassing cognitive, social, and ethical dimensions and is recognized as one of the key competencies of the twenty-first century. The set of professional abilities that enable a manager to ensure the effective functioning of an organization is referred to as managerial competency. It is considered one of the fundamental concepts in modern management, education, and organizational development. In scholarly literature, managerial competency is commonly defined as a

leader's ability to effectively perform core managerial functions, including decision-making, planning, organizing, monitoring, and communication.

Managerial Competence of University Department Heads

In contemporary research, managerial competency is generally conceptualized as a multidimensional construct that combines professional knowledge, practical skills, and values or personal attributes. Knowledge refers to an understanding of management theories, principles, and methods; skills represent the ability to perform managerial tasks and functions effectively; while values and personal attributes encompass responsibility, leadership, ethical behavior, professional integrity, and other characteristics that influence managerial performance. Thus, managerial competence extends beyond professional knowledge and expertise and incorporates the personal and behavioral characteristics required for effective management.

A significant contribution to the competency-based understanding of managerial performance was made by Boyatzis (1982), who conceptualized managerial competence in terms of behavioral characteristics associated with effective managerial performance. From this perspective, managerial effectiveness is determined not only by what managers know but also by how they apply their competencies in professional situations. Building on this perspective, managerial competence can be represented through several interrelated dimensions, including strategic, social and communicative, organizational, analytical, and leadership competencies. These dimensions reflect the ability of managers to formulate strategic goals, communicate and collaborate with stakeholders, organize and coordinate activities, analyze information, and provide leadership in changing organizational environments (Figure 1).



Figure 1. Structure of managerial competence

For university department heads, these dimensions acquire particular significance in the context of digitalization. Department heads operate at the intersection of academic, administrative, organizational and technological process and are increasingly required to coordinate information flows, interpret institutional data, communicate through digital environments, and make evidence-based managerial decisions. Therefore, managerial competence in contemporary higher education cannot be considered independently from the ability to effectively work with information and digital technologies.

Information Competence in the Digital Educational Environment

Information competence is commonly associated with an individual's ability to identify information needs, search for and access relevant information, critically evaluate its reliability, process and organize information, and apply it appropriately to solve professional problems and make decisions (Teixeira & Karim, 2023).

In a digitalized educational environment, the role of information competence becomes increasingly important because managerial process involve growing volumes of heterogeneous digital information. University department heads must work with institutional databases, student and staff information, academic performance indicators, regulatory documents, electronic communication systems, and other digital information resources. Consequently, information competence increasingly intersects with digital competence, data literacy, and analytical capabilities.

From this perspective, information competence should not be limited to the technical ability to locate information. It also includes the ability to critically evaluate information, distinguish reliable information from misleading or incomplete data, integrate information from different sources, and transform information into knowledge that can support managerial action. This broader understanding is particularly relevant to university department heads because information is not merely an object of professional activity but also a resource for planning, coordination, monitoring, evaluation, and decision-making.

Conceptualization of Information-Managerial Competence

The analysis of managerial and information competence suggests that these constructs are closely interconnected but emphasize different aspects of professional activity. Information competence concerns the ability to search for, evaluate, process, manage, and use information, whereas managerial competence concerns the effective performance of managerial competence

concerns the effective performance of managerial functions such as planning, organizing, coordinating, controlling, and decision-making. The integration of these two dimensions provides the conceptual basis for information-managerial competence. For the purpose of this study, information-managerial competence is conceptualized as: “an integrated capacity of university department heads to systematically acquire, critically evaluate, process, manage, and apply information and digital resources in performing managerial functions and making evidence-based decisions”.

This conceptualization emphasizes that information is not considered separately from management. Rather, the effective acquisition and processing of information are directly connected with managerial action. Accordingly, information-managerial competence encompasses several interrelated abilities:

- searching for and selecting relevant information to support managerial decision-making;
- critically analyzing and evaluating information and data;
- applying digital technologies and information systems in managerial activities;
- forecasting and planning on the basis of information and data;
- managing information flows within the department and across institutional stakeholders;
- using information to coordinate, monitor, and evaluate organizational processes.

Thus, information-managerial competence represents an integrative construct located at the intersection of information, digital, analytical, and managerial capabilities. This integration is particularly important under conditions of educational digitalization, where managerial decisions increasingly depend on the availability, quality, timeliness, and interpretation of digital information.

Digital Leadership as a Related Perspective

The conceptualization of information-managerial competence is also related to the emerging literature on digital leadership. International research suggests that digital leadership extends beyond the technical use of digital technologies and involves their strategic integration into leadership, organizational communication, decision-making, and institutional development. Ahlquist (2016), for example, identifies a range of competencies associated with digital leadership, including awareness of the changing digital environment, critical evaluation of digital technologies, into leadership practice, conflict resolution in digital environments, and the use of digital decision-making strategies. These competencies demonstrate that effective digital leadership involves more than technological proficiency. It requires managers, to integrate digital technologies digital technologies into organizational processes,

communication, decision-making, and institutional development. Domeni further develops this perspective by emphasizing that digital leadership encompasses not only technological capabilities but also interpersonal relationships, organizational culture, collaboration, and academic outcomes. From this perspective, effective digital leaders are expected to use technological innovations while simultaneously supporting organizational change, collaboration, and educational quality. The digital leadership perspective therefore reinforces the argument that the competence of university department heads in a digitalized environment should combine technological, information-related, analytical, and managerial dimensions. However, digital leadership itself does not fully explain the specific structure and development mechanisms of information-managerial competence. Therefore, it is treated in this study as a complementary perspective rather than as an equivalent construct.

Existing Competency Frameworks and Models

Several internationally recognized frameworks provide relevant foundations for conceptualizing the dimensions of information-managerial competence. These include the Digital Competence Framework (DigComp), the Skills Framework for the Information Age (SFIA), the PMI Talent Triangle, and relevant ISO standards (Table 1).

Table 1

Comparative Characteristics of Relevant Frameworks

Framework	Focus Area	Key Components	Strengths	Limitations
DigComp	Digital competencies	Information literacy, communication, content creation, safety, problem-solving	Comprehensive digital skills coverage	Limited managerial perspective
SFIA	Professional IT skills	Information management, data analytics, knowledge management	Practical, role-based structure	Complex implementation
PMI Talent Triangle	Project management competencies	Technical, leadership, strategic skills	Strong managerial focus	Weak information literacy component
ISO Standards	Governance and processes	Knowledge management, information security	Standardization and compliance	Not competency-oriented directly

The Digital Competence Framework (DigComp) provides a comprehensive conceptualization of digital competence, including information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving (Cosgrove & Cachia, 2025). Its particular relevance to the present study lies in its emphasis on information and data literacy as a fundamental dimension of professional digital competence.

The Skills Framework for the Information Age (SFIA) focuses on professional skills related to information technologies, data management, knowledge management, and analytics. Its role-based structure links professional skills with levels of responsibility, providing a common language for describing and developing professional capabilities (Brown, 2020). However, its primary orientation toward IT and information professionals limits its direct applicability to university department heads.

The PMI Talent Triangle provides a complementary managerial perspective by integrating technical project-management skills, leadership capabilities, and strategic and business management competencies (Karanja & Malone, 2022). Empirical research has also demonstrated the relevance of these dimensions to project and organizational performance (Sonelma & Sucita, 2022). Nevertheless, the framework does not explicitly address information literacy as a core component of managerial competence.

Relevant *ISO standards*, including ISO 30401 for knowledge management and ISO 27001 for information security, provide an organizational and process-oriented perspective. They emphasize knowledge management, information security, governance, and risk management (Behl, Behl & Dutta, 2021). However, these standards are primarily designed to establish organizational requirements and process rather than to provide an integrated competency-development model for educational managers.

Research Gap and Rationale for the Proposed Model

The comparative analysis of existing literature and competency frameworks reveals several limitations. First, previous studies have established the importance of digital, information, analytical, and managerial competencies for effective professional and organizational performance. However, these dimensions have predominantly been examined as separate or partially overlapping constructs.

Second, existing competency frameworks provide valuable but fragmented perspectives. DigComp emphasizes digital and information literacy; SFIA focuses on professional information and technology-related skills; the PMI Talent Triangle emphasizes managerial, leadership, and strategic capabilities; while ISO standards address information governance and organizational process. None of these frameworks, taken individually, provides an integrated structure specifically addressing the information-managerial competence of university department heads.

Third, the reviewed literature provides limited conceptual guidance on the relationships among information, digital, analytical, and managerial dimensions within a unified competency construct. In particular, insufficient attention has been given to how the ability to acquire, evaluate, process, and manage information is transformed into effective managerial action and evidence-based decision-making at the level of university departments.

Finally, although digital technologies are increasingly incorporated into professional development and educational management, there remains a lack of an integrated approach explaining how pedagogical conditions, development methods, and digital technologies can be systematically combined to develop information-managerial competence among university department heads. Therefore, the identified gap is not simply the absence of research on digital or managerial competencies. Rather, it concerns the lack of an integrated conceptual and technological that connects the structure of information-managerial competence with the pedagogical and technological mechanisms required for its development in the context of higher education digitalization. This gap provides the rationale for the present study and establishes the need to develop a conceptual and technological model specifically oriented toward university department heads.

Theoretical Framework

Based on the critical synthesis of the reviewed literature, the present study conceptualizes information-managerial competence as an integrative construct grounded in complementary theoretical perspectives.

The first foundation is the competency-based approach, which conceptualizes competence as an integration of knowledge, skills, values, and behavioral characteristics. This perspective provides the basis for determining the internal structure and levels of information-managerial competence. The second foundation is the information competence/information management perspective, which emphasizes the process of searching, evaluating, processing, organizing, managing, and applying information. This perspective defines the information-related dimension of the proposed construct. The third foundation is the managerial competence perspective, which focuses on planning, organizing, coordinating, controlling, leadership, analysis, and decision-making. It provides the managerial dimension of the construct. The fourth foundation is the digitalization and digital leadership perspective, which emphasizes the strategic use of digital technologies, digital information, communication networks, and data in organizational and managerial processes.

The theoretical integration of these perspectives can therefore be represented as follows:

1. Competency-based approach – knowledge, skills, values/attitudes.
2. Information competence – information search, evaluation, processing, management, application.
3. Managerial competence – planning, organizing, coordinating, controlling, leadership, decision-making.
4. Digital leadership – digital technologies, digital information environment, data-driven management.

This theoretical framework provides the basis for determining the components, principles, pedagogical conditions, technological tools, development mechanisms, and assessment criteria incorporated into the proposed model.

Method

Research Design

The study employed a design-oriented mixed-methods approach with an embedded mixed-methods design to develop, theoretically substantiate, and empirically validate a conceptual and technological model for developing the information-managerial competence of university department heads in the context of the digitalization of education. The quantitative component involved a survey-based assessment of information-managerial competency and statistical analysis of the collected data, including descriptive statistics, reliability analysis, and correlation analysis. The qualitative component was embedded within the expert evaluation and involved thematic analysis of participants' open-ended comments concerning the conceptual clarity, practical applicability, flexibility, assessment mechanisms, technological usability, and terminological consistency of the proposed model. The qualitative findings were used to complement and contextualize the quantitative results and to identify specific areas for refinement of the model.

The design integrated structured literature review, comparative analysis of established competency frameworks, quantitative survey research, conceptual synthesis, model construction, and expert validation. The embedded design was selected because the qualitative expert feedback served a complementary function, providing contextual explanations and practical insights that enriched the interpretation of the quantitative assessment and informed the refinement of the proposed model. This design was appropriate because the study's primary outcome was not measuring the effect of a specific intervention, but developing and

empirically substantiating a theoretically grounded framework that integrates information, managerial, digital, analytical, and decision-making competencies.

The study was conducted through four sequential and interconnected stages:

1. **Analytical stage** – identification and critical analysis of theoretical and empirical literature

and existing competency frameworks related to managerial, information, digital, and professional competencies.

2. **Conceptual stage** – synthesis of the identified theoretical perspective and empirical evidence to determine the structure and dimensions of information-managerial competence relevant to university department heads.

3. **Design stage** – development of the conceptual and technological framework, including its

components, approaches, principles, technological resources, and assessment criteria.

4. **Empirical validation stage** – empirical examination of the relevance of the identified competency dimensions through a survey of university department heads and validation of the proposed framework through expert assessment.

The methodological sequence established a direct relationship between the identified research gap, theoretical framework, empirical evidence, conceptual synthesis, and the resulting framework. The combination of quantitative and qualitative evidence enabled the proposed framework to be examined from both the perspective of its empirical relevance among university department heads and its content validity and practical applicability as evaluated by experts.

Literature Search and Selection

The theoretical and conceptual foundations of the framework were established through a structured literature search and critical analysis of scholarly publications addressing managerial competence, information competence, digital competence, digital leadership, information management, educational digitalization, and professional development of university managers. The literature search was conducted in Scopus, Web of Science, and ScienceDirect using combinations of relevant keywords and Boolean operators, including “managerial competence”, “managerial competency”, “information competence”, “information literacy”, “information management”, “digital competence”, “digital leadership”, “higher education management”, “university department heads”, “academic middle managers”, “competency framework”, “competence development”, and “digitalization of education”. The search

strategy combined broad conceptual terms with context-specific terms to identify both foundational theoretical contributions and contemporary empirical studies. For the main body of contemporary literature, preference was given to publications published between 2016 and 2026. However, seminal theoretical works and established competency frameworks were retained irrespective of publication year where they provided essential conceptual foundations for the study.

The following inclusion criteria were applied:

- peer-reviewed scholarly publications relevant to the research topic;
- studies addressing managerial, information, digital, analytical, or related professional competencies;
- studies concerning higher education management, academic leadership, university administration, or educational digitalization;
- publication describing or evaluating competency frameworks, models, standards, or approaches relevant to information, management, digital technologies, or professional development;
- seminal theoretical works providing conceptual foundations for the study; and
- publications available in English.

The exclusion criteria included:

- publications unrelated to the competence requirements of managers, educators, or information professionals;
- studies focusing exclusively on technical IT competencies without relevance to managerial or educational contexts;
- publications lacking sufficient conceptual or methodological information;
- non-scholarly materials, opinion papers;
- duplicate records; and
- publications for which the full text was unavailable.

The selected literature was analyzed thematically, with particular attention to conceptual definitions, recurring competency dimensions, relationships among managerial, information, and digital competencies, and limitations of existing competency frameworks. The results of this analysis provided the theoretical basis for identifying candidate dimensions of information-managerial competence.

Comparative Analysis of Existing Competency Frameworks

In addition to the scholarly literature, established competency frameworks and standards were comparatively analyzed to identify their potential contribution to the proposed framework. The analysis included the Digital Competence Framework for Citizens (DigComp), Skills Framework for the Information Age (SFIA), the PMI Talent Triangle, and relevant ISO standards addressing knowledge management and information security. Each framework was examined according to four analytical dimensions:

1. conceptual focus – the primary competence domain addressed by the framework;
2. competency components – knowledge, skills, capabilities, and behavioral characteristics included;
3. relevance to university department heads – applicability to managerial responsibilities in higher education; and
4. limitations and uncovered dimensions – aspects of information-managerial competence that are insufficiently represented within the framework.

The comparative analysis demonstrated that existing frameworks provide *complementary but fragmented perspectives*. DigComp contributes primarily to digital and information literacy; SFIA emphasizes professional information and technology-related skills; the PMI Talent Triangle provides a managerial, leadership, and strategic perspective; while relevant ISO standards emphasize governance, knowledge management, information security, and organizational processes. However, none of these frameworks was specifically designed to integrate information, digital, analytical, and managerial competencies for university department heads. Therefore, the frameworks were not adopted as complete models. Instead, their complementary elements were synthesized to establish the conceptual foundation of the proposed information-managerial competence framework.

Conceptual Synthesis and Framework Development

The conceptual synthesis integrated findings from the literature review and comparative framework analysis with the theoretical perspectives established in the study's theoretical framework. Four complementary perspectives served as the principal conceptual foundations:

- the competence-based approach;
- the managerial competence perspective;
- the information competence perspective; and
- the digitalization and digital leadership perspective.

The competence-based approach provided the basis for understanding competence as an integrated combination of knowledge, skills, values, attitudes, and behavioral characteristics. The managerial competence perspective informed the identification of managerial functions relevant to university department heads, including planning, organization, coordination, leadership, monitoring, analysis, and decision-making. The information competence perspective informed the identification of competencies related to information search, evaluation, processing, organization, management, and application. The digitalization and digital leadership perspective established the technological and organizational context within which these competencies are developed and applied. Based on this synthesis, information-managerial competence was conceptualized as an integrated capacity of university department heads to systematically acquire, critically evaluate, process, manage, and apply information and digital resources in performing managerial functions and making evidence-based decisions in a digitally transforming higher education environment. The preliminary conceptual and technological framework was subsequently subjected to empirical examination through a survey of university department heads and expert validation.

Participants and Sampling

Survey of University Department Heads

The quantitative component of the study involved 125 university department heads and academic administrators representing the target population of higher education managers whose professional activities are increasingly influenced by digital transformation. A purposive sampling strategy was used to recruit participants with relevant managerial experience in higher education institutions implementing or experiencing digital transformation. The selection focused on respondents occupying managerial positions involving planning, coordination, decision-making, information management, and organizational leadership. The survey sample consisted of 125 participants. Information concerning participants' professional position, years of managerial experience, and institutional characteristics was collected as part of the demographic section of the questionnaire.

Expert Panel

The empirical validation of the proposed framework was conducted through an expert panel. Experts were selected using purposive sampling, supplemented where necessary by professional-network and snowball recruitment. Eligibility criteria included:

- a doctoral degree or equivalent advanced academic qualification in a relevant field;

- at least five years of professional or research experience in higher education management, educational technology, information management, competency development, or a related area;
- demonstrated scholarly, professional, or administrative expertise relevant to at least one of the theoretical domains underlying the framework;
- current or recent affiliation with a university, research institution, educational organization, or relevant professional institution; and
- willingness to complete the evaluation instrument and provide substantive comments.

Experts were excluded if they did not meet the minimum qualification or experience requirements, lacked a demonstrable connection with the research topic, submitted an incomplete evaluation, or had participated in developing the framework in a manner that could compromise the independence of the assessment. The final expert panel comprised 21 experts representing higher education management, educational technology, teacher education, educational management, and digital education. Their characteristics are presented in Table 2.

Table 2

Characteristics of the Expert Panel (N=21)

Characteristics	Category	N	%
<i>Academic qualification</i>	PhD	13	62
	EdD	5	24
	Other doctoral degree	3	14
<i>Professional position</i>	Professor	9	43
	Associate Professor	7	33
	Senior Lecturer/Lecturer	5	24
<i>Field of expertise</i>	Educational Technology	4	19
	Teacher Education	2	9.5
	Curriculum and Instruction	2	9.5
	Educational Management	7	33
	Digital Education	6	29
<i>Years of professional experience</i>	5-10 years	4	19
	11-15 years	5	24
	16-20 years	8	38
	More than 20 years	4	19
<i>Institution affiliation</i>	Public universities	8	38
	Private universities	7	33
	Research institutions	6	29

Research Instruments

Two principal instruments were used in the empirical component of the study: a structured questionnaire for university department heads and a structured expert evaluation instrument for validating the proposed framework. Both instruments were developed based on the conceptual framework derived from the literature review and comparative analysis of established competency frameworks.

Survey Questionnaire

The questionnaire for university department heads was developed to assess the perceived importance and structure of competencies relevant to information-managerial competence in the context of educational digitalization. The questionnaire consisted of five sections:

1. demographic and professional characteristics;
2. digital competence;
3. information competency;
4. managerial competency; and
5. perceived challenges associated with digital transformation.

The competency-related items were operationalized through indicators identified during the conceptual synthesis. Digital competency included the use of digital tools and platforms, Learning Management Systems (LMS), data analysis tool, online communication, decision-making in digital environments, and adaptation to new technologies. Information competency included information search and selection, analysis and interpretation of information, data-driven decision-making, knowledge management and sharing, organization of information flows, and information security. Managerial competency included strategic planning and goal setting, managerial decision-making, leadership and teamwork, communication, change management, and coordination and control of organizational processes.

The competency-related items were measured using a five-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). The internal consistency of the competency scales was assessed using Cronbach's alpha coefficient. Reliability was evaluated separately for the digital competency, information competency, and managerial competency scales. A Cronbach's alpha coefficient of 0.70 or higher was considered indicative of acceptable internal consistency. The instrument was administered to 125 university department heads and academic administrators.

Expert Evaluation Instrument

A structured expert evaluation instrument was developed to assess the proposed conceptual and technological framework. The instrument consisted of two sections. The first section collected information concerning the experts' professional background and relevant experience. The second section contained statements corresponding to the principal components of the proposed framework. Experts evaluated the framework according to five criteria: relevance, completeness, coherence, clarity, and practical applicability. Each criterion was assessed using a four-point relevance scale for the content-validity assessment. Open-ended questions were

additionally included to allow experts to identify missing components, redundant elements, unclear formulations, and recommendations for improvement. The qualitative comments obtained from the 21 experts through the open-ended questions were subsequently analyzed thematically and used to inform the refinement of the proposed framework.

Data Collection Procedure

Data collection was conducted in two complementary phases. First, the quantitative survey was administered electronically to university department heads and academic administrators. Participants were informed about the purpose of the study and provided voluntary consent before completing the questionnaire. Second, the preliminary framework was submitted to the expert panel for independent evaluation. The expert validation was conducted electronically during February-August 2026. Each expert received an information sheet explaining the purpose of the study, the conceptual foundations of the framework, the evaluation procedure, and the expected time commitment. Experts independently evaluated the framework components and provided both numerical ratings and qualitative comments. The quantitative ratings were subsequently analyzed statistically, while the qualitative comments were examined thematically. The findings from both forms of evidence were used to identify components requiring clarification, modification, consolidation, addition, or removal.

Data Analysis

Quantitative Analysis

Quantitative data obtained from the survey of university department heads were analyzed using SPSS. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were calculated to examine participants' responses and the perceived importance of the proposed competency dimensions. The internal consistency of the questionnaire scales was assessed using Cronbach's alpha. Coefficients of 0.70 or higher were considered indicative of acceptable internal consistency.

Expert Data Analysis

Expert ratings were analyzed using descriptive statistics and the Content Validity Index (CVI). For content validation, ratings of 3 or 4 on a four-point relevance scale were considered evidence that an item was sufficiently relevant. The item-level Content Validity Index (I-CVI) was calculated using the following formula:

$$I - CVI = \frac{n_{3-4}}{N}$$

Where n_{3-4} represents the number of experts assigning a rating of 3 or 4, and N represents the total number of experts participating in the content-validity assessment. The Scale-level

Content Validity Index/Average (S-CVI/Ave) was calculated as the arithmetic mean of the I-CVI values across the five model components. In addition to quantitative ratings, qualitative comments provided by the experts were analyzed thematically. Comments were categorized according to major dimensions of the framework, including competence structure, pedagogical conditions, technological support, implementation procedures, assessment mechanisms, and practical applicability. Recurring recommendations and substantive criticisms informed subsequent refinement of the framework.

Integration of Quantitative and Qualitative Evidence

The quantitative survey, literature analysis, comparative framework analysis, and expert evaluation were integrated at the interpretation stage. The literature review and comparative analysis established the theoretical and conceptual foundation of the framework. The survey of 125 university department heads provided empirical evidence concerning the relevance and perceived importance of the competency dimensions in the professional context of university management. Expert evaluation subsequently provided evidence concerning the content validity, coherence, completeness, clarity, and practical applicability of the proposed framework. The integration constituted a form of methodological triangulation, allowing the framework to be supported through convergence of theoretical, empirical, and expert evidence.

Validity, Reliability, and Trustworthiness

Several procedures were employed to strengthen the validity, reliability, and trustworthiness of the study. Content validity was established through expert evaluation of the framework components and questionnaire items. The CVI provided a quantitative indicator of the relevance of the proposed components. Internal consistency reliability of the survey instrument was assessed using Cronbach's alpha. The obtained coefficients were above the commonly accepted threshold of 0.70, indicating satisfactory internal consistency of the measurement scales. The credibility of the findings was further strengthened through methodological triangulation, whereby evidence from scholarly literature, competency frameworks, the survey of university department heads, and expert assessment was integrated. Qualitative expert comments were analyzed systematically and used alongside quantitative indicators rather than being treated as anecdotal observations. This enabled the final framework to reflect both measurable expert judgments and substantive professional recommendations.

Ethical Considerations

The study followed established ethical principles for social science research. Participants were informed about the purpose, scope, and expected outcomes of the research before

participation. Participation was voluntary, and respondents were informed of their right to withdraw without negative consequences. No personally identifiable information was collected through the survey or expert evaluation. Responses were treated confidentially and used exclusively for academic purposes. Data were stored securely and were accessible only for research-related purposes.

Findings

Descriptive Statistics

Descriptive statistical analysis was conducted to determine how heads of university structural divisions assess the importance of various components of information-managerial competency in the context of educational digitalization. The findings revealed that respondents assigned a high level of importance to all dimensions of digital, informational, and managerial competencies.

The highest mean scores were observed for indicators related to digital competency, reflecting the growing significance of digital technologies within the higher education sector. The results also indicate that heads of university structural divisions recognize the integrated nature of competencies required in the context of digital transformation. They perceive digital, informational, and managerial competencies not as separate domains, but as interconnected components that collectively contribute to effective leadership and organizational performance in contemporary higher education institutions.

Reliability Analysis

The internal consistency of the three competency scales was assessed using Cronbach's alpha coefficient. The results demonstrated high internal consistency across the three dimensions: $\alpha = 0.88$ for digital competency, $\alpha = 0.85$ for information competency, and $\alpha = 0.90$ for managerial competency. All coefficients exceeded the commonly accepted threshold of 0.70, indicating satisfactory to high internal consistency of the measurement scales. These results support the reliability of the questionnaire for assessing the three competency dimensions in the study sample.

Correlation Analysis

To examine the relationships among the identified competencies, a correlation analysis was conducted. The results revealed statistically significant positive correlations among all three

competency domains, indicating that they develop interdependently and that the enhancement of one competency contributes to the strengthening of the others:

- digital competency and managerial competency ($r = 0.52, p < 0.01$);
- information competency and managerial competency ($r = 0.49, p < 0.01$);
- digital competency and information competency ($r = 0.57, p < 0.01$).

Based on the results of the empirical analysis, conceptual and technological models for the development of information-managerial competency were proposed.

Qualitative Findings from the Expert Evaluation

In addition to the quantitative assessment, qualitative comments from the 21 participants were analyzed using thematic coding. Six major themes were identified: conceptual clarity and coherence, practical applicability and implementation, flexibility and contextual adaptability, assessment and feedback, technological integration and usability, and terminological and structural refinement.

The most frequently reported theme was *conceptual clarity and coherence* (5 of the 21 experts, 23.9%). Participants generally considered the model logically structured but recommended clearer explanation of relationships between its components. One participant noted, “The relationships between some components should be explained more explicitly”. *Practical applicability and implementation* were identified by 3 experts (14.3%), who emphasized the need for clearer implementation procedures. As one participant stated, “Practitioners need clearer guidance on how to implement each stage.” *Flexibility and contextual adaptability* were mentioned by 4 experts (19%). Participants emphasized the importance of adapting the model to different educational contexts and available resources. *Assessment, monitoring and feedback* were identified by 2 experts (9.5%). Participants recommended strengthening evaluation indicators and feedback mechanisms. As one participant noted, “The assessment component would benefit from clearer indicators for monitoring implementation.” *Technological integration and usability* were reported by 3 experts (14.3%), particularly in relation to accessibility and ease of implementation (“The technological component should remain simple and user-friendly.”). Finally, *terminological and structural refinement* were identified by 4 experts (19%). Participants recommended clearer definitions and greater consistency in terminology. One participant noted, “Several key concepts require more precise definitions to ensure consistent interpretation”.

Overall, the qualitative findings complemented the quantitative results by identifying specific areas for refinement. The feedback supported the model's conceptual coherence and practical relevance while indicating the need for greater clarity, flexibility, usability, and consistency. These recommendations were incorporated into the revised version of the technological-conceptual model.

Conceptual Basis of Information-managerial competence

Based on an analysis of international and national scholarly research, the information-managerial competency of heads of university structural divisions in the context of educational digitalization is defined as “*an integrative personal quality of a leader that ensures effective management through the proficient use of information, digital technologies, and evidence-based decision-making*”. This competency reflects a leader's ability to effectively manage organizational processes by integrating information resources, digital tools, and analytical approaches to support informed and strategic decision-making in a digitally transformed educational environment. Accordingly, information-managerial competency is a complex and multidimensional construct that determines the professional effectiveness of heads of university departments in the context of the digitalization of higher education. This competency extends beyond the ability to work with information or make managerial decisions; it also integrates the capacity to effectively utilize digital technologies, manage knowledge, and coordinate organizational processes.

Based on the research findings and theoretical analysis, it was established that the structure of information-managerial competency consists of two interrelated components: information competency and managerial competency. Information competency enhances the quality of managerial decision – making by ensuring the effective implementation of information – related processes, while managerial competency integrates and coordinates these processes to ensure organizational effectiveness at the institutional level. Therefore, information-managerial competency possesses an integrative nature, creating a new qualitative level of governance within higher education institutions. It serves as a critical foundation for effective leadership in digitally transformed educational environments, enabling administrators to respond to contemporary challenges, support innovation, and promote sustainable institutional development. The conceptual framework of information-managerial competency is presented in Figure 2.

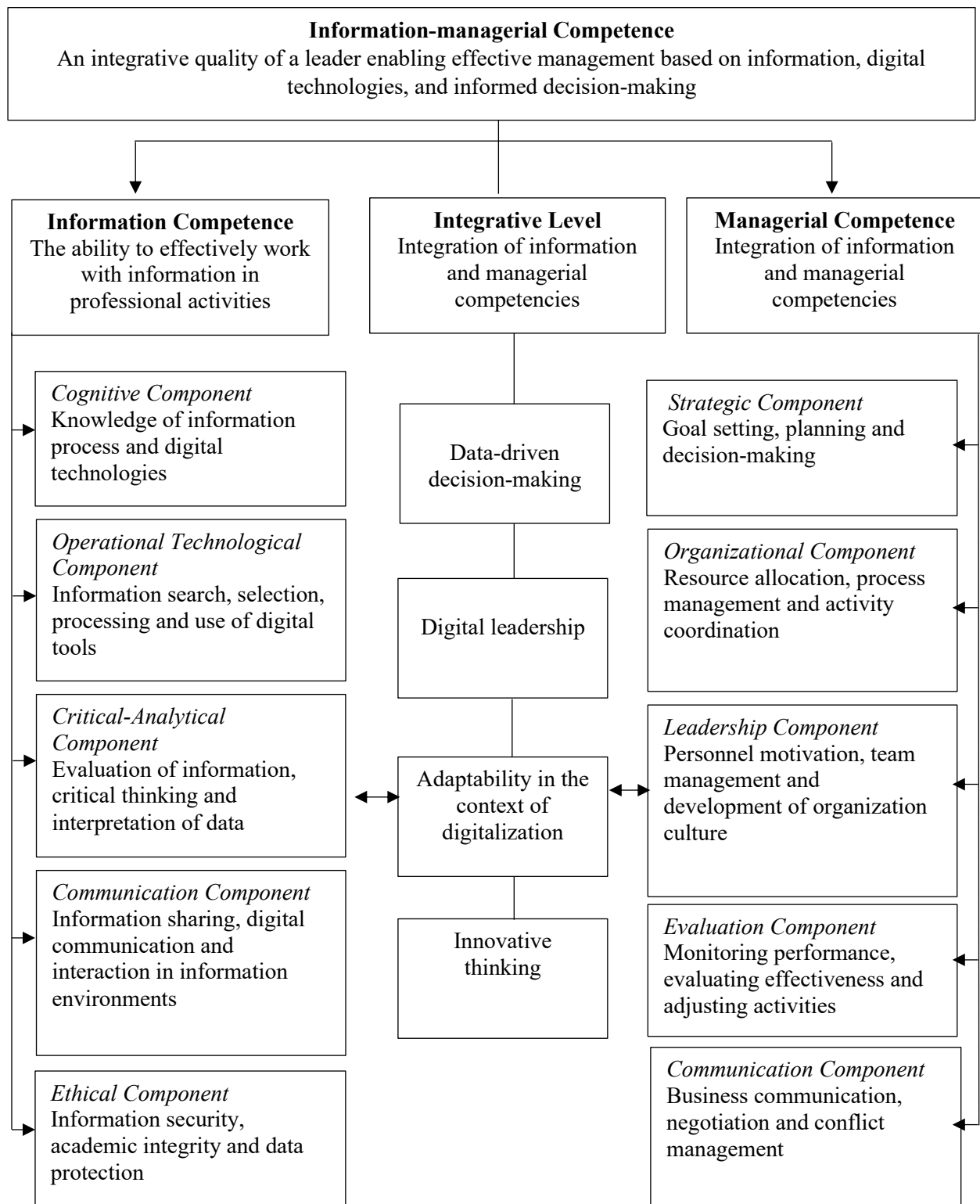


Figure 2. Conceptual framework of information and managerial competence

Source: developed by the authors based on a literature review

Technological Model of Information-managerial Competence of Heads of Structural Divisions of the University

The conceptual model of information-managerial competence has led to the systematization of this technological model. The proposed technological model for the development of information-managerial competence represents a structured and process-oriented system aimed at enhancing the professional capabilities of educational leaders in the context of digital transformation. The model is designed as an integrated framework consisting of six interrelated blocks, each performing a specific function within the overall process of competence development (Figure 3—please see appendix).

The *target block* defines the overall purpose and objectives of the model. The primary goal is to ensure the systematic development of information-managerial competence among education leaders. This includes strengthening their ability to work within information, apply digital technologies, and make informed managerial decisions. The objectives of this block focus on the development of both information-managerial competencies, as well as their integration into a unified professional capability.

The *methodological block* provides the theoretical foundation of the model. It is based on competence-based, system, activity-based, and digital transformation approaches, which collectively ensure a comprehensive understanding of competence development. The implementation of the model is guided by key principles, including integration, continuity, adaptability, and practice orientation. These principles ensure that the development process is consistent, flexible, and aligned with real professional tasks.

The *content block* specifies the key areas of competence development. It includes two main components: information competence and managerial competence. Information competence encompasses skills related to information analysis, the use of digital tools, data literacy, and ethical aspects of information use. Managerial competence includes strategic planning, decision-making, leadership, and communication skills. Together, these components form the substantive basis for the development process.

The *technological (process) block* represents the core for the model and describes the step-by-step process of competence development. The process begins with the diagnostic stage, where the initial level of competence is assessed. This is followed by the design stage, during which individual development trajectories are created.

At the implementation stage, participants engage in various learning activities, including training sessions, case studies, and project-based tasks supported by digital platforms. The

monitoring and feedback stage ensure continuous tracking of progress and provides opportunities for reflection and adjustment. Finally, the evaluation stage assesses the effectiveness of the model by comparing the competence levels before and after the intervention.

Tools and technologies block identifies the digital and methodological tools used throughout the implementation process. These include learning management systems, data analysis tools, digital dashboards, and communication platforms. The integration of these tools enhances the effectiveness of the model and supports data-driven decision-making.

The result block reflects the expected outcomes of the model implementation. These include improved decision-making, enhanced digital leadership, increased adaptability, and the integrated development of information-managerial competence. Ultimately, the model contributes to more effective management practice and supports sustainable professional development in the digital era.

As a result of the conceptual analysis and the systematization of the technological model, the structure of information-managerial competency and its key components were identified. However, it is insufficient to leave the proposed theoretical model solely at a descriptive level, since contemporary scientific research requires that any competency construct be empirically validated and measurable. Therefore, the need arises to operationalize the structural elements of information-managerial competency in order to ensure its accurate assessment. The process of operationalization requires each component of the competency to be described through specific and measurable indicators. On the one hand, this approach ensures the objectivity and reliability of research findings; on the other hand, it enables the practical application of the proposed model. Furthermore, competency assessment is not limited to identifying indicators but also involves determining the levels of competency development. Accordingly, the following section presents a system of indicators for the key components of information-managerial competency, along with descriptions of their respective developmental levels. These indicators provide a framework for evaluating the extent to which university leaders possess and demonstrate the competencies required for effective management in the context of educational digitalization.

Indicators and Levels of Information-managerial Competence

To empirically assess information-managerial competency, a system of specific indicators aligned with its structural components was developed. The proposed framework is based on information, managerial, and digital competencies, each of which is describes through

measurable indicators. These indicators provide a foundation for the development of survey instruments and enable the quantitative assessment of competency levels among heads of university structural divisions. The indicator system allows for a comprehensive evaluation of the competencies required for effective leadership in a digitally transformed educational environment. Furthermore, it facilitates the identification of strengths and areas for improvement, thereby supporting evidence-based professional development and institutional capacity-building initiatives (Table 3).

Table 3

Structural Components of Information-managerial Competencies and Their Indicators

Competencies	Description	Key indicators
Information competence	Characterizes the quality of working with data and knowledge	- ability to effectively search for and select relevant information; - ability to analyze and interpret acquired information; - data-driven decision-making skills; - knowledge management and sharing(knowledge sharing); - ability to organize information flows; - compliance with information security requirements.
Managerial competence	Reflects the ability to effectively manage organizational processes	- strategic planning and goal setting; - effectiveness and managerial decision-making; - leadership and teamwork skills; - communication skills; - change management; - coordination and control of organizational processes
Digital competence	Characterizes the level of proficiency in using modern technologies	- use of digital tools and platforms; - ability to work with Learning Management System (LMS); - use of data analysis tools; - organization of online communication; - decision-making in digital environments; - adaptation and implementation of new technologies.

Main Results

The findings of the study allow several important conclusions to be drawn. First, information-managerial competency is a complex and multidimensional construct. Therefore, in the context of educational digitalization, the integration of digital and information competencies with managerial capabilities is of critical and information importance. The results obtained indicate that effective leadership in higher education institutions requires a balanced combination of these interrelated competencies. Furthermore, the findings provide evidence for the necessity of developing a specialized and systematic model aimed at fostering information, digital, and managerial competencies among university leaders. Such a model would support the successful implementation of digital transformation governance in higher education.

Table 4*Levels of Assessment of Information-managerial Competence*

Low level	Medium level	High level
Uses digital tools in a limited manner. Lacks the ability to systematically analyze information. Makes decisions primarily based on personal experience or intuition. Experiences difficulties in managing organizational processes.	Able to use basic tools effectively. Demonstrates the ability to analyze and utilize information. Makes managerial decisions partially based on data and evidence. Possesses adequate teamwork and communication skills.	Applies digital technologies at a strategic level. Makes data-driven management decisions. Establishes an effective knowledge management system. Successfully implements organizational changes. Capable of managing innovation and digital transformation.

The findings from the different stages of the study demonstrated convergence across the main sources of evidence. The literature analysis identified information, managerial, digital, analytical, and decision-making competencies as recurrent dimensions of professional competence in digitally transforming educational environments. The comparative analysis of established competency frameworks further confirmed the relevance of these dimensions, while also revealing the fragmented representation of information-managerial competencies across existing frameworks. The survey findings from 125 university department heads provided empirical support for the relevance of these competency dimensions in the professional context of university management. In turn, expert evaluation confirmed the relevance, completeness, coherence, clarity, and practical applicability of the proposed framework. Thus, the theoretical, empirical, and expert evidence converged in supporting the inclusion of the identified competency dimensions within the proposed information-managerial competence.

Discussion

The findings of this study contribute to the growing body of research on the digitalization of higher education by providing both a theoretical and empirical foundation for understanding the content and structure of information-managerial competencies among heads of university structural divisions. While previous studies have primarily examined digital competencies integrates information-managerial components into a unified framework specifically focused on middle-level academic administrators.

The study demonstrated that the three core components of information-managerial competency-digital competency, information competency and managerial competency-form a closely interconnected and mutually reinforcing system. This conclusion is consistent with the

concept of digital leadership widely discussed in international scholarly literature. For example, Jameson et al. identify digital leadership as a key factor in implementing digital transformation within higher education institutions. The authors also emphasize the lack of theoretical consolidation and the absence of comprehensive models in this field (Jameson et al., 2022). The present study addresses this gap to a certain extent by proposing a clearly defined structure of information-managerial competency supported by specific indicators and empirical evidence.

The findings further revealed the leading role of digital competency within the overall competency framework. This conclusion aligns with the research of Sukandi, who identifies data-driven decision-making, virtual collaboration, and the development of a digital culture as key elements of digital leadership (Sukandi, 2024). Similarly, the results of the present study demonstrate that the effective use of digital tools by heads of university structural divisions is directly associated with enhanced managerial effectiveness.

In addition, Ghamrawi and Tamim identify five dimensions of digital leadership: digital competence, digital culture, digital differentiation, digital governance, and digital advocacy (Ghamrawi & Tamim, 2023). Conceptually, this model is closely aligned with the structure proposed in the present study. However, the distinctive contribution of this research lies in its integration of these digital leadership dimensions with information-managerial competencies, thereby offering a more comprehensive framework for understanding leadership effectiveness in digitally transformed higher education environments.

Novelty of the Study

The novelty of the study is reflected in several key aspects. First, conceptual and technological models were developed that integrate information competencies (data management, the use of digital tools, and cybersecurity) with managerial competencies (decision-making, strategic planning, and cybersecurity). These models provide a comprehensive framework for understanding the effectiveness of university governance in the context of digital transformation.

Second, the identified competencies were operationalized through specific and measurable indicators, and the relationships among them were established through a structured analytical approach. This contribution advances existing competency models beyond the descriptive level toward practical application and provides a foundation for future validation using advanced

analytical techniques such as Structural Equation Modeling (SEM) and Partial Least Squares Structural Equation Modeling (PLS - SEM).

Third, the study approaches digitalization not merely as a technological transformation but as *an organizational and managerial phenomenon*. Consequently, the primary focus is shifted from digital technologies themselves to the preparedness and competencies of managers who are responsible for their effective implementation and utilization.

The proposed model demonstrates that the effectiveness of competency development depends directly on its continuity, practice-oriented nature, and support from institutional policies. The findings indicate that one-time training initiatives are insufficient; instead, universities require systematic professional development programs integrated into their broader digital transformation strategies. This conclusion is consistent with previous research suggesting that the success of digital transformation depends less on technology itself and more on the managerial capacity and leadership capabilities of those responsible for guiding organizational change.

Significance of the Results of the Study for Kazakhstan

The findings of this study are particularly relevant to the higher education system of Kazakhstan. Although digitalization has been identified as a national priority, a noticeable gap remains between the implementation of digital technologies and their effective utilization at the managerial level. The present study highlights the need to address this challenge through the development of managerial competencies capable of supporting and sustaining digital transformation processes.

The proposed model can be applied within the Kazakhstan context as a framework for developing professional standards for university administrators, designing professional development and training programs, and enhancing management effectiveness. Furthermore, these findings are highly relevant in the context of the internationalization of higher education. The development of information-managerial competencies among university leaders can contribute significantly to strengthening the international competitiveness of Kazakhstan higher education institutions.

In the conclusion, the study demonstrates that the successful implementation of digitalization depends not only on infrastructural and technological changes but, above all, on the development of the human capital of managerial personnel. This conclusion provides an

important scientific and practical foundation for the sustainable modernization of Kazakhstan's higher education system.

The findings also highlight several conditions that may affect the successful implementation of the proposed information-managerial competency development model. The expert evaluation emphasized the importance of clear implementation procedures, practical guidance, contextual adaptability, and technological accessibility. In particular, participants noted the need for clearer guidance on implementing each stage of the model and emphasized the importance of adapting the model to different educational contexts and available resources. These findings suggest that the development of information-managerial competency requires not only technological solutions but also appropriate methodological support, accessible digital resources, and institutional conditions that facilitate implementation. Addressing these conditions may contribute to the sustainable integration of the proposed model into professional development and digital transformation practices in higher education.

Conclusion

This study was aimed at comprehensively examining the theoretical and practical aspects of developing the information-managerial competencies of heads of university structural divisions in the context of educational digitalization. The findings demonstrate that the effectiveness of management conditions of digital transformation largely depends on the extent to which leaders acquire and apply a new set of competencies required by the digital era.

In accordance with the conceptual model proposed in the study, information-managerial competency is substantiated as a multidimensional and integrative construct. In addition to the individual components of information-managerial competencies, the study identified a number of competencies that emerge from the synergy between these two domains, including data-driven management, digital leadership, adaptability in the context of digitalization, and innovative thinking.

The proposed technological model provides a systematic framework for the development of these competencies and highlights the necessity of aligning competency development initiatives with the university's digital transformation strategy. Furthermore, the model enables the identification of professional development pathways for heads of structural divisions, the refinement of performance evaluation criteria, and the enhancement of the quality of managerial decision-making in digitally transformed educational environments.

The result of the study indicate that the development of information-managerial competency should be implemented through a system of continuous professional development. In this regard, institutional support, methodological guidance, and the improvement of digital infrastructure at the university level play a crucial role in ensuring sustainable competency development.

From a theoretical perspective, the study expands the scientific understanding of educational management by clarifying the specific characteristics of managerial activities within digital environments. From a practical perspective, the proposed model and technological solutions may serve as effective tools for improving the quality of governance and strengthening institutional effectiveness in higher education institutions. Overall, the study confirms that the successful digital transformation of higher education depends not only on technological advancement but also on the ability of university leaders to effectively integrate information, managerial, and digital competencies into their professional practice. These findings provide a valuable foundation for future research and for the development of evidence-based strategies aimed at enhancing leadership capacity in higher education.

Research Limitations

The study has several limitations that should be acknowledged. First, the conceptual and technological model proposed in this research is primarily based on theoretical analysis and synthesis. Therefore, there remains a need for extensive empirical validation of the model. Future studies are encouraged to examine its validity using quantitative approaches, including Structural Equation Modeling (SEM) and Partial Least Squares Structural Equation Modeling (PLS-SEM).

Second, the study was conducted within the context of Kazakhstan's higher education system. As a result, the direct generalization of the findings to other national educational systems may be limited. Given the diversity of institutional, are needed to assess the applicability of the proposed model in different environments.

Third, the study examined the competencies of heads of university structural divisions at a general level and did not provide an in-depth analysis of differences across specific academic fields, such as technical, humanities, or social science disciplines. Investigating sector-specific variations in information-managerial competencies represent an important direction for future research.

Despite these limitations, the findings contribute to a more comprehensive understanding of the development of managerial competencies in the context of university digital transformation. The study provides both a theoretical foundation and a practical framework for further scholarly inquiry and supports the advancement of evidence-based approaches to leadership development in higher education. Moreover, it establishes a basis for future research aimed at refining, validating, and expanding the proposed competency model in diverse education contexts.

Conflict of Interest

The authors declare no conflict of interest in this article.

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APPENDIX

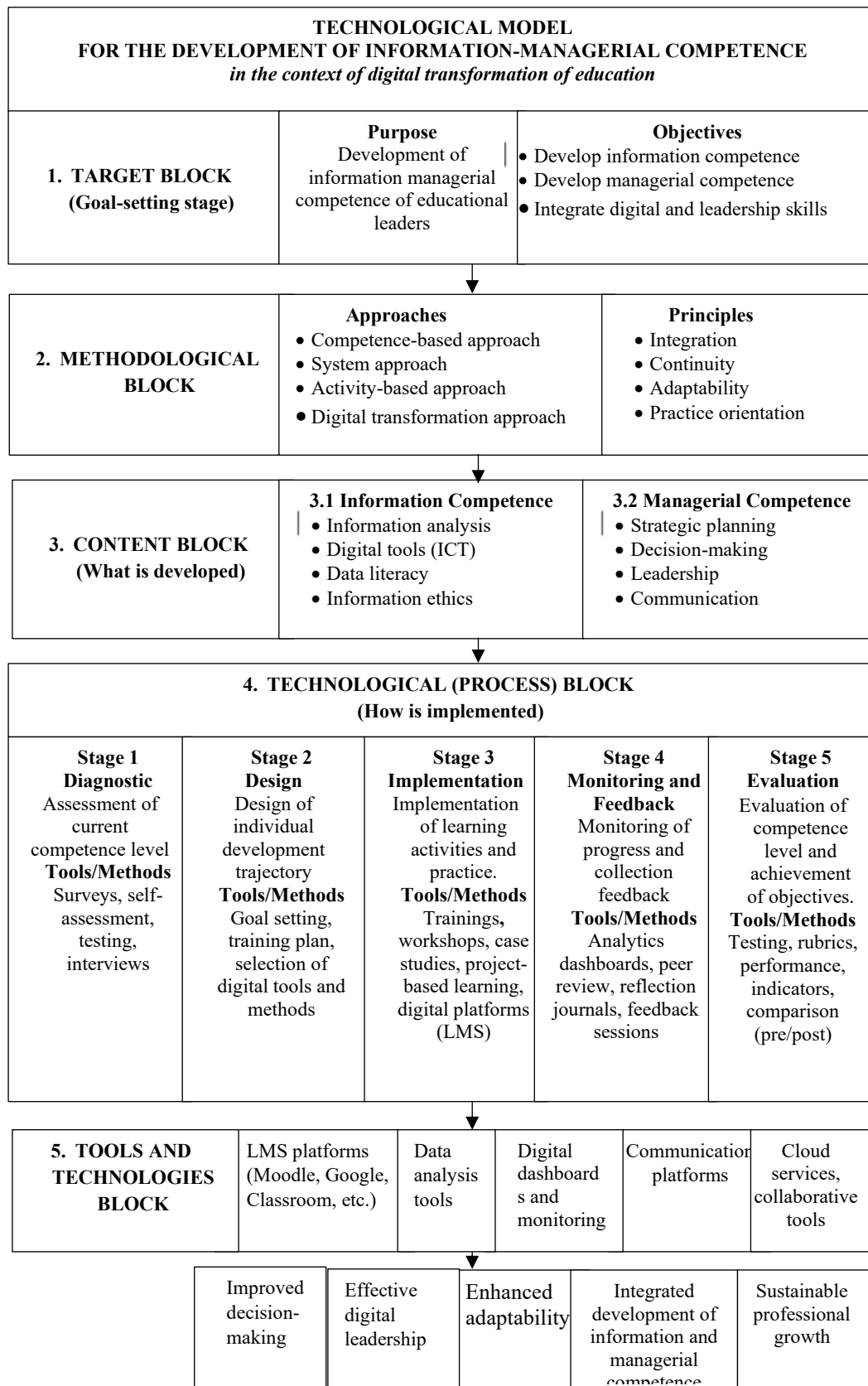


Figure 3. Technological Model for the Development of Information-Managerial Competence.

Source: developed by the authors based on a literature review