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Use Of Information And Communication Technologies For Productivity: A Case Study In The Payments And Charges Sector Of The Federal University Of Amazonas.

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Abstract:
Background*: Information and Communication Technologies (ICT) are fundamental for the modernization and efficiency of the public sector. The Federal University of Amazonas (UFAM) implemented an automation process in the Payments and Charges sector as of 2015, using tools such as Excel VBA and Macro Recorder, in order to optimize manual operations and increase productivity. This study evaluates the impact of automation on the efficiency of the sector, comparing data from 2014 (pre-automation) and 2018 (post-automation), in a context of significant staff reduction.*
Materials and Methods*: The research is based on a case study, with data extracted from the reports of the Siape DataWarehouse system. The number of launches, the average time between each operation and the duration of the launches before and after the implementation of ICT were analyzed. The 2014 data reflects the manual scenario with seven servers performing the operations, while the 2018 data represents the automated scenario with three servers and technological tools optimizing the tasks.*
Results*: The analysis showed that in 2014, the average time between manual entries was approximately 4 minutes, with 410 entries per month. In 2018, with automation, the time between launches was reduced to seconds, and the workload increased significantly, with up to 1060 monthly launches performed by just one server.*
Conclusion: *Automation in UFAM's Payments sector resulted in a significant increase in productivity, compensating for the reduction in personnel. However, challenges such as continuous training of servers and maintenance of automated tools still need to be overcome to ensure the sustainability of long-term gains.*
Keyword*: Information and Communication Technologies; Process Automation; Productivity in the Public Sector; Federal University of Amazonas*

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I. Introduction

In recent years, Information and Communication Technologies (ICT) have been consolidated as an essential element for improving efficiency and productivity in various sectors, including the public sector.

ICT is crucial for the modernization of public administrations, as it allows for the automation of processes, improvement in service delivery, and transparency in government actions (Grönlund & Horan, 2004). In the context of public administrations, the implementation of technological tools aims not only to optimize processes, but also to promote transparency, reduce costs, and improve the quality of services provided to the population.

At the Federal University of Amazonas (UFAM), the Payments and Charges sector benefited from these technologies after 2016, a period in which process optimization tools were implemented, such as an automatic calculation program in Excel VBA and an RPA (Macro Recorder) automation tool. In this context, the objective of this article is to analyze the impact of ICT on the productivity of the Payments and Charges sector at UFAM, discussing how these tools contributed to operational efficiency and the challenges faced during their implementation. The research will be based on a case study, using data obtained from 2014 to 2018, a period in which the main technological changes in the sector occurred.

Since the implementation of ICT in the public sector is essential to improve the efficiency and transparency of the services offered. In the case of UFAM, the use of tools such as Excel VBA and Macro Recorder provided significant process automation, which is expected to have generated substantial improvements in the productivity of the Payments and Charges sector.

Productivity in the public sector is a key concept, encompassing not only the quantity of work performed, but also the quality and efficiency of the services provided. Several case studies demonstrate the success of ICT implementation in public institutions, providing valuable lessons and best practices that can be applied in other contexts. The impact of ICT on public administration includes improvements in operational efficiency, reduced errors, and greater transparency, with case studies at universities and other higher education institutions illustrating these benefits in a practical way.

This study is relevant to understand how these technologies can be applied in other contexts within public administration, promoting a culture of innovation and efficiency. We want to answer the following question: How did the implementation of Information and Communication Technologies influence the productivity of the Payments and Charges sector of the Federal University of Amazonas between 2014 and 2018?

II. Material And Methods

The research will be carried out through a case study centered on the Payments and Charges sector of the Federal University of Amazonas (UFAM), comparing the data of manual entries from 2014, the period before automation, with the data from automated entries from 2018, after the implementation of the technological tools. The objective is to measure the impact of Information and Communication Technologies (ICT) on the productivity of the sector.

The data analyzed will be extracted from internal reports of UFAM's payment management system, available in Siape DataWarehouse. These reports include detailed information about the operations carried out, such as the date and time of each payment entry, both in 2014 and 2016. The analysis will allow you to identify the total number of entries, the execution times, the average time between each launch, and any corrections or errors recorded.

The comparison between the two periods will focus on three main aspects: the number of postings processed per hour, the average time required to perform each operation, and the presence of errors in processing. The impact of automation will be evaluated by comparing the volume of manual releases in 2014 with the automated ones in 2016, considering the execution time and the reduction of errors. In addition, the total time spent in each period will be analyzed to verify the time savings generated by automation, and operational efficiency will be measured based on the increase in postings per hour, comparing the manual and automated methods.

The analysis will focus on the years 2014 and 2016, chosen because they represent the scenario before and after the implementation of technological tools, providing a clear view of the impact of automation on the productivity of the sector.

Theoretical Framework

To contextualize the application of ICT in the public sector, it is essential to understand its history and evolution. ICT has been adopted to improve the efficiency and effectiveness of public services, offering significant benefits but also presenting challenges that need to be managed. The adoption of ICT in the public sector is seen as a response to the need for more agile, transparent and accessible governments. According to Criado (2012), ICT enables ways of interacting between government and citizens, enabling greater transparency and efficiency and also encouraging innovation in public services.

This search for response to the government's needs to make it accessible, efficient and transparent is defined as e-Governance. This concept includes the automation of internal processes as one of its main facets (Grönlund, Horan, 2004).

Robotic Process Automation (RPA) is one of the main advantages of ICT. This refers to the use of software or "bots" that mimic human actions in routine data processing tasks. RPA allows the automation of structured and repetitive processes, without the need for changes to existing systems, which makes its implementation more agile and less disruptive. According to Willcocks, Lacity, and Craig (2015), RPA is a solution that increases efficiency and reduces costs in rule-based work processes by automating tasks that previously required human interaction.

In addition, according to Aguirre and Rodriguez (2017), RPA stands out in the public sector as an effective tool for dealing with large volumes of data, simplifying administrative and managerial processes, which results in productivity and compliance improvements". These authors also mention that, unlike other more complex automation technologies, such as artificial intelligence, RPA can be implemented quickly, with an almost immediate return on investment.

Van der Aalst, Bichler and Heinzl (2018) highlight that RPA is based on the ability to replicate human tasks that follow well-defined rules, such as entering data into systems and performing repetitive calculations. This transforms the way public and private organizations carry out daily operations, allowing for greater accuracy and efficiency. In addition, they emphasize that process automation with RPA significantly reduces the rate of human errors and frees up human resources for more value-added tasks.

Process automation in the public sector has been largely facilitated by tools such as Excel VBA (Visual Basic for Applications), which is one of the most versatile for optimizing repetitive tasks. Excel VBA is a programming language built into Microsoft Excel, allowing users to develop custom scripts to automate routine activities. Excel VBA makes it possible to create macros that automatically perform tasks, from complex calculations to report generation, offering an efficient solution for automating repetitive processes (Walkenbach, 2015).

In the context of the public sector, tools such as Excel VBA play a key role in automating administrative tasks. For example, in areas such as the Payments and Charges sector of the Federal University of Amazonas (UFAM), where there are large volumes of financial calculations, the ability to program automated routines significantly reduces execution time and manual errors.

In terms of simplified automation, Macro Recorder is also used, a basic tool that allows you to record actions in Excel to be played back later. This tool facilitates the automation of simpler processes, without the need for programming knowledge. While Macro Recorder is useful for standardized tasks, it has limitations regarding flexibility and complexity compared to VBA.

Tools such as Excel VBA and Macro Recorder have been widely adopted in the public sector for their ability to improve accuracy and efficiency when dealing with large volumes of data or complex financial operations (Hawley, 2017), helping public servants focus on more value-added activities by freeing up time previously spent on repetitive tasks.

III. Result

Contextualization of the UFAM Payments Sector

The Payments and Charges sector of the Federal University of Amazonas (UFAM) is responsible for managing and processing all payments of the institution, covering salaries, labor charges and other expenses related to active and inactive employees. In 2014, the sector had 8 servers. However, the sector has faced significant changes in staffing. Between 2014 and 2016, three of the servers retired, and a fourth was removed to another unit. This left only three active servers in the sector to deal with a volume of work that continued to grow.

Faced with this reduction in staff, the need to optimize processes and increase productivity has become a priority. To respond to this demand, in 2016 process automation was implemented, which included the use of tools such as Excel VBA and the recording of macros in the SIAPE HOD 3270 terminal. Automation aimed to reduce the time spent on repetitive activities, such as posting payment items, and increase the overall efficiency of the industry.

Productivity Comparison: 2014 (Manual) vs 2018 (Automated)

Productivity in 2014 (Manual Entry) In 2014, all payment processes in the Payments sector of UFAM were carried out manually. Each civil servant was responsible for entering items associated with the enrollments of the civil servants, which involved several operations for each enrollment, with items ranging from salaries, charges and other benefits.

1. Number of Servers: 8 (until 2016, when the staff was reduced to 3).

2. Average time between launches: Data analysis revealed an average of 4 minutes per operation. This includes the time needed to verify the information, enter the data, and confirm the entry in the SIAPE system.
3. Example posting ranges:
1. From 13:07:51 to 13:11:57 (approximately 4 minutes).
2. From 13:13:12 to 13:17:38 (approximately 4 minutes and 26 seconds).
3. Other intervals ranged from seconds to minutes, with longer delays in more complex releases.

Impact of Automation in 2018 With the introduction of automation, the use of tools such as Excel VBA and macros in the SIAPE terminal allowed servers to perform launches significantly faster. The process, which previously required manual intervention and time for the insertion of each rubric, is now carried out in a matter of seconds.

1. Number of Servers: Reduced to 3 after 2016.
2. Average time between launches: Automation has allowed the reduction of time from 4 minutes to only 1 second per operation, making it possible to perform a much larger number of launches in the same time interval.
3. Example of automated posting intervals:
1. From 16:05:21 to 16:05:22 (1 second).
2. From 12:43:55 to 12:43:56 (1 second).
3. Automation allowed consecutive entries of rubrics for a single enrollment to be made in a matter of seconds.

IV. Discussion

The automation of processes in the public sector, especially in an environment such as that of the Federal University of Amazonas (UFAM), has brought significant changes in the productivity and efficiency of the payments sector. The context of 2014, where the sector had 8 servers – of which 7 were responsible for manual entries – contrasts strongly with the reality of 2018, when, after retirements and removals, only 3 servers were available, and automation had already been implemented.

In 2014, work was heavily reliant on manual processes, with each server performing launches individually, which generated a considerable workload and a relatively slow pace. The data show that the launches were made with average intervals of **4 to 5 minutes** between each action, generating approximately **410 launches per month**, distributed among 7 servers. This model not only made the process more susceptible to human error, but also limited production capacity, considering that the division of labor between several servers still resulted in a high operational load for each of them.

On the other hand, in 2018, with the implementation of automation tools such as **Macro Recorder** and **Excel VBA,** the scenario changed drastically. The reduction in the number of servers – from 7 to 3 – was offset by the exponential increase in productivity brought about by automation. Instead of **several minutes** for each launch, the data indicates that launches are now made in **a matter of seconds**. The analysis reveals that, even with fewer personnel, the number of automated entries reached about **1060 per month**, carried out by only **1 server**.

This difference in numbers not only indicates an improvement in productivity, but suggests that work that previously required a multi-server team in 2014 could be done much more efficiently by a single server in 2018. This comparison allows us to argue that automation has not only absorbed the impact of the reduction in personnel, but has also expanded the operational capacity of the sector, evidencing a clear relationship between technological modernization and increased productivity.

In addition, automation has reduced the margin of error, since the tools used minimize the need for repetitive manual interventions, which are more susceptible to failures. By eliminating the need to manually enter item by item, automation has provided not only agility, but also consistency in records, which represents a significant advance in the quality of work provided.

Therefore, by extrapolating this data, it becomes evident that, with automation, UFAM's payments sector was able to multiply its work capacity and, at the same time, reduce the need for direct labor, creating a more agile and efficient operating model. This reality offers a clear demonstration of the benefits of implementing Information and Communication Technologies (ICT) in the public sector, being a concrete example of how the modernization of processes can transform the way institutions manage their operations.

The efficiency gained from automation should not only be seen as a quantitative gain, but also as a qualitative transformation. The release of time and the reduction of errors allowed the servers to focus on activities with greater added value, enhancing the overall effectiveness of the sector. This case study reinforces the argument that, rather than simply reducing costs or labor, automation in the public sector can be a catalyst for **significant improvements in the service provided to society**.

In the analysis of the impacts of automation on UFAM's payments sector, it is evident that the implementation of tools such as Excel VBA and Macro Recorder has brought significant improvements in

productivity and work efficiency. The comparison between data from 2014 and 2018 shows a significant increase in processing capacity, with automation allowing repetitive tasks to be performed in seconds, something that previously required minutes, or even hours, of manual effort. With only three servers in 2018, UFAM was able to process more than 106 pages of entries, a considerably higher amount than that observed in 2014, when there were seven servers working, but the processing volume was lower.

This efficiency gain, however, does not eliminate the challenges that still remain after the implementation of automation. The need for continuous training of civil servants is a critical point. While automated tools have made the job easier, they require specific and up-to-date skills to operate effectively. Without a continuous training program, the risk is that civil servants will not be able to fully utilize the resources offered by technologies, or that they will depend on few trained individuals, which can generate operational bottlenecks.

In addition, the technical maintenance of automated tools is a vital aspect. The efficient functioning of automated systems depends on regular updates and the resolution of faults that may arise during use. The absence of specialized support or an adequate maintenance plan can compromise the continuity of the work, which would require the temporary revert to manual methods, nullifying the benefits achieved.

Another significant challenge is the integration of automation tools with other university systems. The use of fragmented technologies can hinder the flow of information between different sectors, resulting in data redundancy and the inefficiency of processes that rely on multiple platforms. Proper integration is essential to maintain fluidity in operations, ensuring that the positive impact of automation is felt throughout the institution.

Security and compliance issues also gain relevance. With the increase in the volume of data processed automatically, ensuring the protection of this data against breaches and unauthorized access becomes imperative, especially considering the requirements of the General Data Protection Law (LGPD). Any failure in this regard can compromise the privacy of sensitive information, in addition to generating legal and operational implications for the institution.

Adapting to new demands and regulations is another aspect that must be considered. The public sector is constantly changing, and automated tools must be flexible enough to accommodate these variations, without this representing a break in workflow or a need for constant reconfiguration of systems.

Finally, cultural acceptance within the organization and the adaptation of servers to automation are challenges that, if not addressed appropriately, can limit the gains provided by technology. The public sector has traditionally been resistant to change, and even with consolidated automation, it is necessary to encourage a culture that values innovation and the search for continuous improvement.

V. Conclusion

Automation in UFAM's payments sector proved to be an effective solution to deal with the growing demand and limitations of human resources that arose from 2016 onwards. Comparing the data from 2014, when the processes were carried out manually, with those from 2018, after the implementation of technological tools, the gain in productivity and efficiency is evident. Automation has allowed a reduced team to achieve a significantly higher volume of work, with less time and effort.

However, for these gains to be sustainable in the long term, it is essential that UFAM continues to invest in continuous training of servers, ensures adequate maintenance and technical support for automation tools, ensures the security of processed data, and quickly adapts to new regulatory requirements. In addition, fostering an organizational culture that values innovation will be crucial to maximize the benefits of automation and continue to improve the services provided to the academic community.

Automation in the public sector, as evidenced in the case of UFAM, can be a powerful instrument to optimize processes, but its success depends on the combination of technology, people management, and organizational policies that promote innovation and continuous adaptation to change.

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