UNIVERSIDADE CATÓLICA PORTUGUESA

Digital Transformation – Impact in Management Control Practices

Portuguese Companies – Survey Analysis

by

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Católica Porto Business School
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Portuguese Companies – Survey Analysis

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by

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Acknowledgments

I would like to thank my parents for investing on my education and to always help me reach what I dreamed of.
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Resumo

O ambiente organizacional nos tempos atuais é bastante volátil e as tecnologias de informação têm demonstrado um desenvolvimento acentuado (Hock-Doepgen et al., 2021). Estas inovações tecnológicas têm mudado a envolvente das empresas e criado novas formas de fazer negócio, de descobrir oportunidades e de as explorar (Amit & Han, 2017).

Nas áreas de controlo de gestão e contabilidade, as principais funções desempenhadas têm mudado significativamente. Segundo Appelbaum et al. (2017), as tarefas são agora mais estratégicas e menos rotineiras, devido ao impacto da digitalização nas empresas.

Os desenvolvimentos na digitalização e a explosão de dados que se faz sentir nos dias de hoje criam alterações significativas e novas oportunidades para as organizações e acima de tudo para as funções nas áreas financeiras, contabilística e de controlo de gestão.

Ainda existe pouca evidência empírica internacional quanto ao impacto da digitalização nos processos e atividades e no contexto da função de Controlo de Gestão no tecido empresarial português. Em Portugal não é conhecido qualquer estudo empírico que incida sobre esta questão. Desta forma, o objetivo desta dissertação é responder à seguinte questão de investigação: "Qual o impacto dos processos da digitalização nas atividades da função do Controlo das empresas Portuguesas?".

Para procurar dar resposta a esta questão de investigação foi efetuado um inquérito direcionado a empresas que se encontrem a operar no nosso país. A análise dos dados obtidos neste inquérito vai no sentido de perceber que tipo de empresas incluem nos seus processos as várias tecnologias abordadas, tendo

concluído que a automatização dos processos, através de RPA, é a tecnologia mais acessível para empresas de menor dimensão, com poucos recursos financeiros. Enquanto isso, o Business Analytics demonstra ser a tecnologia mais acessível a empresas de maior dimensão. Ainda de salientar que o Machine Learning está muito pouco inserido nas empresas inquiridas.

Palavras-chave: digitalização, controlo de gestão , contabilidade
5594 words

Abstract

The organizational environment nowadays is quite volatile and information technologies have shown an important development (Hock-Doepgen et al., 2021). These technological innovations have changed the business environment and created new ways of doing business, discovering opportunities and exploring them (Amit & Han, 2017).

In the areas of management control and accounting, the main functions performed have changed significantly. According to Appelbaum et al. (2017), tasks are now more strategic and less repetitive, due to the impact of digitalization on companies.

The developments in digitization and the explosion of data that is felt these days create significant changes and new opportunities for organizations and above all for functions in the financial, accounting and management control areas.

There is still little international empirical evidence regarding the impact of digitalization on processes and activities and in the context of the Management Control function in the Portuguese business universe. In Portugal, there is no known empirical study that addresses this issue. In this sense, the objective of this dissertation is to answer the following research question: "What is the impact of digitalization processes on the activities of the Control function of Portuguese companies?".

To try to answer this research question, a survey was carried out aimed at companies that are operating in our country. The analysis of the data obtained in this survey aims to understand what type of companies include the various technologies in their processes, having concluded that process automation,

through RPA, is the most accessible technology for smaller companies, with few financial resources. Meanwhile, Business Analytics proves to be the technology most accessible to larger companies. It should also be noted that Machine Learning is very little inserted in the companies surveyed. The question will be answered through the analysis of a survey aimed at companies that are currently operating in our country.

Key-words: digitalization, management control, accounting

5594 words

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Introduction

This dissertation is structured in 3 main chapters. The first chapter will comprise a literature review on the impact of the new technologies within the management control area.

The main explored topics are: the concept of management control, the digitalization era and the main new technologies, and the impact of the digitalization within the management control function. In the second chapter the methodology to the development of this dissertation is explained in detail. The third chapter comprises that Data Analysis findings from the cluster analysis, followed by the conclusion.

The dissertation explores the three main technologies that Big Data brought, such as Robotic Process Automation, Business Analytics and Business Intelligence, and Machine Learning. This tools, especially BA/BI and Machine Learning, are considered to be important drivers of growth within the corporate environment and their impact have been studied by different authors across the globe.

There is still little empirical evidence regarding the impact of digitalization on Management Control in the Portuguese business universe. For that reason, the objective of this dissertation is to answer the following research question: "What is the impact of digitalization on the Management Control and Accounting of Portuguese companies?".

Cokins (2013) mentioned in his work that technological development has expanded the scope of managerial accounting, turning reporting more real-time and predictive rather than historical. What this dissertation wants to explore is

exactly if this happens in Portuguese companies and what could differentiate the different organizations from adopting or not a specific tool.

Chapter I

Literature Review

1. Management Control

The Management Control function is the process by which the managers influence the other organization members on the implementation of strategies (Anthony and Govindarajan 1998, p.6). This process is composed by six different activities, such as: Planning, Coordinating, Communicating, Evaluating, Deciding, Influencing.

Its concept have been evolving from a strictly financial and accounting view to a more strategic view that ensures that all members within the organization are acting accordingly to the strategy and objectives (Malmi & Brown, 2008).

By analyzing previous research, Malmi & Brown (2008, p. 287) structured Management Control Systems (MCS) as a package around five groups: "planning, cybernetic, reward and compensation, administrative and cultural controls".

The definition of MCS has been described by very different researchers. According to Van der Stade (2007), management control must be separated from strategic control. Also, the authors mention that management control must focus on employees' behavior. "It is people in the organization who make things happen. Management controls are necessary to guard against the possibilities that people will do something the organization does not want them to do or fail to do something they should do...If all employees could always be relied on to

do what is best for the organization, there would be no need for MCS" (Van der Stade, 2007).

Similar to Van der Stede (2007), Malmi & Brown (2008) clarify what must be addressed as a MCS and what may not. For the authors (p. 290, 2008), "Those systems, rules, practices, values and other activities management put in place in order to direct employee behavior should be called management controls.", excluding, however, accounting systems that support decision making at an organizational level.

The role of Controller have been changing over the past years, essentially due to the technological inovations that allow organizations to change their processes. According to Jarvenpaa (2007), new technologies allow controllers to free themselves from repetitive tasks and to manage big databases very quickly, generating importante reports with more flexibility.

Deloitte and the Institute of Management Accountants (IMA) conducted a survey to nearly 800 financial professionals in the controllership function, in order to study the controller function, its main responsibilities and skills. Waelter et. Al (2018), mention that the main roles that controllers play are as "a steward, managing risk and preserving assets, as an operator running an efficient and effective finance operation, as a strategist, influencing the future direction of the company, and as a catalyst, helping to drive execution". However, the analysis of the survey results showed that most controllers spend their time on traditional steward and operator roles, rather than spending time on catalyst and strategist roles. Waelter et. Al (2018) concluded that the most important tasks are planning, budgeting, and forecasting.

The organizational environment is changing due to the emerging technologies and processes, and controllers may feel its impact on their daily work.

2. The era of the Digitalization

The role of management accountants have been changing over the past years due to the appearance of new technologies and volatile organizational environments. This section briefly reviews the main emergent technologies that have been impacting the organizational environments and practices.

3. The Big Data

Technological advancements have always been crucial steps for our evolution as a society. Based on that, we can highlight specific periods in history in which there were important transitions in terms of technology. We are living the third wave of technological advancements, the digitalization era.

The past 50 years enabled companies to reshape competition and strategy due to technological advancements. There were two waves of Information Technology: the first during the 1960's, brought automated activities in the value chain, increasing productivity; the second one, during the 1980's, enabled the integration of activities with the connectivity of the internet. Nowadays, we are living the third wave of Information Technology where Big Data comes in (Porter & Heppelmann, 2014).

Big Data is the enabler of the range of technologies that we see impacting businesses nowadays. It is regarded as large data sets of structured or unstructured data that cannot be processed by traditional systems (Warren et al., 2015). Big Data comes from the automation and informatization of managerial processes that generate large amounts of structured and unstructured data (Rao-Graham et al., 2019).

According to McAfee and Brynjolfsson (2012), Big Data has brought intelligence to companies since executives can now make better predictions based on a huge volume, velocity and variety of data and measure metrics more

precisely, which consequently enables a better management. Besides all the advantages that the access of nearly real-time data brings, organizations must now invest on specialized human resources that can turn data into insightful information about the businesses.

These techniques, termed Big Data Analytics (BDA), include "text analytics, machine learning, predictive analytics, data mining, statistics and natural language processing to gain new insights from previously untapped data sources independently or together with existing enterprise data" (IBM, 2019, 1).

4. Business Analytics and Business Intelligence

Business Analytics is the utilization of data, information technologies, statistical analysis, quantitative method, and mathematical models that help managers to obtain a better perception of operations and make better decisions based on facts. The access to Big Data, both from internal and external sources, could be analyzed used Business Analytics techniques to answer questions about what has happened (descriptive analytics), what will happen (predictive analytics), and what is the optimized solution (prescriptive analytics) (Appelbaum et al., 2017).

These techniques can have a huge impact on management control and accounting, since businesses are requiring more than ever timely and relevant information, rather than backward looking data that reports past events, as the financial statements are (Nielson, 2015). Instead, management accountants can benefit from the data from Enterprise Resource Planning (ERP) and conduct more relevant analysis to support decision makers against uncertainties.

Business Intelligence (BI) is, according to Appelbaum et al (2017), the technique that enable not only the collection and data analysis but also the preparation of reports and dashboards for data visualization and decision

making. Business Intelligence tools help present the results of data analysis in a more effective and insightful way. Some of the most known BI tools are Microsoft Power BI and Tableau, which enable users to build dashboards.

5. Machine Learning

In the context of Big Data and Business Analytics/Intelligence, it is crucial to mention Machine Learning because this is the technology that allow the transformation of complex data into knowledge (Melo & Machado, 2019).

The ability to translate data into knowledge is the key to solve various problems that companies face and this is possible due to the existence of big data and its related techniques. This is because machine learning algorithms learn from the data they are given and the models can get smarter and help make better decisions based on the data (Hurwitz et al., 2019).

Machine learning algorithms has the capability of extracting patterns in data, acquire knowledge and making better decisions based on rules that are not necessarily made by humans (Quinn & Strauss, 2018). However, that does not mean that human intervention is not needed, because these technologies require human perspective and judgment to be correctly applied (Hurwitz et al., 2019).

The enhanced algorithms that machine learning provides decrease information processing costs (Rao-Graham et al., 2020) because they can automate processes, validate strategies and facilitate predictive analysis (Sestino et al., 2020).

6. Robotic Process Automation

Robotic Process Automation (RPA), "represents software agents capable of interacting with software systems by mimicking user actions, thus alleviating the workload of the human force" (Syed et al., p. 1, 2020). This type of technology has been helping businesses improve operational efficiency, strategic goals, productivity, and customer service. For that reason, the demand for that technology is increasing significantly.

According to the Institute for Robotic Process Automation, RPA has innumerous advantages, the implementation is quick and efficient because it is not a part of the company's IT infrastructure but rather sits on top of it. Besides that, RPA combines automation with artificial intelligence, making this technology able to learn and solve problems without human judgment.

Data is a crucial part of RPA since each task of the automated activities produces data that can be analyzed in order to make better decisions in the areas of the process being automated and identifying gaps that need optimization. Companies become more compliant with industry and audit regulators. The adoption of this technology reduces time, cost and human resources, tasks, and workload, which means that operational efficiency and productivity are increased. The fact that robots can work 24/7 can free human resources from tedious tasks and make them able to participate in value-added activities (Syed et al., 2020). Another relevant benefit is the scope of usability across different industries. The only requirement for the application of RPA is that a certain task is definable, repeatable, and rules-based.

However, researchers also point out some constraints with the use of RPA. Kirchmer (2017) refers that this technology can also make mistakes without human assessment. If the data is poor, then the decisions made by RPA will not be robust. Also, if the definition of business rules is insufficient, it won't be as

efficient as expected. For that reason, "RPA requires detailed knowledge about the business process it is used in – otherwise expected performance improvements will not be realized". Syed et al. (2020) also include employee anxiety, lack of tangible benefits, implementation difficulties, the reduced incentive for optimization as limitations of RPA. However, these disadvantages can be minimized if RPA is addressed the right way, the main focus should not be the removal of human resources, but the ability to work together.

Besides the fact that automation and digitalization in accounting have been very mentioned topics in the past few years, little is known about the adoption and organizational implications of the implementation of RPA (Kokina & Blanchette, 2019).

7. The impact of Digitalization on the Management Control

Cokins (2013) mentioned in his work that technological development has expanded the scope of managerial accounting, turning reporting more real-time and predictive rather than historical.

Besides that, reporting and financially-oriented decisions to strategic tasks involve decisions based on information (Appelbaum et al., 2017).

This inevitably leads us to the fact that Big Data and all the technologies that it brings us are changing Management Control and Accounting. That organizational area has been evolving from financially-oriented decision analysis to a more strategic approach that emphasizes the measurement of key drivers of shareholder value (Ittner and Larcker, 2001).

According to a McKinsey survey (2021, p. 4), "the finance-function respondents reporting the use of robotics and artificial intelligence (AI) tools has more than tripled since our 2018 survey, while the share saying that they use

advanced analytics for finance tasks has almost doubled". The survey also suggests that there is an increase in technology adoption in finance, however, the main obstacle to adopting new technologies are the costs, lack of skills and capabilities, and organizational resistance.

In their research, McAfee & Brynjolfsson (2012) discovered that data-driven companies were showing better financial and operating results. Besides that, the productivity and profitability of those companies were higher than its competitors. "Companies succeed in the big data era not simply because they have more or better data, but because they have leadership teams that set clear goals, define what success looks like, and ask the right questions" (McAfee & Brynjolfsson, p. 10, 2012).

Regarding automation and the implementation of RPA, Deloitte finds on a survey that RPA improved compliance by 92%, quality and accuracy by 90%, productivity by 86%, and cost reduction by 59%. Also, 78% of those who have already.

Bhimani & Willcocks (2014) suggest that Big data and data analysis are affecting businesses in relation to the finance function and to management accounting information provision specifically. The authors mention that the finance function is being deeply affected by digital technologies, which affect the corporate strategy and enterprise structures.

Chapter 2

Methodology

1. Research Question

The main objective of this study is to understand the impact of digitalization, or if it effectively exists, in Management Control and Accounting within Portuguese companies.

As mentioned before, digitalization is changing organizational processes and helping companies to be more efficient. There are many new techniques able to automate or better predict the future of the businesses, such as RPA, data analysis, and machine learning.

However, there must be some limitations on the adoption of these tools mainly due to the cost of implementation and lack of skills.

For that reason, the analysis of the survey will help understand how Portuguese companies are positioned in the digitalization process and how to do these tools have been impacting the management control and accounting functions.

The analysis of the survey was made through a cluster analysis, which enabled the analysis of the level of adoption of new technologies, and their impact, within Portuguese organizations.

According to the findings of some studies conducted by Deloitte (2018) and McKinsey (2021), it is expected that data-driven companies increase their competitive advantage and perform better than others. However, most Portuguese organizations are small or medium-sized and that can be a limitation for the adoption of the new technologies since there must be a lack of resources.

In this regard, the proposed research question is the following:

"How are the new technologies impacting the management control and accounting within Portuguese companies?"

The quantitative method was considered the most appropriate method of research and that will be explained in the next sections.

2. Survey and Sample Characterization

In order to answer the research question, a survey and a clustering analysis were conducted.

The target group is 173,652 Portuguese organizations present in the Sabi's database, who are still operating and that provided an email contact. The main reason behind this choice is because the main goal is to assess the state of the art of digitalization in all Portuguese companies, and even understand how the differences in the organizations' dimensions affect the adoption of new technologies.

From all the surveys sent, there were 1705 responses. It is important to note that 80% of the respondents assume revenues lower than 2 million euros and 54% have less than 10 employees That means that the major percentage of the respondents are micro and small companies.

3. Survey Design

The survey was developed through Google Forms and it was organized into different sections, according to the main technologies that are being studied. The survey tries to study the situations in which companies use each one of the technologies and how does this impacts their work.

4. Data Analysis

In order to understand the similarities between companies that use or do not use each one of the technologies, it is relevant to associate the different survey responses into groups.

For that reason, cluster analysis allow the data to be separated into different groups according to similarities in the data.

There were four different cluster analysis in which data was analyzed, in order to avoid an analysis bias. The fact that more than 50% of the respondents were part of a small enterprise, it was important to understand the patterns in data from small, medium and big enterprises separately.

In the following chapter, this analysis is explained in more detailed.

Chapter 3

Data Analysis Findings

1. Data Analysis Findings

As mentioned in the previous chapter, the survey was answered by 1705 Portuguese organizations. For that reason, it is important to note that 54,7% of those are micro-enterprises, 37,9% are small enterprises and, only 7,4% are medium or big enterprises. That was expected since, according to PORDATA data for 2019, 99,9% of all companies in Portuguese are precisely small or medium enterprises.

The adoption of the new technologies by Portuguese companies is still low, being Machine Learning and AI applications the lowest adopted technology. From the inquired companies, only 5.2% of the companies surveyed assume their use, using these techniques for process automation, strategy validation, and predictive analyses, mostly.

Followed by Machine Learning, Business Analytics techniques are used by 16,7% of the survey population and PowerBI is the most important software, followed by Google Data Studio, Tableau, and Primavera.

Finally, RPA is the most used technology, 37% of the companies assume the usage of this technique, especially in the context of e-mail automation, accounting entries, and accounts receivable/payable processing.

According to the results, the main barriers to the adoption of the new technologies are the high costs of implementation, the lack of knowledge about the new techniques, and the resistance to change.

In fact, within the Portuguese organizational universe, which is mainly made of small and medium enterprises, the need for investment for the implementation

of the new technologies and the recruitment of specialized human resources is considerably high.

The usage of Business Analytics and Business Intelligence by Portuguese companies is mainly in the context of Data Analysis, including data extraction and treatment, and the availability of information within the organization.

Business Analytics Context	1 - I do not use	2 - I use little	3 - I use	4 - I use a lot
Data Processing	9%	17%	30%	45%
Data Extraction and Treatment	5%	10%	30%	55%
Reporting	7%	14%	32%	47%
Information Availability	4%	11%	30%	55%
Data Analysis	3%	7%	36%	55%
Prediction	12%	25%	35%	28%
Simulation	21%	29%	29%	21%

Table 1 *- BA Usage Context*

Besides only 16,7% of the population surveyed use Business Analytics/Intelligence, 80% mention a great motivation in adopting these techniques in the future.

Regarding the usage of Robotic Process Automation (RPA), the study shows that 37% of the surveyed organizations have automized processes within their activities. In fact, RPA is the technology with the most implementation. The main contexts in which RPA is used by Portuguese companies are Accounting entries and Email Management.

RPA Context	1 - I do not use	2 - I use little	3 - I use	4 - I use a lot
Accounts Receivable Process	34%	13%	16%	37%
Accounts Payable Process	33%	14%	15%	38%
Accounting Entries	30%	10%	15%	44%
Account Reconciliation	37%	16%	17%	29%
Reporting	29%	15%	26%	30%
Validation of Orders and Invoices	24%	18%	29%	29%
Calculations	25%	16%	30%	29%
Task Creation	30%	21%	26%	23%
Emails	20%	14%	23%	43%
Administrative Workflows	38%	19,5%	26,5%	16%

Table 2 *- RPA Usage Context*

Machine Learning is the least used technology since this is the most complex one. The survey shows that only 5,2% of Portuguese companies use these techniques, especially for predictive, descriptive, and prescriptive analysis.

The main reasons identified as the barriers for the adoption were the high costs of implementation, the lack of knowledge, and the low incentive from management. In fact, we can see the main characteristics of small and medium enterprises: lower financial resources, lack of specialized knowledge, simpler organizational structure, are the main barriers for the adoption. That makes clear that the dimension of the company is a key factor for digitalization.

Besides the low adoption of the new technologies from Portuguese companies, 50% of them assume the motivation for implementation, especially Business Analytics and Business Intelligence, followed by RPA, and Machine Learning.

Cluster Analysis (A)

The results of the cluster analysis identified 5 different clusters, according to the survey answers. In terms of adoption, we can distinguish the clusters from Low adoption to High Adoption.

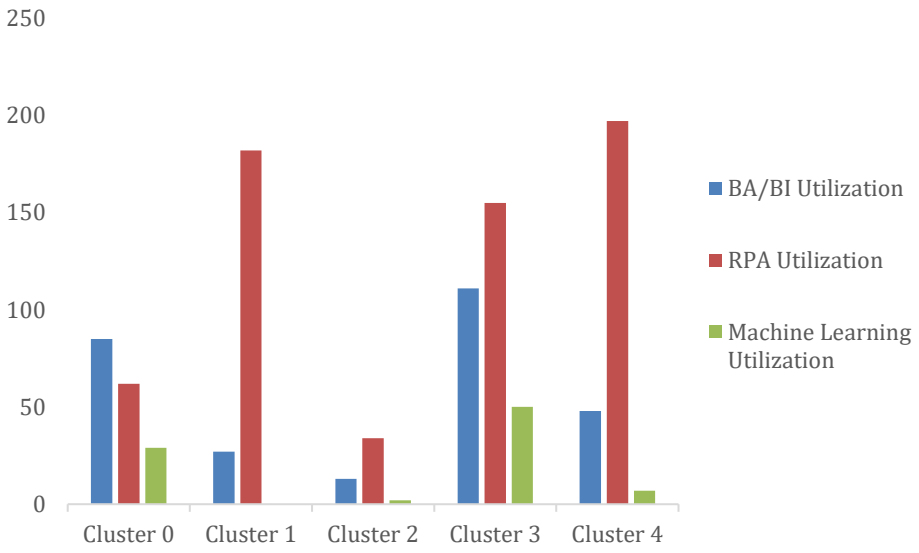

Figure 1- *Cluster Analysis A*

From the chart above, we conclude that clusters 1, 3, and 4 are the ones with the highest Business Analytics adoption, However, cluster 3 is the one where companies adopt the most all the three techniques.

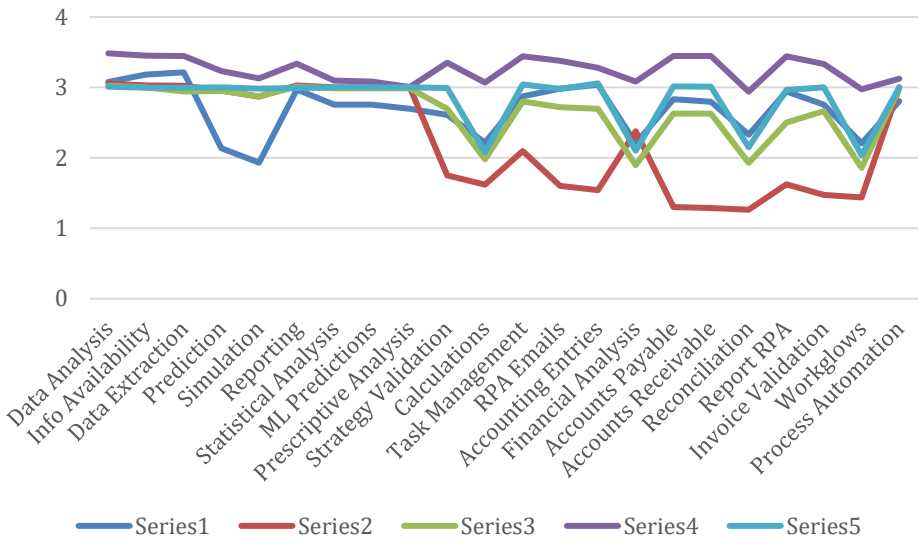

Figure 2 *- Cluster Analysis A Contexts*

The chart shown above shows the distribution of each cluster regarding the context in which the companies use each one of the techniques. We can observe, for example, that Series 2 (Cluster 1) is the one that less utilizes RPA, while Series 4 (Cluster 3) is the cluster with more utilization in each one of the technologies.

We can also see in the chart below the distribution of the clusters by the impact of the adoption of the technologies. Series 3 (Cluster 2), is the cluster in which companies less feel the impact of the new technologies.

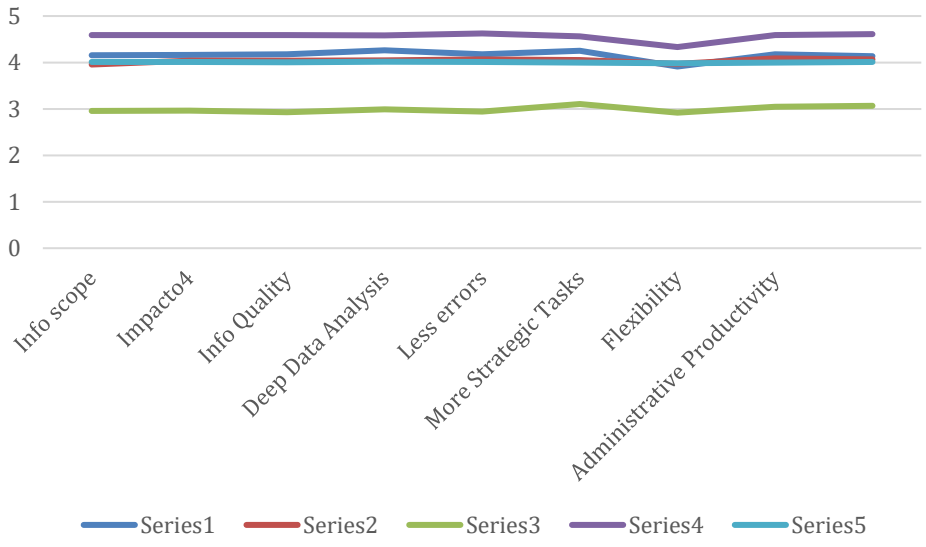

Figure 3 *- Cluster Analysis A Impact*

The distribution of companies by cluster is shown in the pie chart presented next. As we can see, most Portuguese companies are in a state of growing adoption, which means that some of them are slowly adopting the new technologies and are motivated to increase their level of digitalization in the future.

We can differentiate the 4 clusters the following way:

- **Cluster 2 - Low Adoption:** the cluster in which organizations less utilize each one of the three technologies, being RPA the most important one for Email and Process Automatization. As for the impact of the new technologies within the business, cluster 2 is the one with lower impact felt by the respondents.
- **Cluster 0 – Growing Adoption:** this cluster shows organizations with a low adoption of the new technologies but a growing tendency on the adoption, especially for Business Analytics. The context in which the technologies are used are essentially data analysis and process automatization.
- **Cluster 1 – Analytics Development:** the usage of Business Analytics is high in this cluster, while Machine Learning is not utilized. Business Analytics is used in all contexts, and RPA facilitates the automatization of processes.
- **Cluster 3 – High Adoption:** this is the cluster in which organizations most utilize all the three technologies and the impact felt within the business is strong.
- **Cluster 4 – Medium Adoption:** in this cluster we note a high adoption of Business Analytics and a growing adoption in the other technologies.

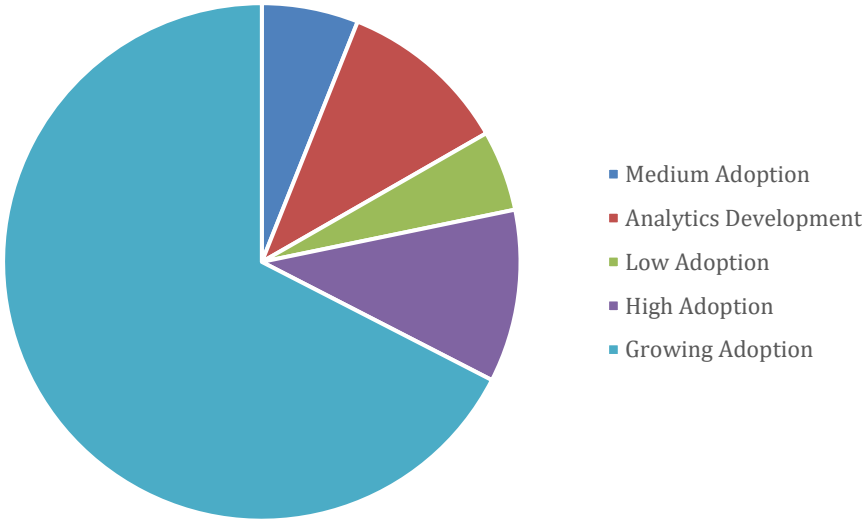

Figure 4 *- Clusters Distribution*

The following heat map clearly shows the distribution of the clusters by revenues and how this relates with the usage of each one of the technologies. We can see that cluster 0 and cluster 3 are the ones in which organizations have higher revenues and the usage of RPA, Business Analytics and Machine Learning are higher. Cluster 2 and Cluster 4 are the ones showing lower usage and revenues.

That confirms that in fact, the availability of investment in new techniques and digitalization is a facilitator of development.

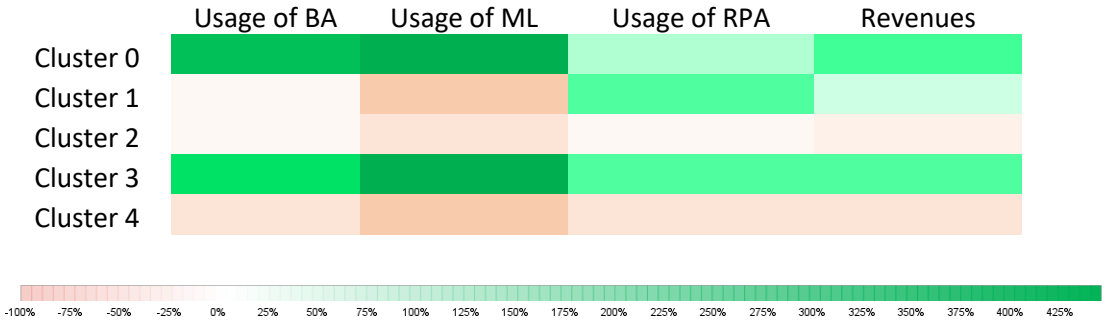

Figure 5 *- Heat Map*

The fact that more than 50% of the organizations that responded to the survey have less than 10 employees, and 80% have less than 2 million Euros as revenues, I would present biased conclusions. For that reason, the cluster analysis is made to the split of the sample into three different groups.

That split is made through the number of employees, because that could give us a more correct idea of and separation between micro, small, medium and big organizations, rather than the revenues. Both variables, revenues and number of employees, are not enough to understand the dimension of a specific organization because it is very complex. However, the number of employees could give us a more clear understand of the organizational dimension.

For that reason, the cluster analysis is now applied to organizations with less than 10 employees, another cluster analysis for those organizations with 10 to 50 employees, and another one for organizations with more than 50 employees.

Cluster Analysis (B)

The following cluster analysis was made to the responses of those organizations with less than 10 workers, and 2 different clusters were identified. The following graph shoes the differentiation of the two clusters in terms of technology usage. While cluster 1 is defined as a heavy user of RPA and a medium to low usage of BA/BI, cluster 2 shows a low utilization of all the three technologies.

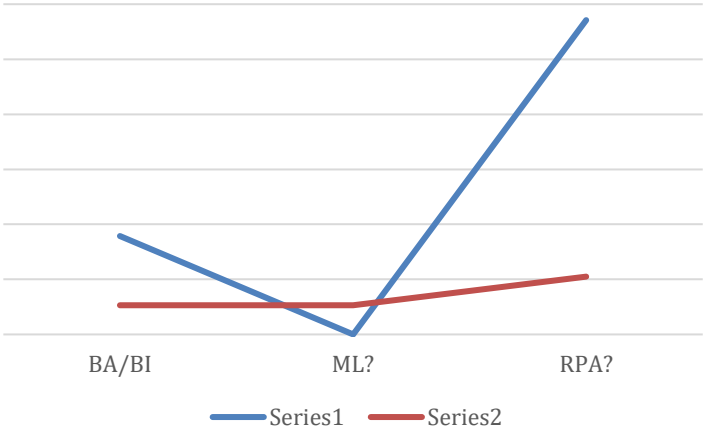

Figure 6 - *Cluster Analysis B Usage*

In terms of revenues, both clusters consider organizations with revenues lower than 2 million, on average.

The context of utilization is the same in both clusters, but the impact attributed to the utilization of the new technologies is higher on cluster 1 even though it shows a lower utilization of the three technologies.

It is important to note that both clusters show a higher utilization of RPA, being that the main adopted technology by small enterprises in Portugal.

Cluster Analysis (C)

Moving forward for another cluster analysis for data related to organizations with 50 employees, 2 different clusters were identified.

The following graphic shows the predominance of RPA, the same that happens with organizations with 10 employees. In fact RPA is a very well adopted technology, followed by Business Analytics. However Machine Learning is still very exclusive to more evolved enterprises or technologic enterprises.

It is also very interesting to see by the cluster analysis that cluster 0, besides the higher revenues, is the one with lower adoption of RPA. One important aspect is the fact that RPA is well established in organizations with lower financial resources.

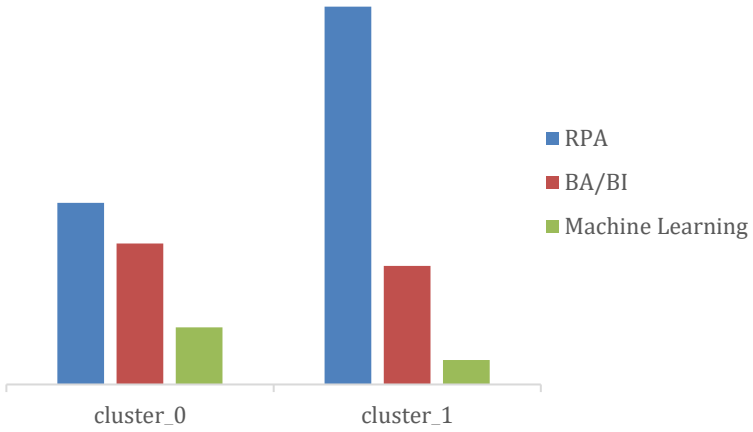

***Figure 7** - Cluster Analysis C Usage*

Cluster Analysis (D)

Lastly, a cluster analysis was made to the group of organizations with 250 or more employees, and two different clusters were identified. The following chart shows the usage of each one of the technologies within each cluster.

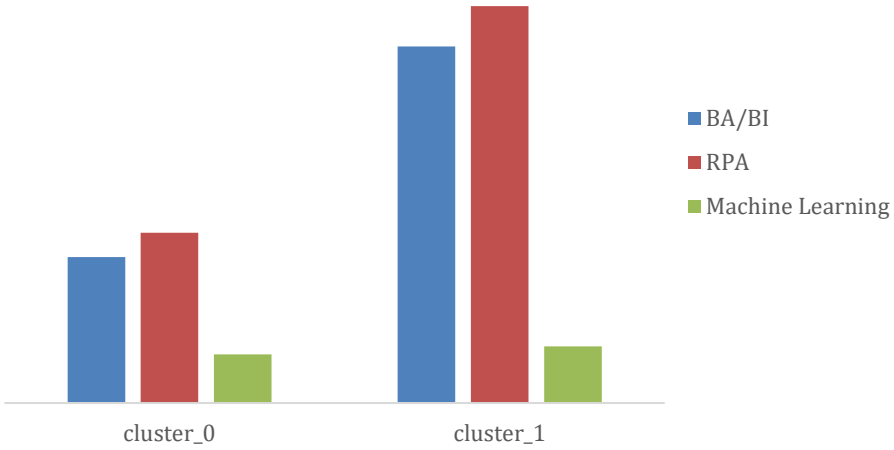

***Figure 8 -** Cluster Analysis D Usage*

It is very interesting to see that the bigger the organization the highest the utilization of Business Analytics, and the lowest the utilization of RPA. It is also clear that Machine Learning is not really adopted by Portuguese enterprises within Management Control. While Cluster 0 shows little adoption of the three technologies and a lower revenue, cluster 1 shows the opposite, not only this is the one with the highest adoption but also with the highest revenues.

Conclusions

The main objective of this dissertation is to understand how Portuguese organizations have been adopting new technologies and digitalizing its business, as well as the main factors that distinguish the organizations which are developing, from those that are not. That analysis was made with a descriptive and a cluster analysis of the survey data.

The analysis of the results made possible the discovering of some conclusions regarding the usage of three different technologies: Business Analytics / Intelligence, Robotic Process Automation and Machine Learning. As defined for the 1705 companies that responded to the survey, the high costs of implementation are the more relevant barrier for the digitalization.

By the cluster analysis, we are able to understand that in fact, Portuguese organizations are not heavy users of all the three technologies, however an important pattern was identified. The highest the revenues and the more employees a Portuguese company has, more focus it has on the adoption of Business Analytics rather than RPA.

Besides that, RPA seems to be the more important technology within the Portuguese organizations, the one which is more accessible and who doesn't need high skilled professionals compares to those needed when BA or Machine Learning are adopted.

According to the results, the main barriers to the adoption of the new technologies are the high costs of implementation, the lack of knowledge about

the new techniques, and the resistance to change. Looking for that, we now understand that this barriers make Portuguese companies invest on RPA, or do not invest at all if the financial and human resources are scarce.

The main contributions of this dissertation to the existing literature, regarding the Digitalization on Management Control are the initiation of investigation on Portuguese companies digitalization, and the delivery of useful insights to understand why some companies choose a specific tool over another.

It is important to note the limitation that came up during the data analysis, regarding a possible bias due to the fact that more than 50% of the survey respondents were small enterprises, making them the heaviest adopters of the new technologies. This limitation was addressed with a specific clusters analysis for small, medium and big enterprises, separately.

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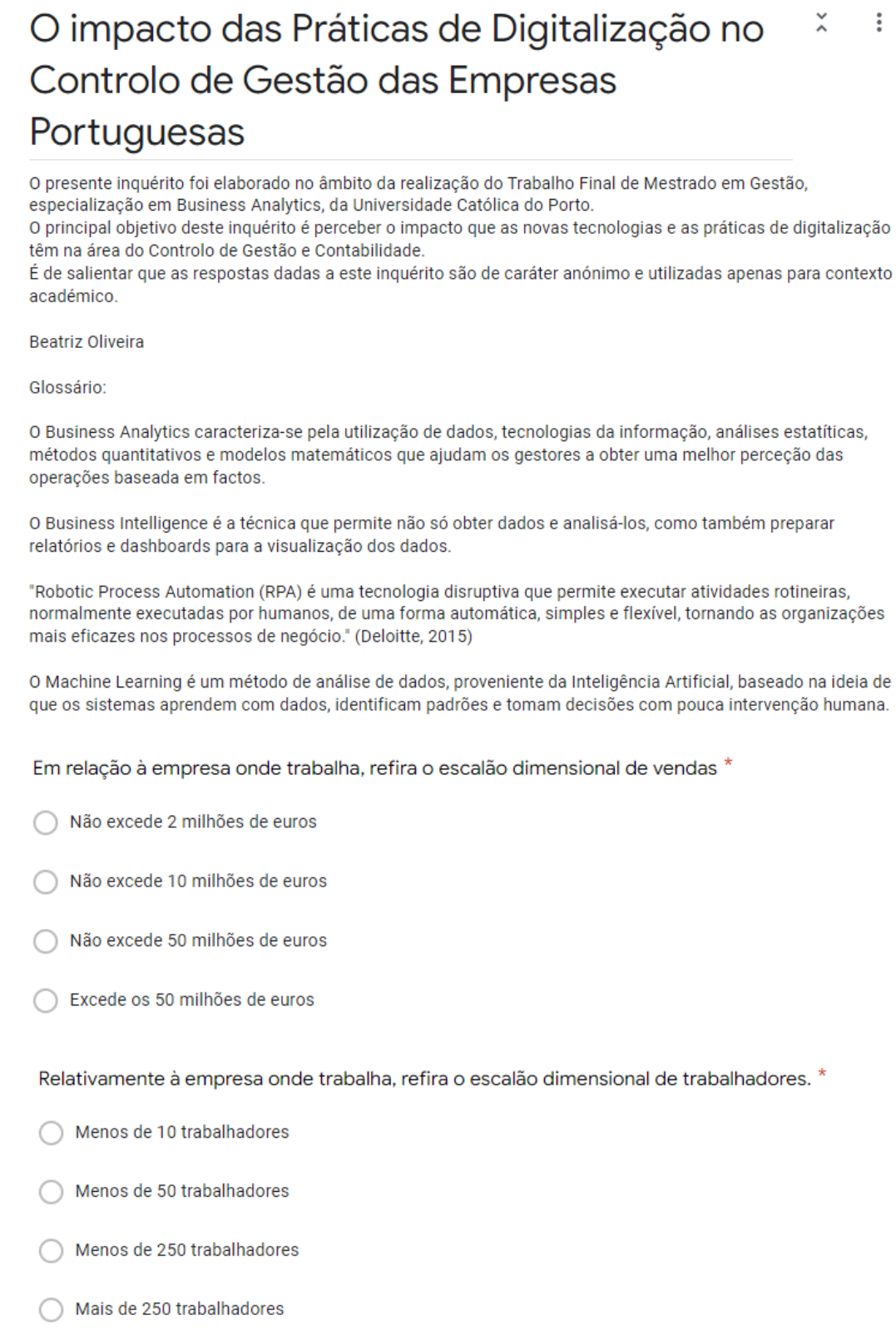
Anexes



O impacto das Práticas de Digitalização no Controlo de Gestão das Empresas Portuguesas

O presente inquérito foi elaborado no âmbito da realização do Trabalho Final de Mestrado em Gestão, especialização em Business Analytics, da Universidade Católica do Porto.
O principal objetivo deste inquérito é perceber o impacto que as novas tecnologias e as práticas de digitalização têm na área do Controlo de Gestão e Contabilidade.
É de salientar que as respostas dadas a este inquérito são de caráter anónimo e utilizadas apenas para contexto académico.

Beatriz Oliveira

Glossário:

O Business Analytics caracteriza-se pela utilização de dados, tecnologias da informação, análises estatíticas, métodos quantitativos e modelos matemáticos que ajudam os gestores a obter uma melhor perceção das operações baseada em factos.

O Business Intelligence é a técnica que permite não só obter dados e analisá-los, como também preparar relatórios e dashboards para a visualização dos dados.

"Robotic Process Automation (RPA) é uma tecnologia disruptiva que permite executar atividades rotineiras, normalmente executadas por humanos, de uma forma automática, simples e flexível, tornando as organizações mais eficazes nos processos de negócio." (Deloitte, 2015)

O Machine Learning é um método de análise de dados, proveniente da Inteligência Artificial, baseado na ideia de que os sistemas aprendem com dados, identificam padrões e tomam decisões com pouca intervenção humana.

Em relação à empresa onde trabalha, refira o escalão dimensional de vendas *

- Não excede 2 milhões de euros
- Não excede 10 milhões de euros
- Não excede 50 milhões de euros
- Excede os 50 milhões de euros

Relativamente à empresa onde trabalha, refira o escalão dimensional de trabalhadores. *

- Menos de 10 trabalhadores
- Menos de 50 trabalhadores
- Menos de 250 trabalhadores
- Mais de 250 trabalhadores

***Figure 9** - Survey 1*

Relativamente à atividade da empresa, é: *

- ◯ Nacional
- ◯ Internacional
- ◯ Ambos

Para um tratamento de resultados mais eficaz, indique, por favor, o nome da empresa.

Texto de resposta longa

Utiliza alguma ferramenta de Business Analytics ou Business Intelligence para o desempenho das funções de Controlo de Gestão e Contabilidade?

- ◯ Sim
- ◯ Não

Que ferramentas de software BA/BI já utilizou? *

- ☐ Microsoft Power BI
- ☐ Google Data Studio
- ☐ Tableau
- ☐ QlikView
- ☐ SAS Business Intelligence
- ☐ SAP
- ☐ Outra opção...

Classifique de 1 a 4, os contextos em que mais utiliza as ferramentas de BA/BI. *

	1 - Não Utilizo	2 - Utilizo Pouco	3 - Utilizo de vez e...	4 - Utilizo Muito
Processamento de ...	◯	◯	◯	◯
Extração e Tratame...	◯	◯	◯	◯
Produção de Repor...	◯	◯	◯	◯
Disponibilização de...	◯	◯	◯	◯
Análise de Informa...	◯	◯	◯	◯
Previsão	◯	◯	◯	◯

Figure 10 *- Survey 2*

Figure 11 *- Survey 3*

Se utiliza qualquer uma das tecnologias anteriormente apresentadas, classifique de 1 a 5 as seguintes afirmações, relativamente ao seu impacto na informação. (Se não utiliza nenhuma tecnologia, ignore esta questão)

	1 - Discordo To...	2 - Discordo	3 - Não concor...	4 - Concordo	5 - Concordo T...
Maior Abrangê...	○	○	○	○	○
Maior fiabilidad...	○	○	○	○	○
Maior facilidad...	○	○	○	○	○
Maior sofistica...	○	○	○	○	○
Menos erros de...	○	○	○	○	○

Se utiliza qualquer uma das tecnologias anteriormente apresentadas, classifique de 1 a 5 as seguintes afirmações, relativamente ao seu impacto no trabalho das equipas de Contabilidade / Controlo de Gestão. (Se não utiliza nenhuma tecnologia, ignore esta questão)

	1 - Discordo To...	2 - Discordo	3 - Não concor...	4 - Concordo	5 - Concordo T...
Otimização dos...	○	○	○	○	○
Maior motivaçã...	○	○	○	○	○
Mais tempo par...	○	○	○	○	○
Maior disponibi...	○	○	○	○	○
Maior qualidad...	○	○	○	○	○

Quais considera serem as principais barreiras à adoção de novas tecnologias?

- ☐ Custos Elevados
- ☐ Falta de Formação / Competências das equipas
- ☐ Desconhecimento das Técnicas / ferramentas disponíveis
- ☐ Pouco Incentivo por parte da Gestão de topo
- ☐ Resistência à mudança
- ☐ Outra opção...

Se não utiliza, existe motivação para a implementação destas novas tecnologias no futuro da sua empresa?

- ○ Sim
- ○ Não
- ○ Talvez

Figure 12 - *Survey 4*

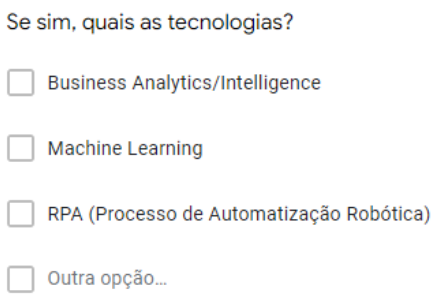


Figure 13 *- Survey 5*