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ANALYSIS OF THE IMPACT OF DIGITALIZATION ON COST MANAGEMENT IN THE EDUCATION SECTOR: CHALLENGES, OPPORTUNITIES AND PERSPECTIVES

Abstract

This paper analyzes the role of digitalization in cost management in educational institutions, as well as its impact on decision-making, budget optimization and the challenges schools face when implementing digital systems. Digitalization significantly transforms cost management in the education sector, offering new opportunities to improve efficiency and transparency. The subject of the paper is the relationship between digital technologies and cost optimization in schools through a quantitative and qualitative approach. The research is based on surveys conducted in primary and secondary schools, as well as on case studies that analyze the practical implementations of digital tools. The results show that the use of digital budgeting systems, automation of administrative processes, and digital communication platforms lead to a significant reduction in operating costs and increased control over resources. In conclusion, this paper suggests that digitalization can be a key factor in improving financial management in educational institutions, but its successful implementation depends on factors such as technological infrastructure, staff training and support from educational policies. The research offers recommendations for improving digital strategies in schools, with the aim of optimal use of resources and improving the educational process.

Keywords: digitalization, cost management, educational institutions, optimization, financial efficiency

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Introduction

In the modern education system, digitalization plays an increasingly important role in improving administrative and financial processes. Cost management in schools is a critical aspect of their functioning, and the application of digital tools and technologies enables greater efficiency, transparency and optimization of resources. In conditions of accelerated technological development, digitalization plays a key role in the transformation of various sectors, including education. With the increased use of digital tools, schools gain opportunities for improved resource management, automation of administrative processes and increased financial transparency. Cost management in the education sector is an essential aspect of the sustainability and quality of the educational process, and modern technologies enable a more efficient distribution of financial resources. The research is motivated by the growing need for cost optimization in educational institutions, transparency and efficiency in financial management, as well as traditional methods of managing budgets in schools that often face problems such as insufficient transparency, inefficient allocation of costs and heavy administrative burden. Digital systems, such as financial management software, electronic procurement systems and automated cost tracking systems, offer potential solutions to these challenges. However, there is insufficient research on the real impact of digitalization on cost optimization in schools, especially in the context of different educational systems and their readiness to implement such solutions. By analyzing good practices and experiences from different educational institutions, the paper will provide recommendations for improving processes through digital innovations, the perspectives and future directions of digitalization in schools, as well as insights and recommendations for improving digital practices in cost management.

Research objectives

Empirical research will provide a comprehensive insight into the impact of digitalization on cost management in the education sector. The research indicates that digitalization significantly improves cost management in schools by automating processes, increasing transparency and reducing administrative costs. However, to achieve maximum effect, it is necessary for schools to invest in staff training and in appropriate security measures for data protection. The purpose of the research in this paper is:

- To examine the theoretical basis of digitalization and its application in cost accounting;
- To analyze the advantages and disadvantages of digital cost management systems in schools;
- To examine the impact of digitalization on transparency and efficiency in budgeting;
- To conduct an empirical analysis of the experiences of educational institutions regarding digital cost management.

1. THEORETICAL BASES OF DIGITALISATION AND COST ACCOUNTING

1.1. Digitalization in education

Digitalization in the education sector represents a process of introducing and using digital technologies to improve administrative, teaching and financial processes.⁴ This process includes the automation of administrative operations, digital resource management and the application of advanced analytical tools for making informed decisions.

Modern technologies, such as cloud computing, artificial intelligence (AI), and blockchain technologies, have the potential to significantly transform the way schools manage their finances.⁵ Cloud systems enable the centralized storage and processing of financial data, which allows access to information in real time. Artificial intelligence can be used to analyze budget trends and forecast costs, while blockchain technologies can increase the security and transparency of financial transactions.

⁴ Brynjolfsson, E., & McAfee, A.: Machine, Platform, Crowd: Harnessing Our Digital Future, W. W. Norton & Company, New York, 2017, p. 78.

⁵ Hennessy, S., & London, R.: Digital Transformation and Educational Management: A Global Perspective, Springer, Berlin, 2019, p. 150.

In addition, digitalization in the education sector is not only about the automation of administrative processes, but also about improving transparency and efficiency in the spending of public funds. This leads to better management of resources and minimizing the possibility of errors or misuse.

1.2. Basic principles of cost accounting in educational institutions

Cost accounting is the process of collecting, processing, and analyzing financial data in order to improve the efficiency of resource management. In educational institutions, this process is crucial for decision-making, optimizing costs, and improving financial accountability.⁶

According to classical accounting principles, school costs can be divided into several categories:⁷

- *Fixed costs* – costs that remain unchanged regardless of the number of students or the operational activities of the school.
- *Variable costs* – costs that change depending on the needs and activities of the school.
- *Capital expenditures* – long-term investments that schools make to improve working conditions.

Effective management of these costs is crucial for ensuring financial stability and improving the quality of education.

1.3 . The relationship between digitalization and cost management

Digitalization has a direct impact on cost management in educational institutions, as it enables automated and more efficient methods for monitoring and analyzing financial flows.⁸

6 Miller, J. A.: Smart Budgeting in Education: Digital Tools for Financial Management, Routledge, New York, 2020, p. 85.

7 Selwyn, N.: Education and Technology: Key Issues and Debates, Bloomsbury Publishing, London, 2016, p. 220.

8 Thompson, S. L.: Cost Efficiency through Digital Financial Systems in Higher Education, Springer, London, 2021, p. 175.

Digital expense management systems enable:⁹

- *Automation of financial reports* – Instead of hand-written reports, schools can use software tools that generate detailed and accurate financial reports with minimal human intervention.
- *Real-time budget analysis* – Digital platforms enable continuous monitoring of the spending of funds, which allows for better control over the budget and timely decision-making.
- *Integration of financial data with other administrative processes* – Through digital systems, financial information can be linked to student management, payroll, and instructional resource systems, enabling more efficient use of resources.

In practice, schools that use digital financial systems experience significant reductions in operating costs, enhanced transparency, and a lower risk of errors or misuse.¹⁰ Digitalization not only simplifies cost management, but also enables better allocation of resources, leading to improved quality of education. Integrating modern technologies into financial management is a key step to increasing the efficiency and sustainability of educational institutions.

2. EMPIRICAL ANALYSIS OF THE IMPACT OF DIGITALISATION ON COST MANAGEMENT

2.1 . Research methodology

The research was conducted via Google Forms, a survey with the participation of principals, financial managers, accountants and administrative staff in 100 schools in the Republic of Macedonia. The aim of the survey was to obtain statistical data on the use of digital systems in schools and their impact on cost management. The survey contained 5 key questions, focused on digitalization in cost management.

9 Westerman, G., Bonnet, D., & McAfee, A.: *Leading Digital: Turning Technology into Business Transformation*, Harvard Business Review Press, Boston, 2014, p. 200.

10 Christensen, C. M., Horn, M. B., & Johnson, C. W.: *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns*, McGraw-Hill Education, New York, 2011, p. 98.

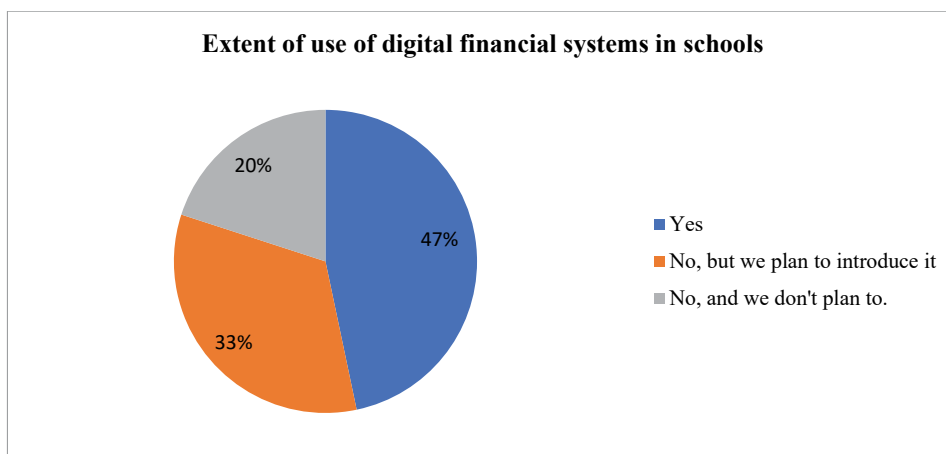
2.2 . Survey results

Table 1. Extent of use of digital financial systems in schools

Question 1: Does your school use a digital expense management system?	
Possible answers	Results
1. Yes	47 (47%)
2. No, but we plan to introduce it	33 (33%)
3. No, and we don't plan to	20 (20%)

Source: authors` own calculations

Chart 1. Extent of use of digital financial systems in schools



Source: authors` own calculations

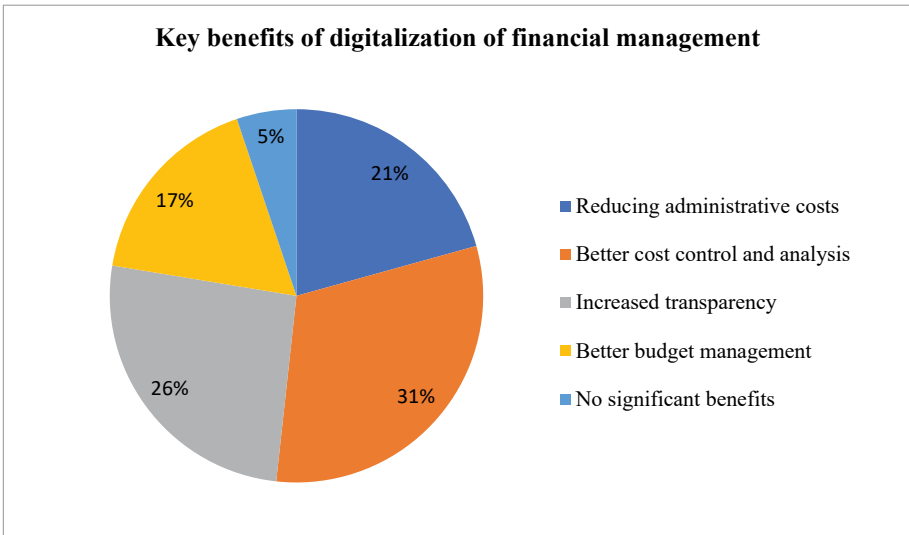
The results show that 47% of schools already use a digital cost management system, 33% plan to introduce one, while 20% have no such intention. This indicates that most schools are committed to digitalization, but there remains a portion of them that still do not see the need or opportunity for implementation.

Table 2. Benefits of digital financial systems

Question 2: What benefits have you noticed since the introduction of digital systems? (Multiple answers possible, the number represents the frequency of responses)	
Possible answers	Results
1. Reducing administrative costs	40 (40%)
2. Better cost control and analysis	60 (60%)
3. Increased transparency	50 (50%)
4. Better budget management	33 (33%)
5. No significant benefits	10 (10%)

Source: authors` own calculations

Chart 2. Benefits of digital financial systems



Source: authors` own calculations

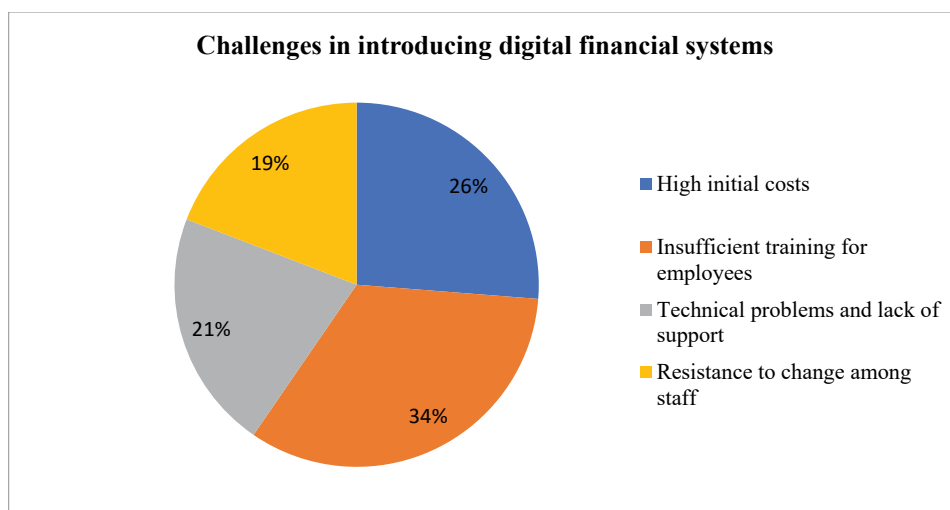
The most common benefits of digitalization include better cost control and analysis (60%) and increased transparency (50%). Around 40% of respondents point to a reduction in administrative costs, while only 10% consider there to be no significant benefits. This indicates a positive impact of digital tools on financial efficiency.

Table 3. Main challenges in implementing digital systems

Question 3: What are the main challenges in introducing digital financial systems ?	
Possible answers	Results
1. High initial costs	37 (37%)
2. Insufficient training for employees	47 (47%)
3. Technical problems and lack of support	30 (30%)
4. Resistance to change among staff	27 (27%)

Source: authors` own calculations

Chart 3. Main challenges in implementing digital systems



Source: authors` own calculations

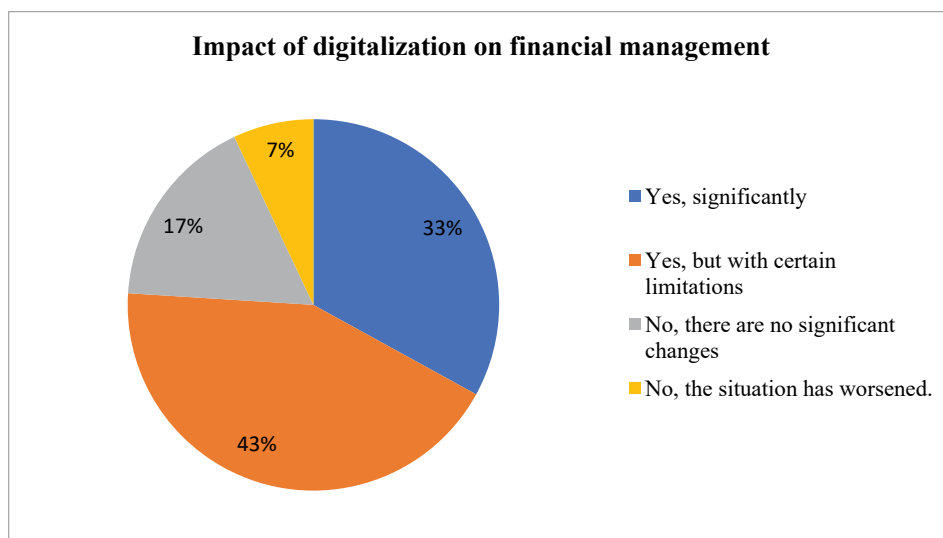
The main obstacles to introducing digital financial systems are insufficient training for employees (47%), high initial costs (37%), technical problems and lack of support (30%), and resistance to change among staff (27%). These results show that in addition to financial barriers, better education and technical support for employees is necessary to enable a more successful implementation.

Table 4. Impact of digitalization on financial asset management

Question 4: Do you think that digitalization has improved the management of school's financial assets?	
Possible answers	Results
1. Yes, significantly	33 (33%)
2. Yes, but with certain limitations	43 (43%)
3. No, there are no significant changes	17 (17%)
4. No, the situation has worsened	7 (7%)

Source: authors` own calculations

Chart 4: Impact of digitalization on financial asset management



Source: authors` own calculations

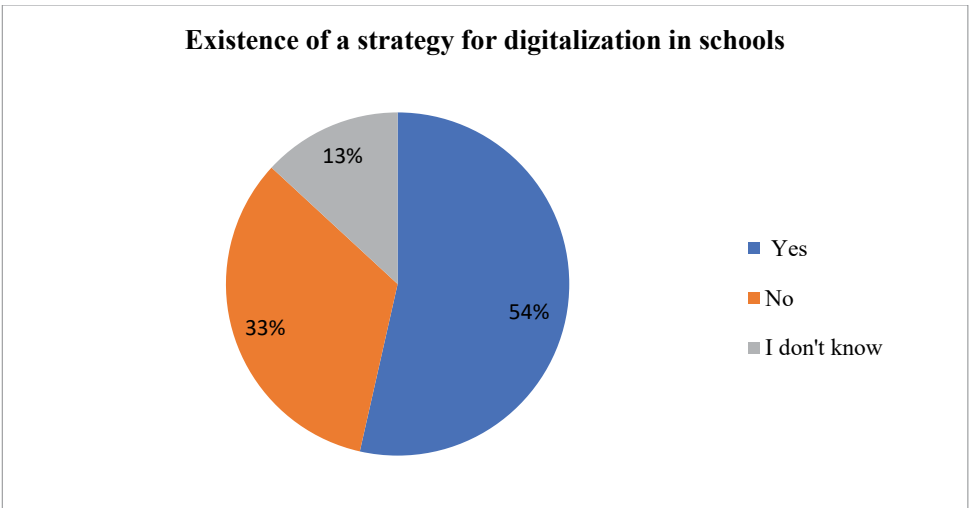
According to the results, 43% of respondents believe that digitalization has improved financial management, but with certain limitations, 33% say that it has significantly improved it, while 17% do not see significant changes, and 7% believe that the situation has worsened. This indicates that digitalization brings positive results, but not always to the expected extent.

Table 5. Strategy for digitalization of accounting processes

Question 5: Does the school have a strategy for digitalizing accounting processes?	
Possible answers	Results
1. Yes	53 (53%)
2. No	33 (33%)
3. I don't know	13 (13%)

Source: authors` own calculations

Chart 5: Strategy for digitalization of accounting processes



Source: authors` own calculations

More than half of the schools (53.3%) have a strategy for digitalization of accounting processes, which shows awareness of the importance of technological solutions. However, 33.3% of schools do not have such a strategy, while 13.3% of respondents are not familiar with this topic, which shows that not all educational institutions are ready for a full digital transformation.

3. RECOMMENDATIONS

1. Introduction and development of comprehensive digital cost management systems - it is advisable for schools to invest in integrated cost management software solutions, which will allow for greater transparency and budget control.
2. Training administrative staff to work with new digital technologies and skills - administrative staff should be trained in the use of digital tools for financial management, which will increase their efficiency.
3. Process automation, cybersecurity and data protection - the implementation of automated financial management systems can help reduce administrative burden and eliminate errors in manual cost management. With the increased use of digital systems, schools need to invest in measures to protect sensitive financial and administrative data.
4. Evaluation of the effects of digitalization - continuous monitoring and evaluation of digital reforms is recommended to improve their implementation.

Conclusion

Digitalization plays a key role in the modernization of cost management in schools, with significant advantages in the optimization of processes, improvement of efficiency and transparency. Digitalization not only redefines the role of cost management in schools, but also opens new avenues for innovation in the education sector. The introduction of digital tools and platforms for monitoring and managing financial resources brings significant opportunities for improving financial planning and control. The application of advanced analytical tools and automation of administrative processes increases efficiency and minimizes the human factor in financial management, which reduces the possibility of errors and irregularities. Digital platforms also enable greater visibility and control of costs, which can lead to better resource allocation and sustainability in the long term. However, as noted during the research, barriers to the implementation of digitalization in some schools include insufficient funding, lack of technical support and resistance to change on the part of staff. By improving the infrastructure, creating training and skill development programs for teaching and administrative staff, as well as improving coordination between government institutions and educational

institutions, a more suitable environment for integrating new technologies can be created. Although digitalization brings positive effects, successful implementation requires a systematic approach, support from institutions and a long-term strategy that will ensure continuous development and adaptation of new technologies. The prospects for the future of digitalization in education are positive, but success depends on the ability of schools to adapt to rapidly changing technologies and to fully utilize their potential.

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