

ANALYSIS OF CLOUD TECHNOLOGY ADOPTION IN ROMANIAN PUBLIC INSTITUTIONS: IMPLICATIONS FOR SECURITY AND CONFIDENTIALITY

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Abstract: In the context of the increasingly digitized society, the adoption of cloud technologies in public administration becomes more relevant and necessary [1]. This study focuses on assessing the degree of cloud service utilization in public institutions in Romania, as well as on analysing the ethical and security implications associated with this adoption. Utilizing a quantitative research approach, data were collected through questionnaires delivered via Internet and collected for 30 days. The research questionnaire comprised 23 questions of various types and the results highlight that only a small part of Romanian UATs actively use cloud services, with a significant difference between rural and urban areas. The main observations indicate that the predominant use of cloud services is limited to file sharing through public platforms such as Google Drive or OneDrive, which may pose security and data confidentiality risks. In contrast, the utilization of cloud services from specialized providers is significantly lower, which could represent an opportunity for improving security and operational efficiency. In light of these findings, the article proposes discussions and recommendations regarding the promotion of more responsible and ethical use of cloud technologies in Romanian public institutions, considering the need to balance operational benefits with respect for citizens' rights and data protection. Through this endeavour, the aim is to contribute to the consolidation and renewal of the digital infrastructure of public administration, for the benefit of efficient and transparent governance.

Keywords: Cloud technology, Digitalization of public sector, Data security

JEL Classification: M15, O32, O33, H83

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Introduction

The digitalization of public administration is a crucial element for the modernization and increased efficiency of the services provided to citizens [2]. The study conducted by the research team at "Alexandru Ioan Cuza" University of Iași examines the degree of digitalization within the town halls and county councils of Romania. It aims to identify both the progress made and the challenges encountered in the implementation of digital technologies in public administration. According to preliminary data, digitalization involves improving communication with citizens [2] by utilizing modern technologies designed to enhance the efficiency and transparency of administrative processes [3]. However, the study emphasizes the importance of skilled and adaptable human resources as key determinants of the success of the digitalization process.

In this study, the researchers addressed essential aspects related to digital infrastructure, the digital competencies of employees, and the availability of online services for citizens. Furthermore, the need for an adequate legislative framework and a coherent strategy for implementing digital solutions was highlighted. The research originates from the DESI (Digital Economy and Society Index) indicator, where Romania ranked last in 2022. Despite this position, there is a significant gap in understanding how the data contributing to this indicator is collected and analyzed. Our study proposes a different approach, moving beyond traditional quantitative analysis and focusing on a qualitative research methodology using the ADKAR model [4]. This methodology explores crucial aspects of communication between local public administration and citizens, emphasizing the role of human resources in the digitalization process. We aim to demonstrate that, with adequate information and openness to change among staff, the process of integrating digital technologies can become a true success, thus contributing to improved transparency and communication in public administration.

Research methodology

The current research aims to investigate the degree of cloud technology adoption in public institutions in Romania, with a focus on analyzing the implications for data security and confidentiality. The research employed a quantitative approach, based on the administration of a structured questionnaire, which was distributed to a representative sample of administrative-territorial units (ATUs) across the country.

Instrument and data collection

For this study, data was collected over a one-month period, from November 23 to December 22, 2023 [5]. The researchers distributed questionnaires via email to a total of 3,186 administrative-territorial units (ATUs). The dissemination process involved several waves of emails, employing the Mail Merge technique to customize the questionnaires for each county. In total, 6,990 emails were sent, resulting in 568 complete responses, which corresponds to a response rate of 17.83%. This rate is superior to the author's estimation rate of 15%. The response's distribution by counties and regions are available in Fig.1 and Fig.2 [5].

The research was based on questionnaire technique and the instrument was structured into 23 questions [4],[5], focusing on the following aspects:

- Technological Infrastructure - analyzing the types of equipment and software applications used within the administrative institutions.

- Cloud Technology Usage – aims to extract the types of cloud services utilized, the purpose of their usage, and preferred providers.
- Perceptions and Attitudes – address the concerns related to data security and confidentiality, as well as openness to the adoption of new technologies.

The questions were a mix of closed, semi-open, and multiple-choice formats, allowing for detailed and comparative analysis of the collected data.

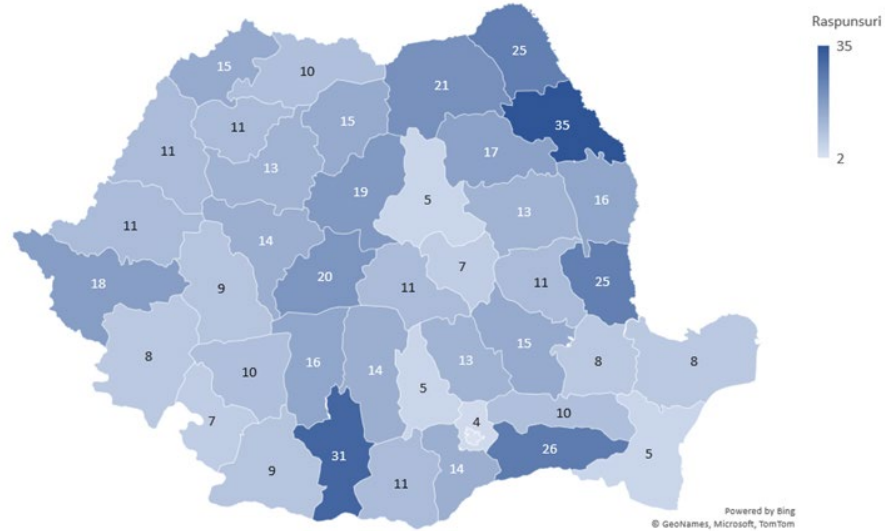


Fig.1 – The number of responses per county on the last day of collection date

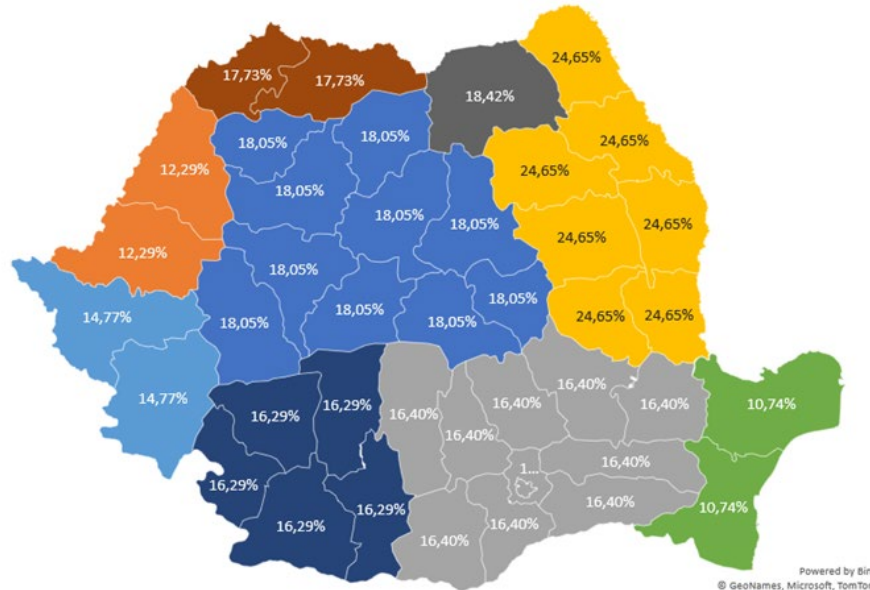


Fig.2 – The number of responses per region on the last day of collection date

Challenges in data collection

One of the major challenges [5] encountered during the data collection process was gathering accurate contact information for the town halls across the country. Initially, we expected to find updated contact details for these institutions on government or prefecture websites. The process began by downloading a dataset from the data.gov.ro platform, which provided information on 3,278 administrative-territorial units (UATs). However, the

dataset was incomplete, containing only 482 email addresses and 531 website links. This represented just 14.7% of the total UATs for email addresses and 16.2% for websites. To address this limitation, we employed a combination of web scraping techniques and manual corrections to gather a more comprehensive dataset. This effort resulted in the collection of 3,186 town hall addresses, as well as the contact information for 42 prefectures and county councils [5]. However, this method was not without difficulties. In many cases, the official websites of town halls were either non-functional or provided outdated contact details. For example, some town halls displayed one email address on their website, while county council sites listed older contact information. Additionally, a significant portion of town halls relied on Yahoo Mail as their primary email provider, and we even encountered instances where town halls lacked both email addresses and dedicated websites. Instead, they were hosted on third-party presentation portals, which indicates the limited technical resources available to some local administrations. Creating and maintaining a website or email server requires specialized skills and can be costly, explaining the absence of these infrastructures in many UATs.

Data Analysis Method

The collected data was centralized and processed using the SPSS (Statistical Package for the Social Sciences) software. In order to analyse data, the authors applied the following analytical methods: Frequency Distribution (to determine the proportion of ATUs utilizing different types of cloud services), Comparative Analysis (urban versus rural areas to highlight differences in technology adoption), Hypothesis Testing (applying the chi-square test and logistic regression analysis to explore the relationships between key variables).

Preliminary solutions

Based on this preliminary analysis, the solution consists in the implementation of a government cloud in the form of a SaaS (Software as a Service) solution. This would provide UATs with limited technical resources access to essential services, such as website and email hosting. In our study, we identified several private-sector e-Government platforms, such as Regista, CityOn, and CityManager, which already support UATs in their digitalization efforts. The establishment of a centralized cloud service could help standardize and streamline digital services, improving communication and operational efficiency in public administration. By offering a unified solution, the government cloud could alleviate the technical and financial burden on local administrations, contributing to the broader digital transformation of public institutions.

Results and Discussion

The research mainly focus on a specific portion of a broader study conducted on the digitalization of public administration in Romania. Accordingly, we have formulated the following research hypotheses:

Hypothesis 1: The majority of public institutions in Romania use computers/laptops connected to the internet and licensed office software applications.

Hypothesis 2: Public institutions in Romania frequently use digital cloud storage services and audio-video communication platforms to facilitate interaction and administrative efficiency.

To achieve our objectives, we analyzed the responses to two key questions from the questionnaire. These questions addressed the types of equipment, software, and subscriptions used in the institutions (Q1) and whether specific cloud storage and communication services were being utilized (Q2). According to the results of the study, hypothesis H1 is validated. Thus, a significant percentage of public institutions use equipment connected to the Internet and licensed software for office activities. The study indicates that the basic infrastructure, including computers and software necessary for administrative activities.

Hypothesis H2 is partially validated. Although many public institutions use digital cloud storage spaces, such as OneDrive and Google Drive, and audio-video communication platforms, the use of these technologies is not yet prevalent. The study revealed that although there is an adoption of these technologies, it is not at a very high level, suggesting that there is room for improvement and an increase in the use of these solutions in public institutions. The results of our study, for the two mentioned questions and tested hypothesis, reveal that:

- 84.28% of ATUs in urban areas use the basic resource of digitization (computers connected to the internet), while the rural areas have adopted this technological solution at a rate of 90.63%.
- 10.93% (62) of respondents stated that they do not use computers connected to the internet, but among them:
 - 46.77% (29) use cloud subscriptions
 - 27.41% (17) use dedicated applications
 - 37.09% (23) use licensed applications
- none of the respondents who declared that they do not use computers connected to the internet use open-source applications
- 87.09% (54) of these have services contracted from suppliers.

This targeted analysis allows us to explore the adoption of cloud technologies and its implications on data security and operational efficiency within Romanian public institutions. Based on the analysis of responses to questions Q1 and Q2 from the questionnaire, several key insights were uncovered regarding the adoption of technology within Romanian public institutions.

The results display three recommendations, as presented below.

1. **Advances and Opportunities.** The results of the study suggest that UATs in urban areas are more advanced in their use of cloud technologies, which reflects an opportunity for improvement in rural areas [6],[7]. Given the advantages offered by the cloud in terms of accessibility and efficiency, expanding the use of these technologies could contribute to the modernization and efficiency of public administration.
2. **Challenges and Barriers.** Among the main challenges identified are data security and privacy concerns, as well as the shortage of skilled IT resources. These represent major barriers that require strategic interventions, such as the development of an appropriate legislative framework and investments in digital infrastructure [8].
3. **Recommendations for Public Policies.** To encourage wider adoption of cloud technologies [9],[10], the study recommends the development of public policies aimed at:
 - Improving the IT infrastructure in the rural environment;
 - Increasing awareness and digital education among administrative staff;

- Implementation of a clear legislative framework to regulate the use of cloud [11] in the public sector.

In conclusion, although cloud adoption in Romanian public administration is still in its early stages [10-12], there is significant potential for development. By addressing the identified challenges and capitalizing on the available opportunities, the digitization of public administration can become a central pillar for more efficient and transparent governance.

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