

O IMPACTO DAS TECNOLOGIAS DIGITAIS NAS PRÁTICAS REGULATÓRIAS DAS UNIVERSIDADES

THE IMPACT OF DIGITAL TECHNOLOGIES ON UNIVERSITY REGULATORY PRACTICES

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RESUMO

Objetivo: O artigo explora o impacto das tecnologias digitais nas práticas regulatórias das universidades, focando em como a transformação digital afeta os aspectos gerenciais e operacionais das instituições de ensino superior. O objetivo é analisar os desafios e oportunidades associados à integração de ferramentas digitais na regulamentação das universidades.

Metodologia: Foi adotada uma abordagem qualitativo-quantitativa, composta por uma revisão de literatura e uma pesquisa com especialistas realizada via e-mail. Especialistas na área de regulação do ensino superior foram entrevistados para compartilhar suas opiniões sobre os desafios enfrentados pelas universidades durante o processo de transformação digital. As respostas foram processadas usando o coeficiente de concordância de Kendall para avaliar a consistência das opiniões.



Originalidade: O estudo é único por focar nos problemas operacionais específicos que as universidades enfrentam ao reportar aos reguladores de ensino superior em meio à crescente influência das tecnologias digitais. Além disso, oferece uma perspectiva sobre como ferramentas digitais, como o Sistema Integrado de Informação para Educação Superior e Ciência (IISHES) e o Sistema Unificado de Antiplágio (UAPS), podem remodelar as práticas regulatórias no setor educacional.

Resultados: Os resultados revelam diversos desafios importantes, incluindo a natureza intensiva do trabalho de relatórios digitais, a necessidade de competências digitais mais robustas entre o corpo docente e administrativo das universidades, além do ônus financeiro para implementar e manter sistemas de TI. O estudo também destaca o potencial das ferramentas digitais para agilizar processos, reduzir a intervenção humana no processamento de dados e melhorar a precisão dos relatórios.

Conclusão: O artigo conclui que a transformação digital bem-sucedida das práticas regulatórias das universidades exigirá uma abordagem equilibrada, considerando tanto os benefícios quanto os potenciais riscos da crescente digitalização. Embora as ferramentas digitais ofereçam inúmeras vantagens, como maior eficiência e melhor gerenciamento de dados, também introduzem desafios relacionados à segurança da informação, custos financeiros e prontidão organizacional.

Palavras-chave: Transformação digital. Regulação universitária. Ensino superior. Sistema Integrado de Informação. Sistema de antiplágio. Tecnologias digitais.

ABSTRACT

Objective: The article explores the impact of digital technologies on university regulatory practices, focusing on how the digital transformation affects the managerial and operational aspects of higher education institutions. The goal is to analyze the challenges and opportunities associated with the integration of digital tools in the regulation of universities.

Methodology: A qualitative-quantitative approach was adopted, consisting of a literature review and an expert survey conducted via email. Experts in the field of higher education regulation were surveyed to gather their insights on the challenges faced by universities during the digital transformation process. The responses were processed using Kendall's coefficient of concordance to assess the consistency of the opinions.

Originality: The study is unique in its focus on the specific operational problems universities encounter when reporting to higher education regulators amidst the growing influence of digital technologies. It also offers a forward-looking perspective on how digital tools, such as the Integrated Information System for Higher Education and Science (IISHES) and the Unified Anti-Plagiarism System (UAPS), could reshape regulatory practices in the education sector.

Results: The findings reveal several key challenges, including the labor-intensive nature of digital reporting, the need for stronger digital competencies among university staff, and the financial burden of implementing and maintaining IT systems. The study



also highlights the potential of digital tools to streamline processes, reduce human intervention in data processing, and enhance the accuracy of reporting.

Conclusion: The article concludes that the successful digital transformation of university regulatory practices will require a balanced approach, taking into account both the benefits and potential risks of increased digitalization. While digital tools offer numerous advantages, such as improved efficiency and data management, they also introduce challenges related to data security, financial costs, and organizational readiness.

Keywords: Digital technology. Digital transformation. University regulation. Integrated Information System of Higher Education and Science. Uniform Anti-Plagiarism System.

INTRODUCTION

The higher education system is a key industry that shapes society's intellectual and professional potential. To ensure its high quality, many countries have implemented a regulation system over higher education, which inevitably transforms due to the advancement of digital technologies (Bodina & Telysheva, 2023). The historical development of university regulation illustrates the evolution from the traditional academic model governed by the church and private and public institutions, through mixed models focused on research and collaboration with industry, to internationalized models driven by innovation focused on entrepreneurship and collaborating in knowledge transfer with a broadly defined environment and international corporations (Maassen, 2017).

Literary sources exploring the evolution of higher education regulation highlight at least three models of universities: the first generation rooted in science, the second generation founded on science and research, and the third generation relying on science, research, knowledge transfer, and the commercialization of research (Beall, 2016). In the past decade, scientific sources have also been referring to the fourth generation of universities, although the nature of this concept is not defined, and neither are the foundations of its regulation. Researchers refer to broadly understood technology and equate University 4.0 with the electronic university, smart university, the university that manages knowledge in educational clouds (cloud-based university) (Ponomareva et al., 2023), or the university cooperating synchronously with Industry 4.0, which realizes the principles of sustainable development (Uskov et al., 2018; Zhang et al., 2020).



A common feature of many concepts of a modern university is closer cooperation with industry and stakeholders (Abad-Segura et al., 2020). Technological changes in industry (Industry 4.0) give impetus to the transformation of universities into entities that utilize advanced technologies, including artificial intelligence (Almaraz-Menendez et al., 2016), and to the creation of virtual environments that simulate the conditions in which economic entities operate (Seres et al., 2018). The operational strategies of modern universities need to account for the effects of their educational offer and their impact on the labor market, such as employment opportunities, the development of entrepreneurial skills, and the adaptation of graduates' training to the requirements of employers (Kaplan & Haenlein, 2016; Ybyraimzhanov et al., 2023).

Modern regulators of higher education (ministries, departments, etc.) seize the opportunities created by digital transformation and consider digital technologies a key factor in developing higher education regulation (Ponomareva et al., 2023). This stems from the difficulty of defining the end result of the transformation of the education system. The wave of technological change leaves many traditional universities trailing behind because they rely on older solutions, and subsequent technological revolutions do not allow them to address the ever-emerging new challenges (Rof et al., 2020).

The ongoing changes in universities suggest that the dominant scenario is a hybrid between open learning and global network scenarios (Lodge, 2018). The most distinctive features of regulation in this scenario likely include the regulation of universities' integration with the economy, both in research and training competent human resources (Cunha & Miller, 2014; Togaibayeva et al., 2023); external financing of education and research (Camilleri, 2021); and cooperation between universities and stakeholders based on sharing economy principles (Boer & Enders, 2017). Thus, this scenario will lead to the establishment of entrepreneurial universities of global reach, collaborating or working in networks (Markuerkiaga et al., 2014).

The regulation of University 4.0 operating in the cloud covers several issues associated with regulating the business architecture of the higher education unit, including ownership of the cloud itself, its content and accessibility, security, and provided services (Scott, 2021). Business architecture covers the organizational and ownership structure and technologies employed and how they are used in the university (Bronstein & Reihlen, 2014). The most commonly mentioned are public, private, hybrid, and community clouds (Bulla et al., 2016), and the systematic design methods include cloud computing deployment models (Kurelović et al., 2013).



Thus, the changes in the regulation of higher education in the near future will mainly be associated with the rising importance of digital technologies (Yakovleva, 2023). Most researchers agree that the transformation of university regulation at the current stage of digital technology development is rooted in the use of big data (Li & Zhai, 2018; Logica & Magdalena, 2015).

Big data can be characterized by a large volume, velocity, and variety of information resources that require new ways of processing to enable better decision-making and process optimization (Camargo Fiorini et al., 2018). However, the essence of big data goes far beyond the specifics of the data being collected, processed, and analyzed. P. Mikalef et al. (2018) point out that the pillar of this concept is the connections and relationships between data and information, which until recently were unobservable. The researchers suggest that big data involves analyzing vast amounts of data, including unstructured data, and the increasing importance of detecting correlations and causal relationships between them. M. Shorfuzzaman et al. (2019) describe big data as a set of data that cannot be managed using traditional research methods or technological tools due to its size and complexity. As suggested by B.K. Chae (2019), the term "big data" is used for data sets characterized by large volume, variety, real-time streaming, variability, and complexity. This data requires using innovative technologies, tools, and methods to draw new and useful insights from it.

Cloud computing is a technological field directly connected to big data (Banica et al., 2014). It is one of the most important innovations in modern information and communications technologies and business services, offering a powerful solution to process data on a massive scale at a high level of development (Pardeshia, 2014). The advantages of cloud computing include resource virtualization, parallelization, interoperability, and integration of data services with scalable disk space. Cloud computing not only allows minimizing the cost of hardware and computer systems but also reduces infrastructure maintenance costs and improves the efficiency of control over resources and access to them (Bouyer & Arasteh, 2014).

In this context, the present study aims to analyze the opportunities for transforming university regulation under the influence of evolving digital technology (Noronha et al., 2023, p. e01594).



METHODS

Consistent with the transformation of university regulation under the influence of evolving digital technologies, we adopted a qualitative-quantitative research approach in this study.

The data were collected between November 28, 2023 and February 28, 2024 through the analysis of scientific literature on the research problem, an e-mail expert survey, and the processing and analysis of its results.

In the first stage of the research, the sources of information necessary to fulfill the research goal were selected. The data was represented by articles and reviews published in journals indexed by Scopus and Web of Science. The search was conducted based on the keywords "digital technologies", "digital transformation", "university", "university regulation", and "regulator" in English and Russian in the title, abstract, and keywords. Based on the analysis of the source base, the study answered the research question: What are the main managerial and operational problems faced by universities in reporting to the higher education regulator?

In the second stage, an expert survey was conducted. E-mails with the proposal to participate in the survey were sent to 55 experts. The selection criterion for the expert pool was the presence of at least three articles on the research problem published in peer-reviewed journals. A total of 49 people agreed to participate in the survey. The letters forwarded to the experts also included a request to give their recommendations and reflections on the research problem in free form. All survey participants were informed about its purpose and the plans of its organizers to publish the results in a summarized form.

The outcome of the second stage was identifying the order of importance of the problems established through the literature review and answers to the question that remained unresolved after the literature review: What are the prospects of the digital transformation of university regulation?

After receiving the experts' responses, a follow-up letter was sent, asking them to rank the prospects of the digital transformation of university regulation by order of importance by assigning points. Following this, the rank of each of the perspectives was calculated according to the scores given by experts.



To improve the objectivity of expert survey data analysis, the consistency of expert opinions was measured through mathematical processing using Kendall's coefficient of concordance.

RESULTS

The analysis of scientific research and the expert survey results showed that universities face several managerial and operational challenges in reporting to the higher education regulator (Table 1).

Table 1. Managerial and operational problems faced by universities in reporting to the higher education regulator

No.	Problems	Source	Rank	Weight
1	Labor intensity associated with filling the database: the persons responsible for it bear an increasingly high cost of reporting activities, which is a focal point of financial costs for such organizations	J. M. Cunha and T. Miller (2014), A. Togaibayeva et al. (2023)	1	0.38
2	The need to strengthen the digital competencies of the dean's staff to correctly use the system and its elements and properly interpret the data and definitions and values assigned to them, which also implies an increase in budgetary expenditures	M. A. Camilleri (2021), H. D. Boer and J. Enders (2017)	2	0.25
3	The need to bear the investment costs of university IT systems and IT services and activities that enable the systems to communicate causing additional financial challenges	L. Markuerkiaga et al. (2014), C. Scott (2021)	3	0.21
4	The application of data culture in educational organizations: increased attention to not only data acquisition but to its continuous implementation, quality interpretation, and regular reporting by all interested parties – scholars, educators, administration, etc.	J. Bronstein and M. Reihlen (2014)	4	0.16

Note: compiled based on the expert survey; the concordance coefficient $W = 0.71$ ($p < 0.01$), showing a strong consistency of expert opinions

The experts believe that to transform university regulation, it is necessary to create an Integrated Information System for Higher Education and Science (IISHES) and a compatible Unified Anti-Plagiarism System (UAPS). These IT systems provide for improvements in the regulation mechanisms in the education sector (Table 2).



Table 2. Prospects of the digital transformation of university regulation

No.	Prospects of the digital transformation of regulation	Rank	Weight
1	Extensive consultations between the regulator and universities about expectations for the establishment of the IISHES and the UAPS compatible with it	1	0.35
2	Automation of reporting and data verification processes to bring human participation in data processing to the essential minimum	2	0.23
3	Providing the interpretive sequence for the obtained data, e.g., using primary support systems rather than only those proposed by the regulator managing the databases	3	0.19
4	Integration of the UAPS database with other databases or knowledge, which will improve the potential convenience of the UAPS	4	0.13
5	Creating knowledge (based on the information centralized in the UAPS) useful to university administration (e.g., by providing university leadership with dashboards allowing them to analyze data and information from their universities and other reference organizations)	5	0.10

Note: compiled based on the expert survey; the concordance coefficient $W = 0.72$ ($p < 0.01$), showing a strong consistency of expert opinions

DISCUSSION

The IISHES will become an extensive repository of data on Russian science and higher education and one of the largest state systems by the volume of collected data. The UAPS will provide support in countering violations of copyright and related rights legislation, having full access to a constantly updated database of written theses. The data entered with papers will be maintained by the IISHES.

The data from works checked by the UAPS are compared with the database of legal acts and judicial and administrative decisions and the OpenAccess document database. A dedicated unit of the Ministry of Education and Science will be tasked with managing the IISHES and UAPS. Importantly, the data processed by the IISHES are largely personal. Hence the collection, input into the system, disclosure, or other processing of IISHES data should also comply with the general provisions established by law, particularly those concerning the principles of processing personal data, its lawfulness, security, and the rights of data subjects.

IISHES data is subject to processing with advanced AI algorithms, which fits into the concept of big data (Li & Zhai, 2018). An even greater accumulation of data is possible by expanding the volume of collected information and introducing new modules, for example, the module "penalties to employees" (disciplinary, court decisions).



The growing demand for university data by the regulator does not currently consider the implications of these expectations for universities – financial, organizational, or managerial, involving rapid computerization of universities (hardware, software, competent staff) – which entails the risk of dissonance between these expectations and the capabilities of universities (Scott, 2021). The challenges of the digital transformation of university regulation far outweigh the traditional IT challenges. IT ecosystems are growing more complex (Rof et al., 2020), increasing coordination costs. There are other negative consequences, such as the risk of losing university employees, who become extremely attractive in the IT labor market when their digital competences are enhanced (Akhmetshin et al., 2024).

The constant expansion of the IISHES reporting system will be perceived not as an element contributing to the improvement of university management and regulation (as is often the case in the economic sphere), but as a traditional bureaucratic pressure that brings no significant benefit to the university (Akhmetshin et al., 2021b). Thus, digitalization in university regulation may be seen more as an unnecessary and burdensome necessity, rather than as a trend of operation contributing to the effective regulation of university activities.

The biggest threats to large databases are their security on the one hand and illegal use on the other (Bulla et al., 2016). In the coming years, as further progress is made in digital transformation, regulators and universities will be forced to focus on the security of information and processed data (Akhmetshin et al., 2021a). Legally, this refers to the obligation to consider data protection at the design stage and implement default privacy settings (Yakovleva et al., 2023). They introduce the responsibility to consider data privacy at every stage of the creation and operation (procedures, tools, software, data accumulation) of the system used for data processing. Privacy principles should be an element of every project involving personal data processing, and privacy protection is an integral part of it from the beginning of the project (Gallese Nobile, 2023). Each university must demonstrate that it meets the requirements before implementing new digital solutions.

CONCLUSIONS

Proper use of big data and other aspects of digital transformation can significantly contribute to the quality of higher education from the standpoint of students



and academic staff and to the formation of state educational policy with respect to the regulation of higher education. This potential, however, is fraught with several threats, including in the aspects of data security (unauthorized use of data by government agencies), culture (transformation of traditional academic culture into corporate culture), technology (further dependence of subjects in the higher education sector on subjects in IT industry), and management (growing dissonance between the regulator's expectations from reporting and the actual ability of digitally competent staff to provide this data within the expected timeframe and in the expected quality).

The fundamental issue lies in finding an approach to the possibilities of big data and cloud computing in the development of regulatory systems that would direct this potential towards creating value (knowledge and information to support decision-making) for all stakeholders rather than towards strict reporting and control measures important only for a limited group of regulatory officials.

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