



THE IMPACT OF DIGITALIZATION IN THE BUSINESS MODEL INNOVATION

Matheus de Almeida Martins



Dissertation

Master's in Innovation and Technological Entrepreneurship



Supervised by

João José Pinto Ferreira



2021

To my grandmothers Ana Martins (in memoriam) and Lourds Almeida

Acknowledgments

To God, sovereign about all things. In him I rest.

To my parents, for all they have done for me, for all the things they gave up in their life to let me learn and be a better person. To my family that always encouraged me to pursue my goals and dreams and was always there in case I needed assistance.

To engineer Nuno Morais, from Impacting Group, and engineer José Xavier, from EFFY Business, for being extremely helpful to validate the framework proposed in this research.

To Jorge Boabaid and Felipe Lima from VGO for allowing me to use their startup to apply the tool developed in this research.

To professor João José that was my guide and sage, the person that helped me every time I needed help to write this research.

Abstract

Digitalization is present in our daily lives more than we may realize, although conventionally we know that much of what we do today is intrinsically connected to digital tools. The same happens for companies that, with each passing day, need to be innovating and applying technology to their products and processes. Despite the convention that technology is increasingly present in companies, there is little evidence of the impacts caused by digitalization on business models.

The objective of this study is to understand and analyze what are, currently, the main impacts that digitalization can bring to business model innovation. Thus, it will be possible to identify the business opportunities present in companies in order to change their operation in a positive way.

For the execution of this research, we developed a framework containing the impacts and opportunities that digitalization can bring to a business and how it is possible to apply these opportunities to a business through a tool called Digitalization Opportunity Deck of Cards. To validate the proposed framework and the tool created, we analyzed a startup from Porto, Portugal, focused on the production of healthy meals sold over the internet.

The analysis and discussion with the entrepreneurs allowed us to identify changes in each of the components of the business model that will be impacted by digitalization, so that the current business model will suffer some changes to adapt to the digital world.

Keywords: digitalization; business models; innovation.

Resumo

A digitalização está presente no nosso cotidiano mais do que podemos perceber, apesar de convencionalmente sabermos que boa parte do que fazemos hoje está intrinsicamente conectada a ferramentas digitais. O mesmo acontece para as empresas que, a cada dia que passa, precisam estar inovando e aplicando tecnologia aos seus produtos e processos. Apesar de ser uma convenção de que a tecnologia está cada vez mais presente nas empresas, existe pouca evidência dos impactos causados pela digitalização nos modelos de negócio.

O objetivo desse estudo é compreender e analisar quais são, atualmente, os principais impactos que a digitalização pode trazer para a inovação dos modelos de negócios. Assim, será possível identificar as oportunidades de negócios presentes nas empresas de forma a alterar sua operação de modo positivo.

Para a execução desta pesquisa, desenvolvemos um *framework* contendo os impactos e oportunidades que a digitalização pode trazer a um negócio e como é possível aplicar essas oportunidades a um negócio através de uma ferramenta chamada *Digitalization Opportunity Deck of Cards*. Para validar o *framework* proposto e a ferramenta criada, analisamos uma startup do Porto, Portugal, focada na produção de refeições saudáveis vendidas pela internet.

A análise e discussão com os empreendedores permitiu que fossem identificadas alterações em cada um dos componentes do modelo de negócio que serão impactados pela digitalização, de forma que o modelo de negócio atual sofrerá algumas alterações para se adaptar ao mundo digital.

Palavras-chave: digitalização; modelos de negócio; inovação.

Index

Acknowledgments.....	ii
Abstract	iii
Resumo.....	iv
Index of Tables	vii
Index of Figures.....	viii
1. Introduction.....	1
2. Literature review	5
2.1. Introduction	5
2.2. Keyword Selection.....	5
2.3. Background Concepts.....	7
2.4. Discussion of the Literature.....	8
2.5. Conclusion	11
3. Methodology	13
3.1. Introduction	13
3.2. Research Approach.....	13
3.3. Selection of Case Study.....	14
3.4. Conclusions	15
4. A framework for business model digitalization	17
4.1. Introduction	17
4.2. The Problem	17
4.3. The Framework.....	17
4.4. Framework Validation with Experts	23
4.5. Tool Creation	23
4.6. Applying the tool created to a case-study.....	24

4.7. Result Analysis and Discussion.....	27
4.7.1. Discussion	27
4.7.2. Limitation of the Study	27
4.7.3. Recommendations	28
4.8. Conclusions.....	28
5. Conclusions.....	29
References.....	31
Annex	33

Index of Tables

Table 1 - A table marking every business model canvas component discussed by author . 11

Table 2 - The Framework for Business Model Innovation using Digitalization 17

Index of Figures

Figure 1 - Diagram of the research using Scopus and the result of the selection.....	6
Figure 2 - Research Framework, adaptation of Herver et al. (2004; p. 80).....	13
Figure 3 - An example of a card of the digitalization opportunities deck	24

1. Introduction

The humanity has been evolving a lot in the last centuries and decades in what relates to technology applied to life and trading; we, as humans, could create and implement technologies in our lives that enabled us to have different ways of living. From nomadism and collecting tribes, from simple farmers and ranchers to an advanced form of living, with technology being part and, sometimes, being the totality of business and how they operate. But it's not the final place for humanity, because how technology is applied daily is also quickly changing (Lucas, R., 2002, p.3).

One of the most famous periods in human history has been the Industrial Revolution, also known as the First Industrial Revolution, because the world quickly adapted itself, and humans were able to reinvent the wheel a few more times (Coleman, D., 1956, p.4). The capacity of the human mind to create and innovate is proof that when humans reach the humanity limit, they gather the knowledge conquered and develop new ways to solve problems. Be it with a new cellphone using a recently discovered technology, or a new surgical technique using robots, or a new agriculture technique with remote vehicles, human life is changing every day at an incredible pace.

And since these changes affect people's lives quickly, a company's business model need to change as fast as possible to follow up the progress experienced by the individuals that are part of the company, the stakeholders.

As Rachinger *et al.* (2017, p. 1145) says, "*the recent developments take place in the 2010s, such as the mobile revolution, social media or the power of analytics, specifically led to the digital transformation of BM*".

In agreement to Rachinger *et al.* (2017), Schallmo *et al.*, 2017, said:

"From 2000 to 2015, the rise of smart devices and social media platforms led to a drastic sea change in the methods customers used to communicate with businesses, and also the expectations customers had with regards to response times and multi-channel availability." (p. 2)

The latest decades have shown that technology is capable of turning the world upside down, be it from an individual perspective or from a commercial point of view.

And as part of human history, people pass the whole life working in businesses, be it your own or third-party. And during the latest decades, the way businesses are developed has

changed enormously. New markets, new ideas, traditional companies going bankrupt, and new companies emerging and becoming the mainstream.

This scenario raises questions regarding what kind of company is most likely to be successful in the long run based on the current reality. Companies need now to involve much more technology in its product or service, which leads to other issues, such as how digitalization impacts a business model innovation.

To the best of our knowledge, no published study has focused on identifying the impacts of digitalization in the business model innovation, specifically in each component of the business model canvas. Given the importance of digitalization in the current context of businesses and the evolution of technology, it would be illuminating to analyze this issue and overcoming this gap in the literature. Therefore, the main research question is: “What are the impacts of digitalization in the business model innovation?”. It generated two subsequent questions, as per the following: a) Is there any reference Business Model Framework for the Digital Transformation?; b) If not, is it possible to propose one to be used as a tool?

To achieve this goal, we started with a search in the literature to identify how authors were discussing about the impacts of digitalization in the business model innovation and which business model components were discussed in each paper. After that, we created a table with the literature contribution from each author and our contribution for this subject using the 55 Business Model Patterns (Gassmann, et al., 2014) as inspiration to find digitalization opportunities. Thus, to validate the table created, we discussed it with digitalization experts to analyze and improve our contribution.

This validation led to a tool creation called “Digitalization Opportunity Deck of Cards”. It is a deck of cards containing digitalization opportunities and it can be used in a context of creative process to explore digitalization opportunities for both existing and new companies.

This document is organized in chapters more annexes. The chapters are presented as follow:

- Introduction – an introduction to the subject that will be analyzed and discussed in this research and its importance for business looking for innovation using digitalization.
- Literature Review – in this chapter we navigated through the literature to find out what were the authors’ contribution to the understanding of the impact of digitalization in the business model innovation. To make it better to understand, we covered how the papers were selected, explained the background concepts needed

to understand the results of the research and then discussed the contributions by each author.

- Methodology – this is a complete description of the research approach used by the author to answer to the hypothesis presented, and an explanation about the selection of the case-study.
- A framework for business model digitalization – this chapter contains the creation of the framework that identifies the digitalization opportunities for businesses and creates a tool for entrepreneurs to find digitalization opportunities called Digitalization Opportunity Deck of Cards. We also present the limitations and recommendations.
- Conclusion – it contains the conclusion of the study, recapping the limitations and recommendations to use the tool.

2. Literature review

2.1. Introduction

Opening a new business is a challenging thing but being able to analyze what is around and how the economy is behaving is even more challenging. It was already hard to analyze in the last decades, but, with the advent of technology and its impacts on business models, it's even harder to understand what the impacts of a more digitalized world will be.

The proposed research wants to analyze how are business models impacted by digitalization and how it has transformed the way humans do business.

This literature review is started by running a keyword research containing the topics relevant to the research. As a matter of example, keywords like digitalization, digitization, digital transformation, business model, and innovation were used to find relevant topics.

In addition, it was important to discuss some background concepts that are crucial for understanding the research and results.

2.2. Keyword Selection

This chapter presents the literature review in order to provide background knowledge, addressing the BMC components and digital transformation.

The first part of the research was to analyze and demonstrate the intersection between the subjects of this research. When doing so, several words were highlighted, and an association was created between them and with the subject in study. The search with the best results was based on the following words:

- *Digitization* OR *digitalization* OR “digital transformation” as **Keywords**
- “Business model” AND innovation **present as keywords, in the abstract and on the article title**

It resulted in the following query string: (KEY (digitization OR digitalization OR "digital transformation") AND TITLE-ABS-KEY ("Business model" AND innovation)).

It was essential to use different words like *digitalization* or *digitization* to find out exactly what was the difference between them and how they are related to each other.

The search was done using Scopus¹, a platform that allows the researcher to find papers from other researchers and scientists. The PRISMA diagram (Page et al., 2021) below shows the process in a generalist way, but it is explained below.

The result of the search was 264 papers that could have some relationship with the subject studied, but to find the best papers, some refining was still needed to check which papers were related to the subject.

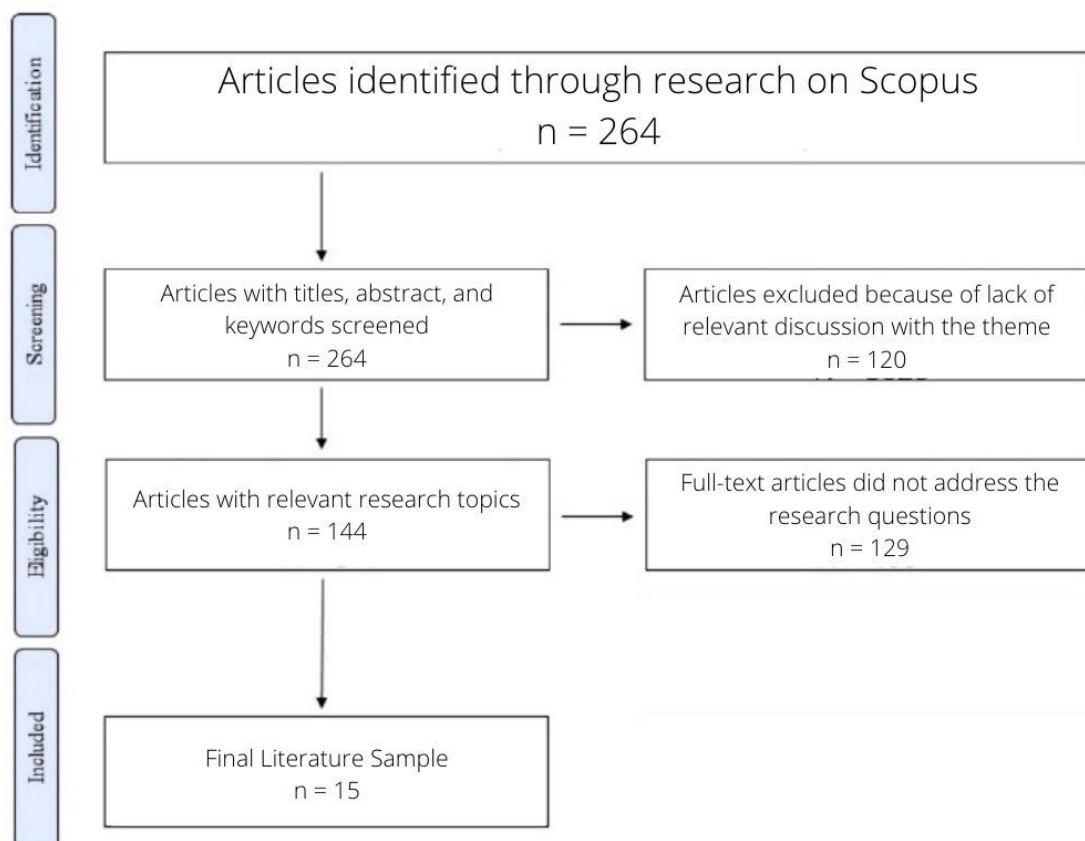


Figure 1 - Diagram of the research using Scopus and the result of the selection

Using the PRISMA methodology (Page et al., 2021), during screening, the second step of the paper's evaluation, one hundred twenty papers were removed from the list due to lack of relevant discussion with the theme. It doesn't mean that these papers are not relevant neither technically bad, it only means that the removed papers are not relevant for this research.

The third step called eligibility, there were still 144 papers that needed to be analyzed to see if they could, in any way, contribute to this research. Although they are good papers for the

¹ <https://www.scopus.com/>

subject, some of them were focusing on specific parts of the business model innovation process and digitalization in a way that could not benefit the research in a pragmatic way. As a result, 129 were removed as they did not add value to this research.

The fourth and last step was to identify the best papers for this research, which is a result of the exclusions above. There are now 15 papers extremely related to this research and that add a lot of value to it.

In summary, Scopus generated a result of 264 papers that were somehow linked to this researched the thorough analysis returned 15 relevant papers.

2.3. Background Concepts

Before reviewing the literature about business model innovation and digitalization, it is important to understand background concepts that will provide the background knowledge relevant to this research.

Digitalization. Digitalization is better understood as the transformation of a business process by leveraging digital technologies. Ultimately, it results in opportunities for efficiency and increased revenue. According to Westerman *et al.* (2011), digitalization can be described as a process permeated by changes in the organization itself and/or its business model, as a result of constant and increasing use of digital technologies to improve the performance and the business' scope.

Digitization. Digitization is the process that converts pictures, texts, or sound into a digital form that can be processed by a computer through a software and generates an output. As Rachinger *et al.* (2017, p. 1145) says, “*it's the process of converting analogue data into digital data assets.*” It's also the framework for digitalization, which allows the exploitation of opportunities in the digital net (Rachinger *et al.*, 2017).

Business Model. A business model can be defined as a description of how a business is going to operate and make money. It includes the business behavior, how it acts, what are its properties, configuration. It's a company's core strategy for profitability doing business (Teece, 2010). Still according to Teece's, understanding, “In essence, a business model embodies nothing less than the organizational and financial ‘architecture’ of a business” (Teece, 2010, p. 191).

Innovation. Innovation is the process of creating new things. These things can be a new object, a new method, a new business model, or even improving something that already exists. It's what we call “carrying out of new combinations”, how things that may already

exist be put together to work in a different manner. The Oslo Manual (OECD/Eurostat, 2018) says that innovation is “*An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations*” (p. 46).

Digital Transformation. Digital Transformation is the process developed and used to structure or restructure societies, economies, and/or institutions on a system level (Brenner and Kress, 2016). Any process that uses digitization and, therefore, turns into digitalization, becomes a digital transformation.

2.4. Discussion of the Literature

To create the literature review, it was necessary to identify the contributions and limitations from each article in regards to the impact of the digitalization in the business model innovation. The literature review was addressed by comparing each author’s perspective concerning the multiple business model components first designed by Osterwalder, the Business Model Canvas (BMC) (Osterwalder *et al.*, 2010). An in-depth analysis of each contribution by author can be found in Annex 2.

The BMC contains nine different blocks used to model the business, and they are: customer segments, value proposition, channels, customer relationships, revenue streams, key activities, key resources, key partners, and cost structure. The research in each article could be related with one or more specific fields from the BMC, and on how the digitalization process impacts the BMC’s components.

Starting by the customer segments, when analyzing them, the entrepreneur must understand that customers will not buy a product only because there is a will to buy products. It’s necessary to highlight that customers want solutions to their needs, and this is why it’s essential to carefully select and understand the customer segment that is going to be the focus of the new business. As the company is going to use digitalized means to reach the new segment, a market segment previously covered may not be the same segment being covered now. (Teece, 2010).

In the process of discovering this possible new customer segment, it’s vital to identify what is the value proposition that will convince this new individual to become a client. A valuable value proposition should not merely reflect the value for the customer, but how this value is perceived (Teece, 2010). A value proposition should always be compelling to customers. It’s key to notice that the changes influenced by the business model innovations may include the

value chain or the value proposition to the company's customer or other partners (Rachinger *et al.*, 2017).

In the creation of this perceived value, when a company considers digitalizing its processes, services and/or products, recombining or inventing (Remate *et al.*, 2016), it's necessary to often reassess the value proposition to ensure that it matches the initial company's motto or, in case the value proposition changes, that the core offering is still addressed (Matt *et al.*, 2015). It may be useful to analyze a conceptual model of digitalization that address the key components of a business model (Ng *et al.*, 2019).

Now that the customer segment and the value proposition are clear, it's time to identify the channels that will be used to reach out to the new customer. Teece (2010) describes that the advent of technology brings changes inside and outside of the company, which means that companies now need to deal with diversified channels and compete with several other companies that were not in the primary channel discussion. As an example, the music recording industry used to profit from selling CDs, and nowadays, the focus has shifted to online streaming.

Schallmo *et al.* (2017), using a case study, explains that company's digitalization enables new revenue sources by creating different channels to be targeted, which may or may not be linked to the core business. The data gathered and simultaneously delivered to both the internal and external stakeholders created tremendous value. Online streaming is strongly connected to social media, which is an important part of the digitalization process. Social media becomes a new channel for the company (Bouwman *et al.*, 2018).

Finally, a channel update requires not only migrating to a digital place, but it includes mind changing, and digital specialization (Priyono *et al.*, 2020).

New channels will have a strong effect on how the relationship between the company stakeholders. The customer relationship changes when there is business model innovation, because not only internal capacities are central to the business model, but also the environment should be considered. It's important to analyze the surrounding context. Rachinger *et al.* (2017) says that "the assessment of the BM is bound to the environmental context. In this context, the business environment is seen as a variable that can be selected by the company, but also vice versa" (p. 1147). The analysis of the surrounding will bring new relationships through social media and impacts the customer relationship strategy (Bouwman *et al.*, 2018).

A company that is discovering new business models through innovation and digitalization may be willing to invest in other companies that, at first glance, are competitors, but in the long run can become partners. This kind of investment will bring a new revenue stream that should be considered (Remane *et al.*, 2016). According to Gebauer *et al.*, (2020), digitalization can and will impact the revenue stream of the organization, but also it will enhance products and services in the physical world. The digital space will contribute and benefit the physical space. And the contrary is also true.

Interestingly, the identification of the revenue stream will also allow us to identify how the digitalization impacts the choice of the key activities of the company. Digitalizing a process, service, product, or even the company itself is a modification and/or substitution of a current activity. This is particularly important to highlight because the company's key activities may change to accommodate the changes brought by the digitalization of the business model. Following the discovery of business models on the Value Proposition component, when recombining or inventing a new business model, the key activities should be changed or improved to match the new value proposition. (Matt *et al.*, 2015; Remane *et al.*, 2016).

Matching the new value proposition will guide the company to decide which are the key resources needed to digitalize the operation. One important thing brought by the digital transformation is that it will require structural changes, which will affect the key resources of the company. These changes are often necessary in order to provide an adequate basis for the new operations (Matt *et al.*, 2015). The digitalization process impacts and influences every industry, and it shakes the corporate strategies and challenges existing business models, which need to be reconsidered and adapted (Rachinger *et al.*, 2017).

For Schallmo *et al.* (2017), the key resources, also called *enablers*, are: digital data, automation, digital customer access, and networking. These resources allow the company to go through a digital transformation and implement digitalization on its products, services, and/or processes (Mugge *et al.*, 2020). And as part of the digitalization process, it's essential that trained staff is hired (Gudergan *et al.*, 2019; Priyono *et al.*, 2020), so the company masters the data exchange, generation, analysis and adaptation to processable information (Bican & Brem, 2020; Wißotzki *et al.*, 2021).

The company will not always be able to do that alone, even when new staff is hired to implement the digitalization process. Also, it's important to analyze the customer segment the business is focused on. This will allow the selection of the best partners for the business and digitalization process. It may require workforce qualification and, in case they do not

possess the resources, they need to develop a network of partners to outsource (Rachinger *et al.*, 2017). Key partners need to be analyzed by how far it can reach in order to add value the supply chain. Digitalizing an organization and implementing new technologies needs to be surrounded by partners willing to follow the same path, and it will improve the circularity of the firm's resource usage and contribute to value creation (Ranta *et al.*, 2021; Mugge *et al.*, 2020).

The components addressed above will have a direct impact in the cost structure of the company. In the industrial era, scale was one of the most important things, and capturing the value was relatively simple. Nowadays, technology allows low-cost structures that facilitate the exploration of alternative solutions for costs and revenues (Teece, D.J., 2010). If the company is going to switch a manufacturing process, for example, it's important to remember that any modification on the strategy, impacts the cost structure of the company. It may be necessary to hire new staff, invest in research and development, machinery, and so on (Matt *et al.*, 2015). Any digitalization process impacts the cost structure. In the first moment, probably the cost goes up due to the adaptabilities needed, but the tendency is that the costs go down (Rachinger *et al.*, 2017).

2.5. Conclusion

After reviewing what authors believe and think about the impact of the digitalization in the business model innovation, analyzing each component of the BMC individually, it was possible to identify a gap for a holistic view of the real impact of digitalizing a business, a point of view that embrace all aspects of a company. Each author addresses one or more specific components of the BMC, but none of them analyze the digitalizations impact on the whole BMC, as per Table 1.

Table 1 - A table marking every business model canvas component discussed by author

	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
Teece, D.J., 2010	X	X	X						X
Matt <i>et al.</i> , 2015		X				X	X	X	X
Remane <i>et al.</i> , 2016		X			X	X			
Rachinger <i>et al.</i> , 2017		X		X			X	X	X
Schallmo <i>et al.</i> , 2017			X				X		
Bouwman <i>et al.</i> , 2018		X	X	X					
Xu & Koivumäki, 2019		X							
Ng <i>et al.</i> , 2019		X							
Gudergan <i>et al.</i> , 2019							X		
Bican & Brem, 2020							X		
Priyono <i>et al.</i> , 2020			X				X		

	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
Mugge et al., 2020							X	X	
Gebauer et al., 2020					X				
Ranta et al., 2021								X	
Wißotzki et al., 2021							X		

It means that there is an opportunity to integrate the knowledge into a single model, that can be used for further research and development concerning the impact of digitalization in the business model innovation.

3. Methodology

3.1. Introduction

The gap acknowledged in the previous chapter led to the definition of the following research question, refined with two sub-questions:

How does Digitalization impact business model innovation?

- a) Is there any reference Business Model Framework for the Digital Transformation?
- b) If not, is it possible to propose one to be used as a tool?

3.2. Research Approach

The goal now is to understand the impact caused by digitalization is business model innovation, and to identify its impact. This research uses the Design Science Approach: addressing the “*research through the building and evaluation of artifacts designed to meet the identified business need*” (Hevner et al., 2004; p. 79-80). By adapting Hevner’s model, we end up with the framework illustrated in Figure 2.

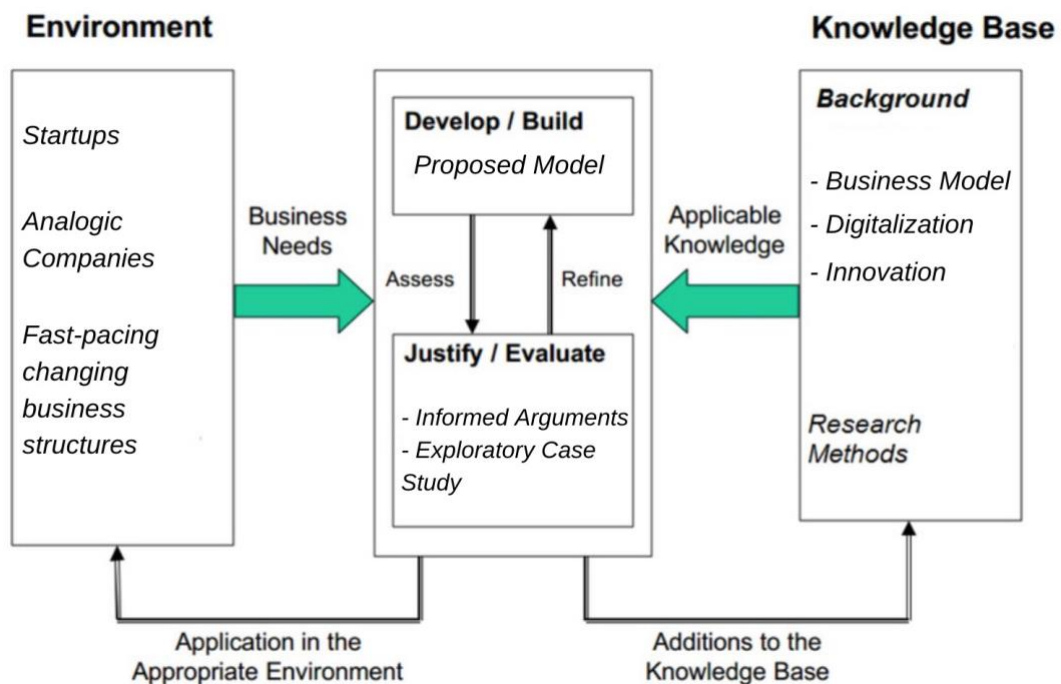


Figure 2 - Research Framework, adaptation of Henver et al. (2004; p. 80)

This framework was elaborated taking into consideration the gap found in the literature, as discussed previously in Chapter 2. The proposed research approach allows for the proposal of a new framework for Business Model Innovation using Digitalization.

The first step to create the framework for Business Model Innovation using Digitalization was to analyze individual papers from different authors. It is important to notice that each paper addressed one or more elements of the Business Model Canvas by Osterwalder (Osterwalder et al., 2010).

Consequently, after an in-depth analysis of each paper, a table was created containing each paper's contribution and limitation for the research along with the author's view for each BMC component. Each author addressed one or more points of the BMC, but none of them addressed all of them in a way that allows a holistic comprehension.

To find new contributions for the framework, in a brainstorming process, we navigated through the 55 Business Patterns Cards (Gassmann, et al., 2014) to find out what would be the digitalization opportunities for different business. For each business pattern option, we tried to figure out where digitalization could be used to improve the processes, products, and even business opportunities.

To validate our contributions, we discussed them with two digitalization experts that contributed with new ideas and suggestions to fine and tune our contributions.

The result of this process was a tool that can be used in the creative process by entrepreneurs, managers, CTOs, and CDOs to identify digitalization opportunities for the business they are working on.

Finally, the last step to validate the framework proposition was to apply it to a case study of a startup that is innovating in the tech-food industry. By analyzing this case study, it will be possible to identify the gaps that the company still needs to address in order to digitalize its processes and products.

3.3. Selection of Case Study

In order to test the framework proposed in the next chapter, VGO, a startup from Porto, Portugal, was selected to be studied. VGO is a startup that aims to develop, produce, and deliver delicious, practical, and healthy food without animal product. VGO was selected to be mentored in the Startup Voucher project, which is one of the projects of StartUP Portugal – National Strategies for Entrepreneurship that dynamizes the development of entrepreneurial projects in the idea phase promoted by young people between 18 and 35 years old during a period of about 12 months.

Although the company is not selling its products now, they are running tests with possible early adopters to identify their needs, assess how the platform works for them, and the digital

needs they have when buying food online. They are working on how to customize the meal packages and how to prioritize seasonal ingredients from regional farmers.

This exploratory case study (Baxter & Jack, 2008, p. 548) will allow us to investigate the applications of the proposed framework and find out what are the results of the digitalization intervention in this specific company.

This startup was selected for its fit for applying digitalization to a new business as the entrepreneurial team is still working to define its future solid business model, in which digitalization will play a key role in the process. In addition, knowing its founders and having direct contact with them allow us to collect much more information from the people effectively operating the company.

3.4. Conclusions

Possessing the understanding of the literature and how different authors apply digitalization in the business model innovation led us to develop the methodology explained above.

Consequently, it will be important to find new contributions for each business model component from the Business Model Canvas (Osterwalder et al., 2010) to consolidate the knowledge dispersed between different authors in a framework that can be used by managers and entrepreneurs.

Conclusively, the case-study will allow us to see the applicability of the tool in a business and see how things can change based on the framework contribution.

4. A framework for business model digitalization

4.1. Introduction

To help the entrepreneur in finding digitalization opportunities, a framework was developed to facilitate the comprehension and validated with experts. The digitalization specialists' validation and assistance on the framework allowed us to develop a tool recommended for managers that expect to implement a digital transformation in a company, be it for products or processes.

Limitations of the framework and the tool will also be addressed in this chapter to allow the reader to understand how far he or she can go using this tool and what are the next steps for further research.

4.2. The Problem

Implementing different strategies on a company is a complex task because it frequently involves changing how the company's stakeholders act. This is also applicable when the company is working out to become a digitalized firm. The literature review helped us to compile how researchers considered the impact of digitalization in a company. The author projected the result of this analysis into the business model canvas. This was the starting point for the framework to be proposed in the next section.

4.3. The Framework

This research aims to provide a holistic view of the impact of digitalization in each Business Model Canvas (BMC) component. To do so, distinct views gathered from the literature are combined with proposals put forward by the author of this dissertation.

The author's contribution (A.C.) in Table 2 was developed in the context of a brainstorming session. In the process we browsed through the 55 business model cards (Gassmann, et al., 2014) and the next step was the interaction with digitalization specialists that helped both on the validate but also in tuning and bringing new ideas for each card, trying to figure out where we would have an opportunity for digitalization. The following table is the result of the whole process.

Table 2 - The Framework for Business Model Innovation using Digitalization

(Legend: L.C. stands for "Literature Contribution" and A.C. stands for "Author's Contribution")

Business Model Component	The impact analysis
Customer Segment	L.C.:

-
- Carefully select the customer segment mainly because now the company is going to use digitalized means to reach the new segment (Teece, D.J., 2010).

A.C.:

- Analyze how the internet works in different parts of the world (for speed & behavior) (Graham et al., 2012).
- Digitalization enables users to combine green products with a market segment focused on highly engaged public.
- Leveraging custom data allows companies to better understand its customer and reachable market. Digitalizing the data analysis will help find better customer segments to target.
- Digitalization democratizes the customer segmentation. Users not reachable a while ago are now reachable and may become users/customers.
- Companies need to test their digital service because users expect it to be flawless.

Value
Propositions

L.C.:

- It should not merely reflect the value for the customer, but how it's perceived now that the company is digitalized. (Teece, D.J., 2010).
- Often reassess the value proposition, so the team makes sure that the core offering remains the same or, if needed, modifies it to the new proposition (Matt et al., 2015).
- There are two options for discovering new business models: recombination or invention, and most likely both will include applying digital knowledge and transformation to the business. (Remane et al., 2016).
- It may include the value chain or the value proposition to the customer or other partners of the company. (Rachinger et al., 2017).
- It's necessary to promote the value proposition branding it via Facebook and Twitter. (Bouwman et al., 2018)
- Agility should be in the value proposition, since it's responsible for bringing valuable product and/or service offerings to customer with the aim of achieving market success. (Xu & Koivumäki, 2019)

A.C.:

- Customer Support by providing online self-service features, combining AI in answering users' questions as well as, for example, videos with detailed instructions to be followed.
 - Digitalization allows the company to propose a value proposition that can provide a green and ecological option for customers, allowing them to live their beliefs through your brand. As an example, the company may not have physical store and sell things digitally only, reducing its carbon footprint.
-

	<ul style="list-style-type: none"> – Business operating a “<i>Anything Digital as a Service</i>” model should be supported by a strong value proposition that focus on solving customers’ problems using digitalization. As an example, a company may contact the client via email and chat, but never sending mail. – Digitalization allows the company to be closer to its users and customers, offering individual value propositions inside the general value proposition.
--	--

Channels	<p>L.C.:</p> <ul style="list-style-type: none"> – It’s necessary to deal with diversified channels and compete with several other companies that were not in the primary channel discussion (Teece, D.J., 2010). – New channels allow the company to find new sources for revenue by creating different channels to be targeted (Schallmo et al., 2017). – The social media can become a new channel, where new relationships can be created. (Bouwman et al., 2018) – A channel update requires not only migrating to a digital place, but it includes mind changing, and digital specialization. (Priyono et al., 2020) <p>A.C.:</p> <ul style="list-style-type: none"> – Users creating digital content for your brand can be considered as a new channel where other users will have access to the goods from your company. – Leveraging customer data allows new channels to be focused on depending on the data collected by the companies. – Offer ways to share a digital peer-to-peer campaign, awarding the user by his sharing on social media. – Digitalization enables the company to multiply its marketing channels using new tools.
----------	---

Customer Relationships	<p>L.C.:</p> <ul style="list-style-type: none"> – Not only internal digital capacities are central to the business model - the environment should also be considered. (Rachinger et al., 2017). – The social media impacts how new customer relationships are created through a new channel. (Bouwman et al., 2018) <p>A.C.:</p> <ul style="list-style-type: none"> – Promoting the use of mass customization, by enabling users’ interfaces that enable the users’ configuration of the actual product. – Digital user-generated content can create brand-loyalty and improve the relationship between the brand and its customers. – Offer online auctions via social media for the followers. – Digital crowdfunding via social media using a third-party tool to show the earnings live.
------------------------	--

	<ul style="list-style-type: none"> – The information gathered digitally allows the creation of valuable customer profiles that helps establishing customer relationships.
Revenue Streams	<p>L.C.:</p> <ul style="list-style-type: none"> – Digitalization can/will impact the revenue stream of the organization, but also it will enhance products and services in the physical world. (Gebauer et al., 2020) – Competitor acquisition can bring a new revenue stream that should be considered (Remane et al., 2016) <p>A.C.:</p> <ul style="list-style-type: none"> – Digital user-generated content can be a source of income due to the reach of the “free” advertisement. – On a data as a service business, charge users based on the data collected, processed and analyzed about their personal day-to-day. – Create digital courses and content that generates new revenue to the company by leveraging resources already available. – Share the revenue of a digital crowdsourced product using online gifts. – The company needs to analyze the revenue stream to avoid digitalization from cannibalizing a revenue stream that the company already has. If it is going to happen, it’s necessary to analyze how to merge and improve current revenue streams. – Depending on the business model of the company, digitalization facilitates a subscription revenue model.
Key Activities	<p>L.C.:</p> <ul style="list-style-type: none"> – The digitalization is a modification or substitution of a current activate (Matt et al., 2015) – The key activities should be changed or improved to match the new value proposition. (Remane et al., 2016) <p>A.C.:</p> <ul style="list-style-type: none"> – Mass customization must be supported by advanced production management systems that enable the one-of-a-kind product in the production line. – Anything Digital as a Service needs to be supported by digital processes that allow for quick restoration in case of failure. – Franchising support by providing business analysis online using artificial intelligence, comparing its key performance operators with the past data and competitors. – Implement AI to understand when a product is more requested and change its price automatically based on previous rules – dynamic pricing. – Digitalization allows companies to use third-party services to improve the organization and management – Trello, Slack, Asana, and so on.
Key Resources	<p>L.C.:</p>

-
- Digital transformation requires structural changes, which will affect the key resources of the company. (Matt et al., 2015)
 - Digital data, automation, digital customer access, and networking are the digitalization enablers. (Schallmo et al., 2017)
 - Hiring trained staff, a chief digital officer, and moving products to the cloud (Gudergan et al., 2019)
 - It's necessary to master the data exchange, data generation, data analysis, and data adaption to processible information (Bican & Brem, 2020)
 - Implement a learning culture that allows the company to change, being a pivotal enabler of dynamic capabilities. Resources should be focused in generating revenue and overriding activities not related to revenue (Priyono et al., 2020).
 - “The relationship between resources and strategy is a two-way street. Strategy affects resources and resources affect strategy.” (Mugge et al., 2020; p. 32)
 - The resources need to be aligned "to smooth out the rough edges". (Wißbotzki et al., 2021)

A.C:

- Anything as a Service might request computation resources for the company in order to keep the service live.
- An online platform that allows customer resell their recently purchased items that they do not want anymore.
- A platform needs to have a strong technological team behind it to make the service to be available 24/7. It needs computational and personal resources.
- Offer digitalization via virtual reality that allows the user to virtually test the product. It's an example on how to modify the bricks & clicks business pattern with digitalization.
- Digitalization should bring people transformation, by renewing or training the staff. This trained staff will be attentive on how the customer relationship may change. The key resource in a digitalized company is technology plus people.

Key Partners

L.C.:

- The company needs know-how and competences in cyber physical systems or analytical data processing. (Rachinger et al., 2017).
- It's fundamental that they create breakthrough business models that include key partners, such as suppliers, distributors, customers, even other developers, from outside the boundaries of the enterprise. (Mugge et al., 2020)
- Digitalizing an organization and implementing new technologies needs to be surrounded by partners willing to follow the same development path. (Ranta et al., 2021).

A.C:

-
- A digital platform must be supported by partners to enable the service to operate in different locations.
 - In a long tail business model, find partners that allow you to have their less searched products on your digital application and then use create niches to work on.
 - Find local partners to act like distribution centers to allow disintermediation. A digital network for the supply chain will include both companies and individuals, both working to deliver products as quickly as possible.
 - Charge for data exchange between platforms by providing customer analytics.
 - Digitalization may help integrating the value chain completely – with all the partners, giving visibility to all the processes and what is happening in real-time.
-

Cost Structure

L.C.:

- It's important to consider what is going to change financially in the business operation. (Teece ,2010)
- Nowadays, technology allows low-cost structures that facilitate the exploration of alternative solutions for costs and revenues. (Teece ,2010)
- When implementing a new digital strategy at the company, any modification on the digitalization strategy impacts the cost structure of the company (Matt et al., 2015).

A.C.:

- Use of digitalization to select the goods the users want before loading it on a truck or airplane. As an example, instead of loading an airplane with product that user *might* want, the company loads only the products already requested by customers, saving weight and fuel.
 - Reduce company costs by collecting, combining and interpreting the business data, offering analysis to third-party companies – digital data as a service.
 - Reduce costs of production by using the expertise of the company and leverage resources – digital courses, for example.
 - Small stores inside digital marketplaces from big stores to reduce prices, a digital shop-in-shop.
 - Digitalization might require a rearrangement of the money used for company improving.
 - The back-office, production, staff, all that might require rearrangement to fit into the new way the company is structured.
 - Digitalization allows the company to automate selling of products and services that does not need contact to the selling team.
 - When implementing digitalization, new areas may be created, competences may change, and processes are substituted.
-

-
- To reduce costs, creating customer profiles are useful to analyze where the money should be invested.
 - Digitalization can bring disintermediation, which can reduce production costs.
-

4.4. Framework Validation with Experts

To validate the framework proposed and its applications in a real situation, we contacted two digitalization experts - engineer Nuno Morais, from Impacting Group, and engineer José Xavier, from EFFY Business.

The Impacting Group is an innovative digital business that owns and controls companies in the Digital Business Technology Based. This group owns and control companies of publishing, lead generation, email marketing, marketing automation, digital transformation, push notifications, e-commerce, and custom service.

The EFFY Business works to assure business efficiency using analytics, automation, and assurance all-in-one. The focus of the company is to reduce business inefficiencies with actionable analytics and proven revenue assurance technologies. They ensure financial oversight of digital transformation processes. Their clients vary from finance and insurance, retail and logistics, healthcare and life sciences, energy and utilities to mobility and transportation.

The validation occurred via videoconference using the Google Meet service due to the COVID-19 pandemic. The pandemic disallows in-person discussions and debates, so the analysis was made by sharing the screen and adding comments and improvements, suggesting changes and removals. Both specialists helped shaping the framework and contributed to new insights of digitalization opportunities according to each business model component.

4.5. Tool Creation

The framework creation and the validation with experts allowed us to start designing and elaborating a tool that grants a business manager or someone designing a business model to identify digitalization opportunities in their current model.

To create this tool, we assembled each of the proposed digitalization opportunities in the framework, both author's and literature's contributions, as a card belonging to a deck of "Digitalization Opportunity Cards".

Each card contains the business model component they pertain to at the top of the card and the digitalization opportunity identified in the research at the bottom section of the card. Figure 3 - An example of a card of the digitalization opportunities deck is an example of how the card will look like.



Figure 3 - An example of a card of the digitalization opportunities deck

The Digitalization Opportunity Cards should be used by people that are willing to digitally transform a company's products and/or processes. As an example, if the people in charge of the digitalization of the company wants to find digitalization opportunities for its channels, they would pick up a channel card that belongs to the deck similar to the one you can see in the Figure 3 - An example of a card of the digitalization opportunities deck.

This card will contain a digitalization opportunity, that in this example is the opportunity of creating a new channel based on customers creating digital content for the company. It would help the brand to be promoted by a third-party, allowing the marketing team to focus on collecting content generated by the users to use in their marketing campaign, for example.

The deck can be used in the context of a creative process whenever digitalization comes into discussion to find ways to integrate digitalization in the company's business model. All business model components can be affected by digitalization using the Digitalization Opportunity Cards.

4.6. Applying the tool created to a case-study

The validation of the framework by the digitalization specialists was important to identify required changes and what improvements. In this exploratory case-study, we now apply the tool in the context of a startup in Porto, Portugal. A workshop was organized with the startup

CEO and COO, and the result of this workshop with the startup team is described in the table below, organized per business model canvas component.

Table 3 - The results of the workshop and the digitalization opportunities found

Business Model Component	The Card	The Results
Customer Segment	Digitalization enables users to combine green products with a market segment focused on highly engaged public.	The first application of the Digitalization Opportunity Cards concerns the customer segments of the company. VGO focus is to create a company for people that want to reduce or stop eating meat. A digitalization opportunity found using the Digitalization Opportunity Cards is that digitalization enables the company to sell its green products to a customer segment that is focused on health and is an extremely engaged public.
Customer Relationship	The information gathered digitally allows the creation of valuable customer profiles that helps establishing customer relationships.	A contribution used by the startup is to create customer profiles using a digital platform based on the information gathered by the users' footsteps on the platform. These footsteps are a great source of information for further analysis to understand the customer and establish customer relationship.
Channels	Users creating digital content for your brand can be considered as a new channel where other users will have access to the goods from your company.	When they selected their target customer, they understood that they need to focus on people that want to have a more balanced life in terms of what they eat. Knowing that people, now more than ever, want to share their life online, they created a Highlights section on their official Instagram account (@vgo.pt) called <i>Early Adopters</i> where they share with the internet users how their customers behave when they receive their meals. The highlight section creation process allowed them to see how people are reacting to their meals and how other possible users are reacting to it.
Revenue Streams	Depending on the business model of the company, digitalization facilitates a subscription revenue model.	The startup will work to implement a subscription revenue model using the digital platform and a key partner as a payment gateway. This will allow the startup to have a predictable revenue that they can use to improve the company operation.
Value Proposition	Digitalization allows the company to propose a value proposition that can provide a green and ecological option for customers, allowing them	Another digitalization opportunity concerns the value proposition. Using digitalization, VGO can provide a green and ecological option for customers, allowing them to live their believes through their brand. VGO will produce the food in a shared place and deliver it bi-weekly

	to live their believes through your brand. As an example, the company may not have physical store and sell things digitally only, reducing its carbon footprint.	for its customers. This will allow them to rent a place and pay per use only, instead of a monthly rent.
Key Activities	Mass customization must be supported by advanced production management systems that enable the one-of-a-kind product in the production line.	For the company to have mass customization of its meal packages, it must be supported by advanced production management systems that enable the one-of-a-kind product in the production line. The company is looking for a tool that will allow them to manage the orders they receive via website and to find the best production order.
Key Resources	Offer digitalization via virtual reality that allows the user to virtually test the product. It's an example on how to modify the bricks & clicks business pattern with digitalization.	With virtual reality occupying a great space right now, the startup will consider offering virtual tests of the food, by presenting the food ready-to-eat. The company expects to record the preparation of the meals to also share with the customers, so they can be immersed on how things are prepared.
Key Partners	Digitalization may help integrating the value chain completely – with all the partners, giving visibility to all the processes and what is happening in real-time.	Digitalization allows VGO to find key partners for their business model. Digitalization may help integrating the value chain completely – with all the partners, giving visibility to all the processes and what is happening in real-time. One of the important things to this company is that they will need to deliver a huge number of meals for its customers, and it will be important for them to find a partner that allows the meals to be tracked, so the customers know exactly when to expect the meal to arrive.
Cost Structure	To reduce costs, creating customer profiles are useful to analyze where the money should be invested.	Finally, the cost structure of the business might change when they implement digitalization. One of the digitalization opportunities found in the framework is to reduce costs by using customer profiles to analyze where the money should be invested. VGO is going to design and create customer profiles for the people they expect to reach, so that they can invest the money intelligently, investing only in people that really can become a customer.

4.7. Result Analysis and Discussion

Aiming to respond the research questions raised in the methodology chapter, we worked to find out the digitalization impacts in the business model innovation and to propose a new business model framework using digitalization opportunities.

4.7.1. Discussion

During our research, we could not identify a business model framework for the digital transformation in a company, only sparse contributions from different authors regarding digitalization and its impacts on business model components.

The inexistence of a framework led us to develop a framework where we could consolidate what the literature was saying plus contributions created by us and validated by digitalization experts. This framework led to a tool that we used to apply in a case-study to investigate the outcome of it.

Our research shows that digitalization can impact every single component of a business model, from partners to customer segment, from cost structure to channels. Digitalization can impact on how the partners of a company are selected, how the money is invested, managed and applied, and how channels should be used and changed.

A company working to implement digitalization needs to be aware that this process can change its core operation, so it is necessary to monitor how the stakeholders are reacting when the change is in place.

4.7.2. Limitation of the Study

As a limitation of this research, we have the number of specialists that contributed to it. The interviews with the specialists didn't allow us to reach the saturation, so it will be necessary for further studies to interview more specialists from other industries to get a broader overview of more digitalization opportunities.

It would be important to validate the framework and the tool designed here – the Digitalization Opportunity Deck of Cards – in other startups from different sectors to see if the contributions can be applied to them as well.

Lastly, testing the Digitalization Opportunity Deck of Cards in small, medium, and large companies will allow the data collection about its applicability and the effects on the companies' processes and products.

4.7.3. Recommendations

In one hand, this study will be most useful for managers that have a close supervision of implementation of business strategies, so they can apply the contributions found here more closely.

It can also be a great tool for chief technology officers (CTOs) and chief digital officers (CDOs) that oversee applying digitalization into a company providing them with a tool that allows for the exploration of digitalization opportunities.

Finally, this study can be also used by startup entrepreneurs to identify digitalization opportunities to their business, and possibly improve the startup digitalization results. This tools also allows the entrepreneurs to pivot the business model if needed based on digitalization.

4.8. Conclusions

The framework creation allowed us to identify and analyze the impact of digitalization in the business model innovation, by identifying what literature is saying about the digitalization and its impacts.

The framework, validated by the digitalization specialists, also allowed us to create a tool that will help manager, CTOs, CDOs, and startup entrepreneurs to find digitalization opportunities on their business, as it helped VGO to identify new channels, change its cost structure, rethink its key partners, and increment its value proposition.

Further research is needed to corroborate that it can be used in different business models, from small to large companies.

5. Conclusions

Since the first Industrial Revolution, the humanity has been evolving quickly and implementing technology in the day-to-day decision we need to make. Every day technology becomes more and more part of our lives.

This is also true about businesses that need to innovate frequently to be competitive in the market. Technology has become one of the best friends and ally of companies willing to innovate namely the business model they operate.

For companies looking for innovation using digital technology, also called as digitalization, it's not easy to identify the digitalization opportunities on the current business model, mostly because we didn't have a synthesized and concise framework that would allow the entrepreneurs and managers to find these opportunities.

This research started by asking what are the impacts brought by digitalization to the business model innovation and trying to identify the existence of a business model framework for the digital transformation. The result was that we couldn't find any, so we answered the second sub-question by elaborating a framework.

To answer our research questions about the impact of digitalization, we analyzed what the literature said about the impacts of digitalization in the business model innovation by understanding what each author had to aggregate to the business model components created by Osterwalder in his Business Model Canvas.

The collection of the information available on the papers regarding the literature contribution for each business model component allowed us to compile in a table the considerations of each author regarding the business model canvas clock. In addition, we were able to identify new digitalization opportunities based on the 55 Business Patterns Cards (Gassmann, et al., 2014). These cards were used as reference to generate ideas for digitalization in each business model component.

The table created with both literature and our own contribution was validated by digitalization specialists that went through each contribution, suggesting changes and tuning the impacts and opportunities brought by digitalization.

To facilitate the applicability of this framework, we created a tool called Digitalization Opportunity Deck of Cards that aims to help entrepreneurs, CTOs, CDOs, and managers to identify digitalization opportunities on their business models. Each card contains the

business model component affected by digitalization and an idea of impact and opportunity digitalization brings to the business.

Finally, we applied the Digitalization Opportunity Deck of Cards to a startup that is focusing on selling deep-frozen meals online. The tool created helped the company to detect new channels, rethink its cost structure, better analyze its key partners, improve its value proposition, identify new key partners and key resources, and rethink its revenue model.

Further research should focus on reducing the limitations described on this research by applying the Digitalization Opportunity Deck of Cards to different businesses in different sectors to catalogue the outcome of the exercise. Also, collecting more feedbacks from other digitalization experts will be useful to validate and find new contributions to the business model framework.

References

- Bican, P., & M Brem, A. (2020). Digital Business Model, Digital Transformation, Digital Entrepreneurship: Is there a sustainable “digital”? *Sustainability (Switzerland)*, 12(13). <https://doi.org/10.3390/su12135239>
- Bouwman, H., Nikou, S., Molina-Castillo, F. J., & de Reuver, M. (2018). The impact of digitalization on business models. *Digital Policy, Regulation and Governance*, 20(2), 105–124. <https://doi.org/10.1108/DPRG-07-2017-0039>
- Brennen, J.S. and Kreiss, D. (2016), “Digitalization”, in Jensen, K.B., Rothenbuhler, E.W., Pooley, J.D. and Craig, R.T. (Eds), *The International Encyclopedia of Communication Theory and Philosophy*, Wiley-Blackwell, Chichester, pp. 556-566.
- Caputo, A., Pizzi, S., Pellegrini, M. M., & Dabić, M. (2021). Digitalization and business models: Where are we going? A science map of the field. *Journal of Business Research*, 123, 489–501. <https://doi.org/10.1016/j.jbusres.2020.09.053>
- Coleman, D. C. (1956). Industrial Growth and Industrial Revolutions. *Economica*, 23(89), 1. <https://doi.org/10.2307/2551266>
- Gassmann, O., Frankenberger, K., & Csik, M. (2014). Revolutionizing the Business Model - St. Gallen Business Model Navigator. *Management of the Fuzzy Front End of Innovation*, 18(3), 89–97.
- Gebauer, H., Fleisch, E., Lamprecht, C., & Wortmann, F. (2020). Growth paths for overcoming the digitalization paradox. *Business Horizons*, 63(3), 313–323. <https://doi.org/10.1016/j.bushor.2020.01.005>
- Graham, M., Hale, S., & Stephens, M. (2012). Featured graphic: Digital divide: The geography of internet access. *Environment and Planning A*, 44(5), 1009–1010. <https://doi.org/10.1068/a44497>
- Gudergan, G., Mugge, P., Kwiatkowski, A., Abbu, H., Michaelis, T. L., & Krechting, D. (2019). Patterns of Digitization - What differentiates digitally mature organizations? *Proceedings - 2019 IEEE International Conference on Engineering, Technology and Innovation, ICE/ITMC 2019*. <https://doi.org/10.1109/ICE.2019.8792585>
- Hevner von A., R., March, S. T., Park, J., and Ram, S. (2004). Design science in information systems research. *MIS quarterly*, 28(1), 75-105.
- Kurti, E., & Haftor, D. (2015). Barriers and enablers of digital business model transformation. *Proceedings of the European Conference on IS Management and Evaluation, ECIME, 2015-Janua*, 262–268. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994130127&partnerID=40&md5=c02408dc050e3df2494ba98c2780b053>
- Lucas Jr., R. E. (2002). The Industrial Revolution: Past and Future. *Lectures on Economic Growth*, XLIV(8), 109–188.
- Matt, C., Hess, T., & Benlian, A. (2015). Digital Transformation Strategies. *Business and Information Systems Engineering*, 57(5), 339–343. <https://doi.org/10.1007/s12599-015-0401-5>

- Mugge, P., Abbu, H., Michaelis, T. L., Kwiatkowski, A., & Gudergan, G. (2020). Patterns of Digitization: A Practical Guide to Digital Transformation. *Research Technology Management*, 63(2), 27–35. <https://doi.org/10.1080/08956308.2020.1707003>
- Ng, H. Y., Tan, P. S., & Lim, Y. G. (2019). Methodology for Digitalization - A Conceptual Model. *IEEE International Conference on Industrial Engineering and Engineering Management, 2019-December*, 1269–1273. <https://doi.org/10.1109/IEEM.2018.8607457>
- OECD/Eurostat (2018), *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition*, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg, <https://doi.org/10.1787/9789264304604-en>.
- Osterwalder, A., Pigneur, Y., In Clark, T., & Smith, A. (2010). *Business model generation: A handbook for visionaries, game changers, and challengers*.
- Priyono, A., Moin, A., & Putri, V. N. A. O. (2020). Identifying digital transformation paths in the business model of smes during the covid-19 pandemic. *Journal of Open Innovation: Technology, Market, and Complexity*, 6(4), 1–22. <https://doi.org/10.3390/joitmc6040104>
- Rachinger, M., Rauter, R., Müller, C., Vorraber, W., & Schirgi, E. (2019). Digitalization and its influence on business model innovation. *Journal of Manufacturing Technology Management*, 30(8), 1143–1160. <https://doi.org/10.1108/JMTM-01-2018-0020>
- Ranta, V., Aarikka-Stenroos, L., & Väisänen, J.-M. (2021). Digital technologies catalyzing business model innovation for circular economy—Multiple case study. *Resources, Conservation and Recycling*, 164. <https://doi.org/10.1016/j.resconrec.2020.105155>
- Remane, G., Hanelt, A., Nickerson, R. C., & Kolbe, L. M. (2017). Discovering digital business models in traditional industries. *Journal of Business Strategy*, 38(2), 41–51. <https://doi.org/10.1108/JBS-10-2016-0127>
- Schallmo, D., Williams, C. A., & Boardman, L. (2017). Digital transformation of business models-best practice, enablers, and roadmap. *International Journal of Innovation Management*, 21(8). <https://doi.org/10.1142/S136391961740014X>
- Teece, D. J. (2010). Business models, business strategy and innovation. *Long Range Planning*, 43(2–3), 172–194. <https://doi.org/10.1016/j.lrp.2009.07.003>
- Wißotzki, M., Sandkuhl, K., & Wichmann, J. (2021). Digital innovation and transformation: Approach and experiences. *Intelligent Systems Reference Library*, 188, 9–36. https://doi.org/10.1007/978-3-030-49640-1_2
- Xu, Y., & Koivumäki, T. (2019). Digital business model effectuation: An agile approach. *Computers in Human Behavior*, 95, 307–314. <https://doi.org/10.1016/j.chb.2018.10.021>

Annex

Annex 1 - The Framework for Business Model Innovation using Digitalization

Business Model Component	The impact analysis
Customer Segment	<p>L.C.: When analyzing the customers segments, it's highly important that the entrepreneur understands that customers will not buy a product only because they want goods. It's necessary to highlights that customers want solutions to their needs, and this is why it's important to carefully select the customer segment that is going to be the focus of the new business, mainly because now the company is going to use digitalized means to reach the new segment (Teece, D.J., 2010).</p> <p>O.C.: In addition to Teece's (2010) understanding, it's crucial for the people in charge of the digitalization process to have a broader understanding of how the internet works in different parts of the world (for speed) and how people behave when using it (& behavior).</p>
Value Propositions	<p>L.C.: The value proposition should not merely reflect the value for the customer, but how it's perceived. A value proposition should be compelling to customers to evidence the digital means now available (Teece, D.J., 2010).</p> <p>When considering digitalization for a company, it's necessary to often reassess the value proposition, so the team makes sure that the core offering remains the same or, if needed, modifies it to the new proposition (Matt et al., 2015).</p> <p>The author, in agreement with Fichman et al. (2014), outline that there are two options for discovering new business models: recombination or invention, and most likely both will include applying digital knowledge and transformation to the business. Each one of them will bring changes to the value proposition of the business (Remane et al., 2016).</p> <p>The changes influenced by the business model innovations may include the value chain or the value proposition to the customer or other partners of the company. For a business considering digitalization as a way to innovate, it's indispensable that partners have the same vision for applying digitalization (Rachinger et al., 2017).</p> <p>Bouwman et al. (2018) understands that, in the context of small and medium enterprises, when experimenting their business model, it's necessary to promote the value proposition branding it via Facebook and Twitter.</p> <p>Xu & Koivumäki (2019) believes that agility should be in the value proposition, since it's responsible for bringing valuable product and/or service offerings to customer with the aim of achieving market success.</p>

Business Model Component	The impact analysis
Channels	<p data-bbox="440 277 1302 421">Ng et al. (2019) create a conceptual model of digitalization methodology that can be used for companies to apply the digitalization process on the company. This methodology assesses all the key components of a business model, although not explicitly.</p> <p data-bbox="440 432 1302 575">The advent of technology brings changes inside and outside of the company, meaning that companies now need to deal with diversified channels and compete with several other companies that were not in the primary channel discussion (Teece, D.J., 2010).</p> <p data-bbox="440 586 1302 792">Using a case study, the authors explain that company's digitalization will allow it to find new sources for revenue by creating different channels to be target (p. 11). Also, Schallmo et al. (2017) believe that "the data gathered and simultaneous delivered to both the internal and external stakeholders created tremendous value" (Schallmo et al., 2017).</p> <p data-bbox="440 804 1302 947">As part of the digitalization process, Bouwman et al. (2018) understands that the social media has an extreme impact on small and medium enterprises because social media can become a new channel, where new relationships can be created. (Bouwman et al., 2018)</p> <p data-bbox="440 958 1302 1055">A channel update requires not only migrating to a digital place, but it includes mind changing, and digital specialization (Priyono et al., 2020)</p>
Customer Relationships	<p data-bbox="440 1070 1302 1214">The customer relationship changes when there is business model innovation, because not only internal capacities are central to the business model - the environment should also be considered. It's important to analyze the surrounding context (Rachinger et al., 2017).</p> <p data-bbox="440 1225 1302 1400">Still based on Bouwman's et al. (2018) comprehension of how social media impacts business model innovation, social media also impacts how new customer relationships are created through a new channel. According to the research, this is still an area that businesses lack complete understanding (Bouwman et al., 2018)</p>
Revenue Streams	<p data-bbox="440 1415 1302 1588">According to Gebauer et al., (2020), digitalization can/will impact the revenue stream of the organization, but also it will enhance products and services in the physical world. It's like a profit-cycle, where the digital benefits the physical, which benefits the digital again, and so on.</p> <p data-bbox="440 1599 1302 1776">A company that is discovering new business models through innovation and digitalization may be willing to invest in other companies that, at first glance, are competitors, but in the long run can become partners. This kind of investment will bring a new revenue stream that should be considered (Remane et al., 2016)</p>
Key Activities	<p data-bbox="440 1792 1302 1859">The digitalization of a process or of the entire company is a modification or substitution of a current activate (Matt et al., 2015)</p> <p data-bbox="440 1870 1302 2004">Following the discovering of business models on the Value Proposition column, when recombining or inventing a new business model, the key activities should be changed or improved to match the new VP. (Remane et al., 2016)</p>

Business Model Component	The impact analysis
---------------------------------	----------------------------

Key Resources	<p>Digital transformation will require structural changes, which will affect the key resources of the company. These changes are often necessary to provide an adequate basis for the new operations (Matt et al., 2015)</p> <p>The digitalization process impacts and influences every industry, but shaking the corporate strategies and challenging existing business models, which needs to be reconsidered and adapted (Rachinger et al., 2017)</p> <p>The key resources, also called as enablers, listed by the author are: digital data, automation, digital customer access, and networking. These resources allow the company to go through a digital transformation and implement digitalization on its products, services, and/or processes (Schallmo et al., 2017)</p> <p>Digitally mature companies consider that investing in key components are the best way to move forward, and it means hiring trained staff, a chief digital officer, and moving products to the cloud (Gudergan et al., 2019)</p> <p>In order to manage the digital transformation, it's necessary to master the data exchange, data generation, data analysis, and data adaption to processible information (Bican & Brem, 2020)</p> <p>For a company, it's important to implement a learning culture that allows the company to change, being a pivotal enabler of dynamic capabilities. As a key resource, the high specialized staff will be able to seize opportunities and perform transformations. Resources should be focused in generating revenue and overriding activities not related to revenue (Priyono et al., 2020).</p> <p>Mugge et al. (2020) argues that "Resource allocation is a central management activity. No achievement of strategic objectives is possible without the proper allocation of scarce resources. The relationship between resources and strategy is a two-way street. Strategy affects resources and resources affect strategy. Yet in many cases, the process is subject to personal and political preferences. Consequently, strategy formulation and implementation activities are deferred." (p. 32)</p> <p>Discussed as capabilities by Wißotzki et al. (2021), the key resources of a company will wrap the capabilities needed by the company/future company to implement the developed business model. The resources need to be aligned "to smooth out the rough edges". Taking into consideration what capabilities are needed, the resources will be better provided. (Wißotzki et al., 2021)</p>
Key Partners	<p>In the Business Model Innovation context, the company needs know-how and competences in cyber physical systems or analytical data processing. It may require workforce qualification and, in case they do not possess the resources, they need to develop a network of partners to outsource (Rachinger et al., 2017).</p> <p>The analysis made by Mugge et al. (2020) considers that digitally mature companies/organizations understand that it's fundamental</p>

Business Model Component	The impact analysis
---------------------------------	----------------------------

that they create breakthrough business models that include key partners, such as suppliers, distributors, customers, even other developers, from outside the boundaries of the enterprise.

A key partner needs to be analyzed by how far it can go in order to add value the supply chain. Digitalizing an organization and implementing new technologies needs to be surrounded by partners willing to follow the same development path, so it will improve the circularity of the firm's resource usage and contribute to value creation (Ranta et al., 2021).

Cost Structure

In agreement with Teece (2010), it's important that the people in charge of the digitalization process that considers what is going to change financially in the business operation. In the industrial era, scale was one of the most important things, and capturing the value thesis was relatively simple. Nowadays, technology allows low cost structures that facilitate the exploration of alternative solutions for costs and revenues.

It's vital that the business administrators know that when implementing a new digital strategy at the company, any modification on the digitalization strategy impacts the cost structure of the company (Matt et al., 2015). Most likely, in the first moment, the costs go up due to the adaptabilities needed, but the tendency is that the costs go down (Rachinger et al., 2017).

Annex 2 - The author's contribution regarding digitalization for each business model canvas component.

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
Teece, D.J., 2010	When analyzing the customers segments, it's highly important that the entrepreneur understands that customers will not buy a product only because they want products. It's necessary to highlights that customers want solutions to their needs, and this is why it's important to carefully select the customer segment that is going to be the focus of the new business, mainly because now the	The value proposition should not merely reflect the value for the customer, but how it's perceived. A value proposition should be compelling to customers to evidence the digital means now available. (p. 174)	The advent of technology brings changes inside and outside of the company, meaning that companies now need to deal with diversified channels and compete with several other companies that were not in the primary channel discussion (p. 174)	-	-	-	-	-	In the industrial era, scale was one of the most important things, and capturing the value thesis was relatively simple. Nowadays, technology allows low cost structures that facilitate the exploration of alternative solutions for costs and revenues (p. 174)

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
	company is going to use digitalized means to reach the new segment. (p. 175)								
Matt et al., 2015	-	When considering digitalization for a company, it's necessary to often reassess the value proposition, so the team makes sure that the core offering remains the same or, if needed, modifies it to the new proposition (p. 339)	-	-	-	The digitalization of a process or of the entire company is a modification or substitution of a current activate (p. 340)	Digital transformation will require structural changes, which will affect the key resources of the company. These changes are often necessary to provide an adequate basis for the new operations (p. 4)		When implementing a new digital strategy at the company, it's important to remember that any modification on the strategy, impacts the cost structure of the company (p. 340)

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
Remane et al., 2016	-	The author, in agreement with Fichman et al. (2014), outline that there are two options for discovering new business models: recombination or invention, and most likely both will include applying digital knowledge and transformation to the business. Each one of them will bring changes to the value proposition of the business.	-	-	A company that is discovering new business models through innovation and digitalization may be willing to invest in other companies that, at first glance, are competitors, but in the long run can become partners. This kind of investment will bring a new revenue stream that should be considered (p. 46)	Following the discovering of business models on the Value Proposition column, when recombining or inventing a new business model, the key activities should be changed or improved to match the new VP.	-	-	-

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
Rachinger <i>et al.</i> , 2017	-	The changes influenced by the business model innovations may include the value chain or the value proposition to the customer or other partners of the company. For a business considering digitalization as a way to innovate, it's indispensable that partners have the same vision for applying digitalization (p. 1146).	-	The customer relationship changes when there is business model innovation, because not only internal capacities are central to the business model - the environment should also be considered. It's important to analyze the surrounding context.	-	-	The digitalization process impacts and influences every industry, but shaking the corporate strategies and challenging existing business models, which needs to be reconsidered and adapted (p. 1145)	In the BMI context, the company needs know-how and competences in cyber physical systems or analytical data processing. It my required workforce qualification and, in case they do not possess the resources, they need to develop a network of partners to outsource (p. 1147)	The author's perspective is that any digitalization process impacts the cost structure. In the first moment, probably the cost goes up due to the adaptabilities needed, but the tendency is that the costs go down (p. 1144)

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
Schallmo <i>et al.</i> , 2017	-	-	Using a case study, the authors explain that company's digitalization will allow it to find new sources for revenue by creating different channels to be target (p. 11) Also, Schallmo <i>et al.</i> (2017) believe that "the data gathered and simultaneous delivered to both the internal and external stakeholders created tremendous value." (p. 13)	-	-	-	The key resources, also called as <i>enablers</i> , listed by the author are: digital data, automation, digital customer access, and networking. These resources allow the company to go through a digital transformation and implement digitalization on its products, services, and/or processes (p. 8)	-	-

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
Bouwman et al., 2018	-	Bouwman et al. (2018) understands that, in the context of small and medium enterprises, when experimenting their business model, it's necessary to promote the value proposition branding it via Facebook and Twitter (p. 117)	As part of the digitalization process, Bouwman et al. (2018) understands that the social media has an extreme impact on small and medium enterprises because social media can become a new channel, where new relationships can be created. (p. 106)	Still based on Bouwman's et al. (2018) comprehension of how social media impacts business model innovation, social media also impacts how new customer relationships are created through a new channel. According to the research, this is still an area that businesses lack complete understanding (p. 107)	-	-	-	-	-

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
Xu & Koivumäki, 2019	-	Xu & Koivumäki (2019) believes that agility should be in the value proposition, since it's responsible for bringing valuable product and/or service offerings to customer with the aim of achieving market success (p. 307)	-	-	-	-	-	-	-

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
Ng et al., 2019	-	Ng et al. (2019) create a conceptual model of digitalization methodology that can be used for companies to apply the digitalization process on the company. This methodology assesses all the key components of a business model, although not explicitly. (p. 1271)	-	-	-	-	-	-	-
Gudergan et al., 2019	-	-	-	-	-	-	Digitally mature companies consider that investing in key components are the best way to move forward, and it means hiring trained staff, a chief digital officer,	-	-

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
							and moving products to the cloud (p. 6; p. 7)		
Bican & Brem, 2020	-	-	-	-	-	-	In order to manage the digital transformation, it's necessary to master the data exchange, data generation, data analysis, and data adaption to processible information (p. 3)	-	-

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
Priyono et al., 2020	-	-	A channel update requires not only migrating to a digital place, but it includes mind changing, and digital specialization (p. 13)	-	-	-	For a company, it's important to implement a learning culture that allows the company to change, being a pivotal enabler of dynamic capabilities. As a key resource, the high specialized staff will be able to seize opportunities and perform transformations . (p. 12). Resources should be focused in generating revenue and overriding activities not related to revenue.	-	-

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
Mugge et al., 2020	-	-	-	-	-	-	Mugge et al. (2020) argues that "Resource allocation is a central management activity. No achievement of strategic objectives is possible without the proper allocation of scarce resources. The relationship between resources and strategy is a two-way street. Strategy affects resources and resources affect strategy. Yet in many cases, the process is subject to personal and political preferences. Consequently,	The analysis made by Mugge et al. (2020) considers that digitally mature companies/organizations understand that they need to create breakthrough business models that include key partners, such as suppliers, distributors, customers, even other developers, from outside the boundaries of the enterprise. (p 32)	-

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
							strategy formulation and implementation activities are deferred." (p. 32)		
Gebauer et al., 2020	-	-	-	-	According to Gebauer et al., (2020), digitalization can/will impact the revenue stream of the organization, but also it will enhance products and services in the physical	-	-	-	-

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
					world. It's like a profit-cycle, where the digital benefits the physical, which benefits the digital again, and so on. (p. 314)				
Ranta et al., 2021	-	-	-	-	-	-	-	A key partner needs to be analyzed by how far it can reach in order to add value the supply chain. Digitalizing an organization and implementing new technologies needs to be surrounded by partners willing to follow the	-

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
								same path, and it will improve the circularity of the firm's resource usage and contribute to value creation. (p. 4)	
WiBotzki et al., 2021	-	-	-	-	-	-	Discussed as capabilities by WiBotzki et al. (2021), the key resources of a company will wrap the capabilities needed by the company/future company to implement the developed business model. The resources need to be aligned "to smooth out the	-	-

Ref.	Customer Segments	Value Proposition	Channels	Customer Relationship	Revenue Streams	Key Activities	Key Resources	Key Partners	Cost Structure
							rough edges". Taking into consideration what capabilities are needed, the resources will be better provided. (p. 21)		