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Faculty of Business Economics

Master of Management

Master's thesis

Evolution of business models within an ecosystem: A practical approach through the digital transformation lens

Julieth Quesada

Thesis presented in fulfillment of the requirements for the degree of Master of Management, specialization Strategy and Innovation Management

SUPERVISOR :

Prof. dr. Wim VANHAVERBEKE

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2021
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This master thesis was written during the COVID-19 crisis in 2021-2022. This global health crisis might have had an impact on the (writing) process, the research activities, and the research results that are at the basis of this thesis.

Preface

This master dissertation has been written in order to complete the master of management at Hasselt University, specialization Strategy and Innovation Management.

This story began in 2018 when two Costa Rican boyfriends decided to start an adventure in the unique European educational world. To be honest, it was more difficult for me to decide to fly away from home.

Today I can say it was one of my best decisions. I immensely grow up as a student, professional, and person.

I want to express my gratitude to my husband (yes, we got married!), that has given me all the necessary support to accomplish this shared goal. I feel pretty proud of us!

Also, I extend my thanks to our families, who offered us unconditional support from Costa Rica during the entire process.

My special gratitude is expressed to my supervisor, Professor Dr. Wim Vanhaverbeke, for his valuable guidance and support.

Finally, I extend my gratitude to Hasselt University for all the accompanying during the process and giving me a tool kit full of new knowledge to share.

Thank you all!

Summary

The digital transformation has triggered a significant change in people's life and society, and businesses are not the exception. The complexity of the recent technological developments has created the necessity for companies to position themselves in a digital ecosystem. It allows the emergence of multi-stakeholder interactions and the development of competitive dynamics to embrace digital transformation. Interdependency and joint value creation become a priority for businesses to react and adapt appropriately to the fast-changing environment of digital technologies. Thus, it becomes crucial to map the ecosystem in which the firm is embedded and systematically analyze how the business model must proactively evolve.

Adner (2017) pointed out that from the business model perspective, the value creation and capture focus on the focal firm rather than the constellation of actors. On the other hand, current literature regarding ecosystems has been focused on the general changes the major actors make, the inclusion or modification of actors, the new flows within the ecosystem, and so on. However, still, it has not considered the internal changes each actor must apply within its business model.

Moreover, the existence of the interdependence explained by Adner and Feiler (2019) indicates that there must be an alignment between all the ecosystem actors since they now depend on each other. To date, there is a gap in the literature since existing approaches fail to address the specific business model changes a company should consider in embracing the digital transformation within an ecosystem.

Research question

This research aims to understand how the evolution of a business model can be managed within an ecosystem. The study looks to identify the consequences for firms' operation in the ecosystem and the major changes business needs to take internally to remain competitive considering the digital transformation changes. This research contributes to the literature since existing approaches fail to address ecosystem alignment at the business model level and how the interdependence between the actors is managed. A case study is applied to address the research since it is a "how" question, there is little or no control over behavioral events, and the focus of the study is a contemporary phenomenon (Yin, 2018). It is based on two cases: the digital cinema ecosystem and the healthcare ecosystem.

Research findings

The findings of this research sustain that digital transformation provokes ecosystem alignment, meaning changes in the actors, activities, and links. Principal changes are: 1) New activities to achieve the shared value proposition: technology integration, stakeholders management, financial support, and data management, 2) actors adaptation to offer the new service/product and addition of actors in the ecosystem to facilitate the activities: suppliers, complementors, and financial support entities, 3) new links to achieve the correct flow of funds and information: the flow of funding from the leader to the restrictive actor(s) and flow of information between customer to the rest o the actors' ecosystem.

The study presents a blueprint visualization that shows ecosystem interdependency. The blueprint shows how the ecosystem alignment is achieved only through each actor's building block changes, and a change in one actor directly affects the rest of the ecosystem actors.

Besides, the alignment also implies actors' business model-specific changes. Some changes need to be adopted by all ecosystem actors. Some specific actions are taken by the leader (the actor or actors that perceive the most benefit with the ecosystem alignment), and others exclusively by the restrictive actor (the one perceiving the least benefit in the ecosystem).

The findings indicate that seven building blocks need to change in actors that constitute an ecosystem evolving by digital technologies: value proposition, key activities, key resources, cost structure, revenue streams, channels, and customer relationship. The major changes in each building block are: 1) value proposition: the inclusion of the value offered by the new technology, 2) key activities: the addition of data management, stakeholders' management, supply chain management, R&D, and personnel training activities, 3) key resources: technology acquisition, skilled personnel, contracts and customer database, 4) cost structure: includes payment of technology acquisition, skilled personnel, data management, contracts, and R&D, 5) revenue streams: to map an increase in revenues led by the new product/ service offered, 6) channels: including digital channels (mobile, website, etc.), and 7) customer relationships: including transactional (through the new channels) and direct (customized service) customer relationships.

Regarding the specific leader activities, the actor (or actors) needs to consider a change in four specific building blocks: 1) key activities: including technology standardization or integration and financial incentives, 2) key resources: contracts related to the financial incentives, 3) cost structure: payment of financial incentives/mechanisms, and 4) key partners: partnering strategies.

Finally, the restrictive actor (or actors) also needs to consider one specific change in its business model: the revenue streams, since the actor will receive financial incentives to ensure faster technology adoption and make the innovation more attractive for him (subsidizing plan, leasing contracts, funding).

Managerial implications

Firms' managers should consider the prompt adoption of the specific building blocks changes proposed in this research. Being part of an ecosystem requires accepting the existence of a leader, that any firm can become a restrictive actor, and that the ecosystem will always be in continuous evolution.

From the government and policymakers' perspective, educational models should evolve based on market needs. Data management (data storage, analysis, confidentiality, and maintenance) and digital technologies (such as cloud computing, the internet of things, big data architectures, artificial intelligence, etc.) have become priorities to prepare future citizens proactively. Also, new policies facilitating the ecosystem's evolution can generate a significant impact in countries since digital transformation would be promoted. For instance, fewer taxes pay for businesses pursuing digital transformation or cutting-edge equipment acquisitions. Moreover, the government can create a space to facilitate and encourage public and private institutions'

collaboration and alignment and even make the next five years' country's agenda regarding digital transformation.

Limitations and directions for future research

This research is based on only two case studies, which limits the results' generalizability. Besides, the changes found in the actors' business models could be biased by the author's perspective and knowledge.

Future investigations should focus on empirical studies that deeply analyze the specific actions actors within an ecosystem take to align the value proposition triggered by technological innovation—also considering particular actions for leaders and restrictive actors.

Moreover, it would be essential to understand the specific changes each technology would need, for instance, artificial intelligence, the internet of things, virtual reality automation, etc. Besides, future studies should identify particular capabilities that firms, regions, and nations need to develop to embrace digital technologies at a macro level successfully.

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Keywords

Digital Transformation - Business model interdependency - Ecosystem Interdependency

Introduction

The digital transformation has triggered a significant change in people's life and society. The use of digital technologies is present in our day-to-day: smartphones to communicate, the computer to work from home, applications to solve daily tasks, home delivery, payments automation, etc.

At the global level, digital transformation is one of the six priorities of the European Union for 2019-2024, and the Commission has set a strategy called *A Europe fit for the digital age*, which aims to facilitate this transformation in people's lives and businesses (European Commission, 2021). The European Union's efforts promote human-centered companies toward a more prosperous and sustainable digital future. For instance, one of the potential projects is to deploy a network of Security Operations Centers powered by artificial intelligence to anticipate, detect and respond to cyberattacks at the national and EU level.

At the business level, firms have been impacted by an accelerated and changing environment, where technological tendencies and customer needs evolve quickly, faster than the time needed for business adaptation. Digital transformation, meaning *combinations of information, computing, communication, and connectivity technologies* (Vial, 2019, p.118), has provoked a pervasive change in business. Therefore, those who do not adapt and seize a digital transformation process lose competitiveness and leave an open opportunity for more agile competitors. Thus, digital transformation gets supreme importance since it is a phenomenon that affects the entire value chain.

A business model *describes the rationale of how an organization creates, delivers, and captures value* (Osterwalder and Pigneur, 2010, p. 14). Thus, companies are adapting and creating innovative business models where digital technologies and collaboration are pillars of building a competitive position (Legner et al., 2017; Parida et al., 2019, de Man and Luvison, 2019; Rachinger et al., 2019). Moreover, Porter and Kramer (2019) state that new digital business models will be more accurate and efficient, going beyond economic needs and addressing societal challenges, generating shared value that impacts the companies, organizations, consumers, and the public. Proof of this is the current situation caused by the Covid-19 global health crisis. Thanks to technological applications such as home delivery, digital payments, and service automation, many business transactions have kept functioning.

Appio et al. (2021) state that the interconnection between digital transformation and business model innovation has increased attention in the last decade. According to the authors, the complexity of the recent technological developments in cloud computing, the internet of things, big data architectures, and the smart principle of products have created the necessity for companies to position themselves in a digital ecosystem.

Adner (2017) defines the ecosystem concept as *the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize* (Adner, 2017, p. 2). Firms have adapted to the new reality mainly by providing services and products tied to many other

actors (especially data capturing and sharing businesses) (Vial, 2019). The position of a company within an ecosystem allows the emergence of multi-stakeholder interactions and the development of competitive dynamics to embrace digital transformation.

In the last years, the interest in digital ecosystems has increased (Trabucchi and Buganza, 2019). For instance, big data plays a vital role in this transformation by combining data from multiple sources, sharing it with diverse stakeholders, and analyzing it in different ways, enabling digital transformation and joint value creation (Pappas et al., 2018). Consider, for example, the urban planning and infrastructure industry, where development can be based on autonomous vehicles, which collect data on city traffic (Nallaperuma et al., 2019). Based on that information, digital technologies can offer recommendations for adapting urban infrastructure in response to emerging needs, considering the interaction of different actors such as suppliers, regulators, and customers.

On the other hand, Adner and Feiler (2019) pointed out that conjunctive interdependence is one characteristic of ecosystem settings. With this, they mean that *a focal actor's success is dependent not only on its own ability to execute the task, but on the successful execution of other tasks by other actors* (Adner and Feiler, 2019, p. 110). Thus, interdependency and joint value creation become a priority for businesses to react and adapt appropriately to the fast-changing environment of digital technologies. It becomes crucial to map the ecosystem in which the firm is embedded and systematically analyze how the business model must proactively evolve.

Digital technology needs to become central to how the business operates, and organizations need to effectively re-think and possibly re-invent their business models in order to remain competitive (Reis et al., 2018). But what specific actions do actors need to include in the business model to achieve a successful digital transformation? Thi question drives the present study.

Adner (2017) pointed out that from the business model perspective, the value creation and capture focus on the focal firm rather than the constellation of actors. Also, the level of analysis is a firm strategy rather than a value proposition. This view differs from the ecosystem strategy because it does not include the rest of the actors nor the value proposition as the central focus. Current literature regarding ecosystems has been focused on the general changes the major actors make, the inclusion or modification of actors, what are the new flows within the ecosystem, and so on, but it has not considered the internal changes each actor must apply in its business model. Contrarily, business model literature has been focused only on the principal changes for the focal actor without considering the rest of the members of the ecosystem it is embedded.

Moreover, the existence of the interdependence explained by Adner and Feiler (2019) indicates that there must be an alignment between all the ecosystem actors since they now depend on each other. To date, there is a gap in the literature since existing approaches fail to address the specific business model changes a company should consider in embracing the digital transformation within an ecosystem

This research aims to understand how the evolution of a business model can be managed within an ecosystem. The study looks to identify the consequences for firms' operation in the ecosystem and the major changes business needs to take internally to remain competitive considering the digital transformation changes.

This research contributes to the literature since existing approaches fail to address ecosystem alignment at the business model level and how the interdependence between the actors is managed. Romme (2016) stated that creating boundary objects at the interface between scientific knowledge and practice becomes crucial. Thus, the perspective adopted provides different points of view, which are especially beneficial for practitioners who must make strategic decisions in business and policymakers related to innovation and economic/technological development.

A case study is applied to address the research. Since it is a "how" question, there is little or no control over behavioral events, and the focus of the study is a contemporary phenomenon (Yin, 2018). The study focuses on two different examples: the digital cinema ecosystem (as this example will help clarify the theory of ecosystems explained by Adner (2012)) and the healthcare ecosystem since it is known that improvements in healthcare have always been of utmost importance for society.

The findings of this research sustain that digital transformation provokes ecosystem alignment, meaning changes in the actors, activities, and links. Principal changes are: 1) New activities to achieve the shared value proposition: technology integration, stakeholders management, financial support, and data management, 2) actors adaptation to offer the new service/product and addition of actors in the ecosystem to facilitate the activities: suppliers, complementors, and financial support entities, 3) new links to achieve the correct flow of funds and information: the flow of funding from the leader to the restrictive actor(s) and flow of information between customer to the rest o the actors' ecosystem.

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Finally, the restrictive actor (or actors) also needs to consider one specific change in its business model: the revenue streams, since the actor will receive financial incentives to ensure faster technology adoption and make the innovation more attractive for him (subsidizing plan, leasing contracts, funding).

From the managerial perspective, firms' managers should consider the prompt adoption of the changes proposed in this research and also analyze that to be part of an ecosystem, it is needed to accept the existence of a leader, that any firm can be a restrictive actor, and that the ecosystem will always be in continuous evolution.

Also, educational models focused on data management (data storage, analysis, confidentiality, and maintenance) and digital technologies (such as cloud computing, the internet of things, big data architectures, artificial intelligence, etc.) become a priority in preparing the future citizens proactively.

Moreover, the government can create a space to facilitate and encourage public and private institutions' collaboration and alignment and even make the next five years' country's agenda regarding digital transformation. Additionally, new policies facilitating the ecosystem's evolution (fewer taxes, for instance) can significantly impact countries since digital transformation would be promoted.

As this study has shown, new policies, educational models, and collaborations between public and private institutions must be aligned to the technological necessities facilitating digital transformation. This alignment has become a critical factor to be considered by governments, scholars, firms, policymakers, and public and private institutions. Hence, by combining the learnings and methodologies mentioned in this research, it is defensible that digital transformation can be fostered.

Research question

This research aims to understand how the evolution of a business model can be managed within an ecosystem. The study looks to identify the consequences for firms' operation in the ecosystem and the major changes business needs to take internally to remain competitive considering the digital transformation changes.

RQ: How can the evolution of a business model be managed within an ecosystem?

Research sub-questions

To be able to answer the research question, the following sub-questions are stated:

1. What is a business model?
2. What is an ecosystem?
3. What is the role of digital technologies in changing companies' business models?
4. What means business models interdependency within an ecosystem?

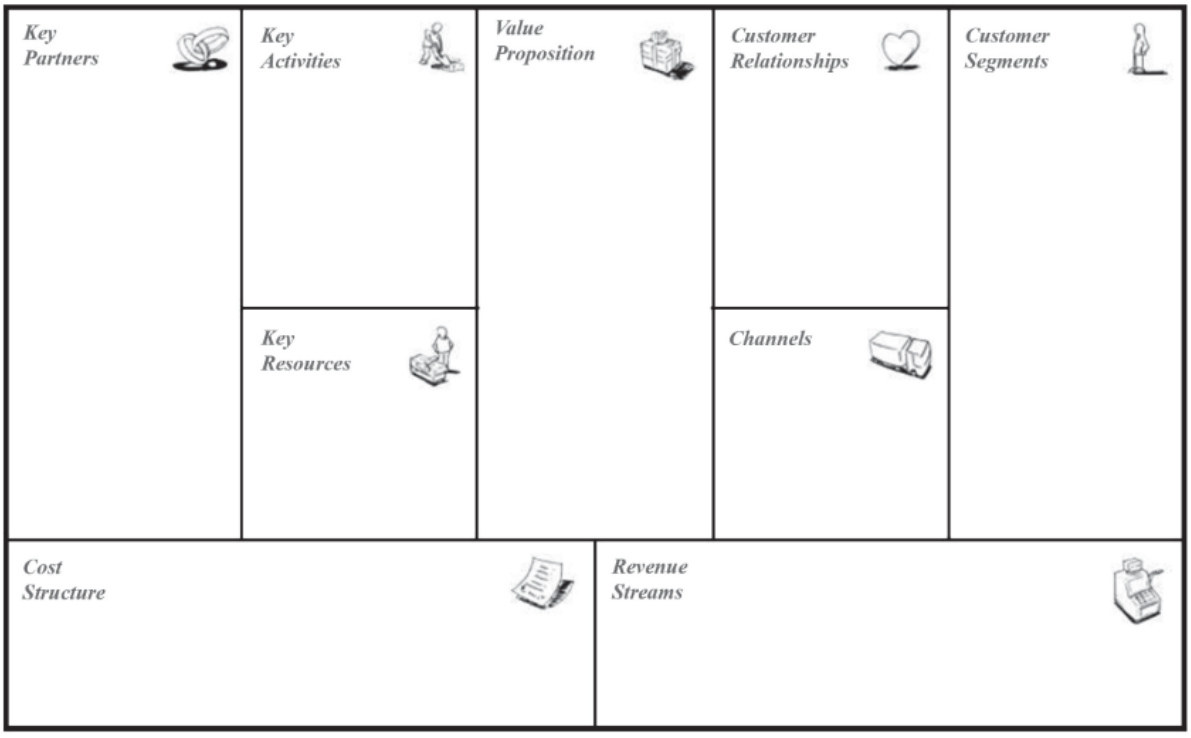
Literature Review

Business model definition

A *business model describes the rationale of how an organization creates, delivers, and captures value* (Osterwalder and Pigneur, 2010, p. 14). According to Wireland (2017), much of the early literature regarding business models defined them as *sets of decisions variables that allow firms to use and coordinate the resources to create and deliver value to customers for appropriate monetary compensation (Wireland, 2017, p.3).* This definition implies that firms' success is attributed to securing valuable and inimitable resources and developing competencies and capabilities that allow them to respond to opportunities adeptly.

One framework proposed for visualizing and structuring a business model is the Canvas (Figure 1). In the Canvas blueprint, a business model can be described through nine basic building blocks that cover the four primary areas of a business: customers, offer, infrastructure, and financial viability (Osterwalder and Pigneur, 2010). Specifically, the Canvas is focused on identifying the value proposition, key activities, key resources, customers, customer relationships, partners, channels, cost structure, and revenue structure that explain the logic of how a company intends to make money.

Figure 1 Business Model Canvas



Source: (Osterwalder and Pigneur, 2010)

For example, consider the Netflix business model (Figure 2). The customer segment is the video streaming viewers. The customer relationship is transactional (there is no direct interaction), and the way customers can access the service is through the website or any other digital device. The value proposition is to offer a secure platform with a wide range of videos and recommendations at an affordable price. This value proposition is possible thanks to the major key activities: Video production, R&D, data analysis, channels management, marketing strategy, and platform maintenance. And the primary key resources are video patents, the Netflix brand, customers database, skilled personnel, and the IT platform. Regarding the finance, customers pay the subscription fee (revenue streams), and Netflix pays all the costs related to providing the service (video production, IT services, patents, personnel, etc.).

Ecosystem definition

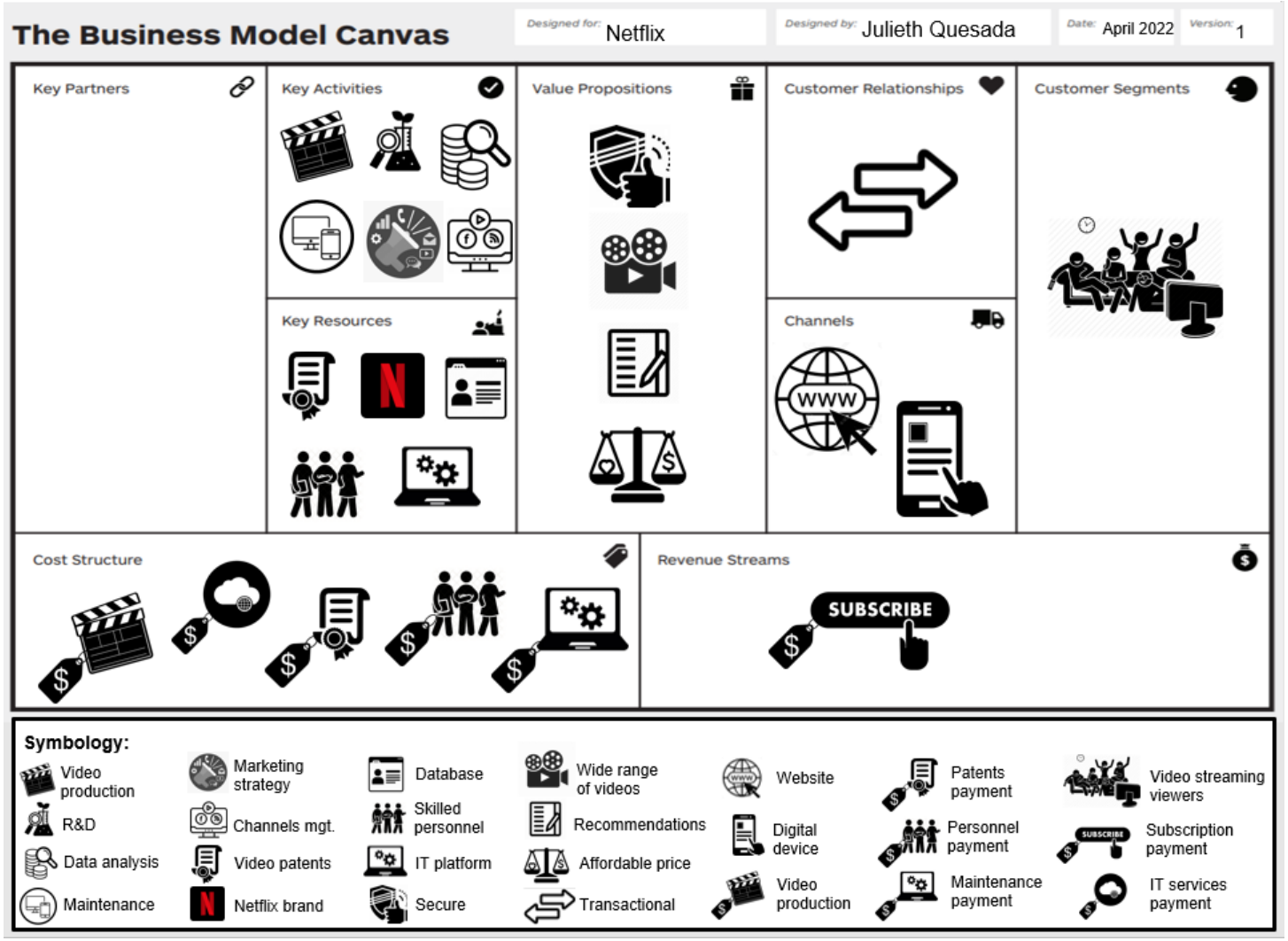
As Adner and Feiler (2019) pointed out, the collaboration between firms has become increasingly important in the last few years. This collaboration shifted from stand-alone firms' value to ecosystem innovations, where the value proposition depends on several actors.

Moore (1993, 1996) introduced the ecosystem metaphor into the management field and defined it as a socio-economic system based on social actors and institutions, including customers, competitors, organizations, and governmental and regulatory institutions. The author indicates that a *business ecosystem* is *an economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world* (Moore, 1996, p. 26).

In the same line, Teece (2007) considers a *business ecosystem* a community, where an individual firm or new venture identifies all relevant actors beyond its boundaries (organizations, institutions, individuals) that all affect each other through their activities. For instance, the automotive industry. Car manufacturers, raw material suppliers (batteries, wheels, etc.), dealers, car buyers, filling stations, and government (regulations) are the principal actors in this ecosystem. All these actors need to collaborate because they constitute the industry's economic community or business ecosystem.

Additionally, Adner (2006) introduced another related concept: *innovation ecosystem,* defined as a system focused on the development of a particular innovation and the set of components (upstream) and complements (downstream) that support it. The author describes it as *the collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution* (Adner, 2006, p. 98). Consider, for example, when digital cinema was launched. In this example, there were a set of components (raw materials and technologies) and complementors (digital telecine scanner, data trader, data storage, etc.) from different players that needed to be ready before the launch of this innovation (Adner, 2012).

Figure 2 Netflix Business Model



*This is a representative but not complete canvas for the Netflix business model.

Source: The author, using the Canvas template from Osterwalder and Pigneur (2010)

Other authors have proposed different metaphors trying to understand the innovation ecosystems deeply. Some of them are Breslin et al. (2021) that presented a view of innovation ecosystems as complex adaptive systems where actors are bound together through changing modes of coevolution. They state that innovation maintains and drives change within the innovation ecosystem by altering the microlevel rules of interaction and coevolutionary relationships between actors. Another example is the proposal of the ecotone stated by Ghazinoory et al. (2021). An ecotone is a zone of transition between two ecosystems. It is an open system with higher diversity and exchange of species than the ecosystem. Based on this biological definition, the authors propose the "ecotone of innovation" as the bridging area that facilitates the commercialization of ideas.

On the other hand, Clarysse et al. (2014) pointed out the concept of a *knowledge ecosystem*. It is defined as geographical hotspots usually centered around leading universities and public research organizations that play a critical role in developing basic and applied research that will baseline future development collaborations in the network, for example, Silicon Valley. Some characteristics of these hotspots are the flow of tacit knowledge and personnel mobility.

At this point, the literature has explained three types of ecosystems: business ecosystem (focused on creating customer value), knowledge ecosystem (focused on generating new knowledge and technologies), and innovation ecosystem (focused on exploration and exploitation of technologies). Precisely, Valkokari (2015) investigated these three ecosystem types and concluded that they are interconnected, indicating that what is explored in the knowledge ecosystem is exploited in the business ecosystem, and the innovation ecosystem acts as the bridge between them.

Additionally, Jacobides et al. (2018) pointed out that there is a fourth definition for an ecosystem called a *platform ecosystem.* This concept focuses on a specific technology (platform) and the interdependence between sponsors and their complements. For instance, Airbnb is a technological architecture that creates value by generating economies of scope in the supply and demand of accommodations in many world regions (Gawner, 2014). It brings together owners and tenants and provokes direct network effects (as more owners/accommodations are included, more tenants get into the platform and vice versa).

From the value perspective, Adner (2017) defines the ecosystem concept as *the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize* (Adner, 2017, p. 2). He presents the ecosystems as a structure, interpreting them as configurations of activity defined by a value proposition that is considered the focal target of coordination and alignment. In this approach, there are four elements of structure: 1) activities: discrete actions to be undertaken in order for the value proposition to materialize, 2) actors: entities that undertake the activities, 3) positions: specify where actors are located in the flow of activities, and characterize who hands off to whom, and 4) links: meaning transfers across actors (matériel, information, influence, funds, etc.).

As the literature demonstrates, there are multiple definitions of ecosystems, and they depend on the focus or central target (such as the value proposition, the innovation, the technology, etc.). The Adner (2017) definition is selected as the theoretical baseline across this study chapters.

Digital technologies: driving business models evolution

According to Vial (2019), digital transformation is a phenomenon that encompasses disruptive changes in industries through the use of digital technologies. It can be considered an external phenomenon that triggers organizational changes since more and more companies invest in digital technologies to open new possibilities and change their business models (Frishammar et al., 2018). Furthermore, the impacts of this phenomenon are extended to society since cultural behaviors are also evolving due to a more digitalized world (Majchrzak et al., 2016). Consider, for example, companies such as UberEats, which, by combining internet services, data analysis, and other digital technologies, have disrupted the food delivery industry and reshaped how people select their options nowadays.

The concept of digital technologies is also ambiguous since most researchers describe it differently. Some refer to social media, analytics, and embedded devices (Chanias, 2017; Fitzgerald et al., 2014; Singh and Hess, 2017). Other authors indicate technologies related to Industry 4.0 such as big data, automation, artificial intelligence (algorithmic decision-making), augmented reality, additive manufacturing (3D), cloud computing cybersecurity, and the internet of things (physical and virtual interfaces) (Appio et al., 2021; Casalet and Stezano, 2020; Furjan et al., 2020). Besides, some authors mix some technologies from the last two categories previously mentioned (Remane et al., 2017; Nwankpa and Roumani, 2016).

To come to a more general definition of digital technologies, Hanelt et al. (2020) indicate that the nature of digital technologies is constantly evolving, and the emerging technologies are characterized by being generative, not restricted to the firm's boundaries provoking new digital business models. A more inclusive definition states that digital technologies correspond to *combinations of information, computing, communication, and connectivity technologies* (Vial, 2019, p.118).

Fitzgerald et al. (2014) pointed out that digital technologies enable innovative business models, increasing customer experience and engagement. For instance, digital technologies in the retail industry have allowed companies to offer a value proposition based on consumer behavior. This leads to new vital activities such as developing solutions to increase turnover and change both the inside of grocery stores and the geographical location of the stores themselves (Grewal et al., 2017). Channels are also impacted since the customer can now request purchases from the digital application, not only from the store. Cost structure and revenue streams need to be also updated since there are more costs related to a more customized offer that can be reflected in the product prices.

Similarly, other authors indicate that digital transformation triggers tactical or strategic business moves by data-driven insights and the launch of digital business models (Haffke et al., 2016; Hess et al., 2016; Clohessy et al.,2017). Complementary, Vial (2019) pointed out that in many cases, a firm's business model depends on the collection, sharing, and selling of data provided by multiple parties in the ecosystem. This shared data are an integral part of the firm's value proposition. One example is shown in the urban planning and infrastructure industry since development can be based on autonomous vehicles, which collect data on city traffic (Nallaperuma et al., 2019). Based on that information, digital technologies can offer recommendations for adapting urban infrastructure in response to emerging needs. This new model can be achieved through new activities such as data analytics or partnering with another company focused on IT and data analytics interested in getting into the industry.

Appio et al. (2021) state that the interconnection between digital transformation and business model innovation has been increasing attention in the last decade. According to the authors, the complexity of the recent technological developments in cloud computing, the internet of things, big data architectures, and the smart principle of products have created the necessity for companies to position themselves in a digital ecosystem. This ecosystem allows the emergence of multi-stakeholder interactions and the development of competitive dynamics to embrace digital transformation.

Complementarily, Newell, and Marabelli (2015) argue that digital technologies have significantly altered the ways firms create value through the emergence of platforms and ecosystems. Even firms that develop physical products need to incorporate services and software as part of their core offerings, turning their value proposition into an exchange of valuable data (Porter and Heppelmann, 2014).

In the same line, Van Alstyne et al. (2016) pointed out that digital business models are led by data, the creation of ecosystems, and markets enabling interactions. They analyzed that more and more companies are becoming platform business models, managing interactions between different actors (buyers, sellers, some of them invited for free, others paid to be on board, etc.). Also, the source of value creation shifts from an internal process to an external interaction in the ecosystem. Thus, interactions become crucial, and the data is the enabler that improves the vast interactions between ecosystems.

For instance, the PlayStation value proposition changed from an individual video game console to a multisided platform where gamers can play with people worldwide, buying complements from the internal marketplace, where games developers can also upload their creations. This example implies adding new activities such as platform governance, technology developments, value co-creation mechanisms, etc.

In the same line, Song et al. (2019) pointed out that digital technologies can capture the dynamic context of business processes, automating related decision-making activities. Thus, a traditional business process or entire business model can be transformed into a digital business ecosystem by identifying and linking relevant factors. Consider Amazon’s grocery store: Amazon Go, as

an illustrative example. In this grocery store, shoppers' mobiles link purchases, allowing them to pay for items without queuing at tills. In this new business model, there are several changes such as 1) new key activities: data analytics, platform development, and maintenance, channels management, 2) new key resources: new customers database and IT personnel, 3) new channels: now customer can view/buy products through the mobile, and, 4) different value proposition: fast payment process at the grocery store, among others.

Another example is given by Hoch and Brad (2021). They proposed a framework to integrate digital technologies into a business model innovation systematically. In this framework, the authors highlight the importance of considering exogenous and endogenous factors during business model design, mainly the impacts driven by digital technologies. They found that the major challenges in the construction rental industry are the limited availability of qualified human resources and the lack of expertise in how to use new or advanced ICTs in earthwork construction. The identified some factors to be added to the business model for an effective digital transformation: 1) a new management team with service and software experience, 2) implementation of advanced IT applications, 3) outsourcing software development to a specialized partner (developing a digital ecosystem and a multisided platform), 4) the coexistence of two business models (one for the conventional rental and other for the development of a sophisticated business ecosystem), 5) to build up training centers to specialists that have to position the digital applications, and, 5) transparent and structured digital work procedures.

Business models interdependence within an ecosystem

The literature states that the ecosystem concept comes from the biological metaphor that includes a natural community of interacting organisms in their environment. Nowadays, the idea is more and more related to interdependencies, considering the fast-changing environment and the evolution of new technologies, making the business world more complex over time.

Adner (2012) states that the ecosystem creates an interdependent world, in which collaboration means dependence and directly affects the probability of success. Those partners need to innovate and agree to adapt in order to succeed as an ecosystem, which creates a set of dependencies. This said, there is a joint value proposition in the ecosystem, which is achieved only through the collective action of the partners. The author creates a wide lens paradigm to broaden the innovator's view by considering the complete set of dependencies. He identified two types of risks in the ecosystem: Co-innovation Risk, in which innovation success depends on other successful innovations, and Adoption Chain Risk, in which partners adopt the innovation before end consumers.

In the same line, Adner and Feiler (2019) pointed out that conjunctive interdependence is one characteristic of ecosystem settings. By conjunctive interdependency, they mean that *a focal actor's*

success is dependent not only on its own ability to execute the task, but on the successful execution of other tasks by other actors (Adner and Feiler, 2019, p. 110).

At this point, it is clear the necessity for collaboration and alignment within an ecosystem. However, it raises the question: how do ecosystems achieve the alignment between the actors? Adner (2012) states a critical starting point for the alignment: the leadership role. According to the author, *an effective leader creates the ecosystem's structure, establishes fair standards and consistency, and convinces potential followers that there is value in it for them (Adner, 2012, p. 118)*. Thus, alignment without a leader is almost impossible since this figure allows the conciliation between all the partners. Each partner has its own goal, its value proposition, and how to capture value within the market. Then, ecosystem alignment means that each partner has to change its business model (how the company generates value and monetizes it) to follow a new shared target. The way to effectively achieve this alignment is through the leader's strategy.

Adner (2012) points out that the leader must understand each partner's business to identify the possible wins. If one partner is not gaining any value with the alignment, there will be no willingness to join. Consider, for instance, the digital cinema case mentioned before (Adner, 2012). Once the first commercial digital projector was launched, it provoked the necessity for alignment within the ecosystem. And how was this achieved? It was possible thanks to the leadership role. In this case, the author explains that studios were the ones that would gain more in the ecosystem with the digital cinema since they were paying high printing and shipping costs. Thus, they took the leadership to understand each actor's position in the ecosystem and then take the necessary actions to convince them to join. This example will be developed in detail in the following section.

Adner (2017) introduced the concept of *ecosystem strategy* as *the way in which a focal firm approaches the alignment of partners and secures its role in a competitive ecosystem (Adner, 2017, p. 47).* The author indicates that partner alignment needs first to recognize gaps and second to create the conditions (for example, resource allocation) for closing these gaps. He states that the gaps can arise from partners' activity-based challenges and expectations. The first one is related to co-innovation and adoption chain risks (the ability and willingness to undertake the required activities). The second one is related to structure and roles, who hands off to whom, and the response to the leader and follower roles. The author also indicates that leadership need not be only of a single firm but can be shared as the case of collaborative consortiums.

Ecosystem alignment then needs a leader who will orchestrate other partners' alignment. And the changes each partner makes will affect the rest of the ecosystem. However, the literature is still pending to deep dive into the major changes each actor executes internally in their business model, being those internal changes the pillars of ecosystem alignment.

Methodology

This chapter aims to explain the methodology used to develop the study research. A case study is selected as the research methodology since the study aims to explore how the evolution of a business model can be managed within an ecosystem. As Yin (2018) pointed out, case study research is chosen when the research question is a "how" or "what" question, there is little or no control over behavioral events, and the focus of the study is a contemporary phenomenon.

This case study aims to analyze two cases that allow the understanding of the interdependence between the members of an ecosystem and the major changes that each partner has to integrate into its business model to respond to the ecosystem changes. The condition for the two cases selected is that change is driven by digital transformation.

Scope

The study is focused on two different examples: the digital cinema (as this example will help to clarify the theory of ecosystems explained by Adner (2012)) and one example of the healthcare ecosystem since it is known that improvements in healthcare have always been of utmost priority in society.

Case 1 Digital Cinema

Consider the digital cinema case mentioned before (Adner, 2012), when the digital projector technology was launched. For decades, the players in this ecosystem were studios, theaters, and viewers. Once the first commercial digital projector was launched, it provoked the alignment of all the actors in the ecosystem and introduced new players. In the following paragraphs, the major changes in each actor will be shown from the business model perspective.

The cinema ecosystem had to react to succeed in introducing the new digital projection technology. Thus, internal changes in the actors were needed. First of all, co-innovation risk: suppliers and complementors of digital cinema technology are added into the ecosystem since the technology integration depends directly on them.

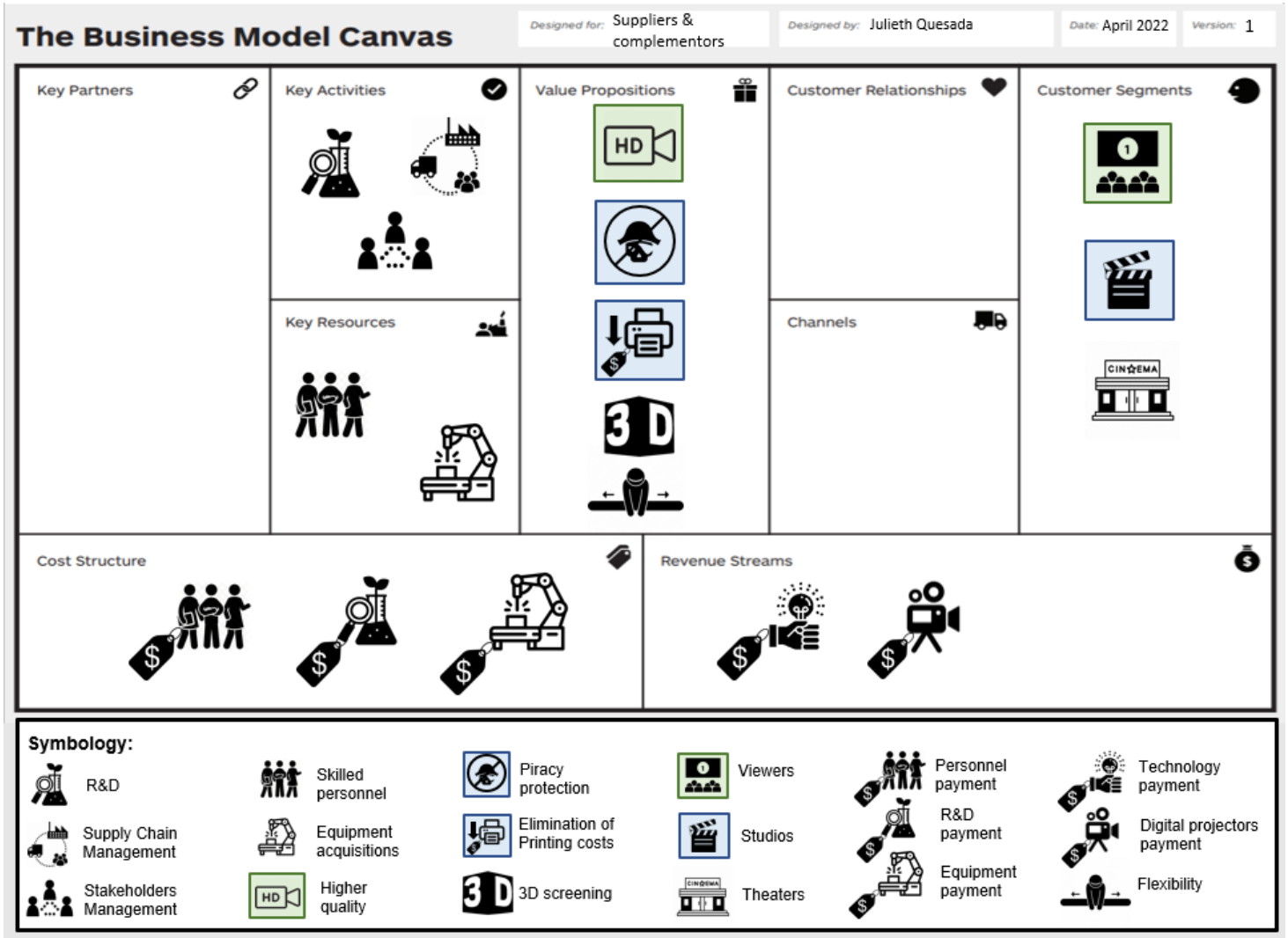
The major business model changes for these players are: 1) the value proposition includes state-of-the-art technologies to integrate the digital cinema, presenting higher-resolution picture quality (for viewers), better protection from piracy, the elimination of costly film prints (for studios), and the potential for 3-D screening and the flexibility of programming for all the customers (viewers, studios

and theaters), 2) new activities such as Research and Development (R&D) for the new technologies, supply chain management (for instance new raw materials negotiations), and stakeholders management (for the respective alignment with the ecosystem actors), 3) new resources such as skilled personnel and equipment acquisitions, 4) cost structure is modified to be able to pay the skilled personnel, R&D activities, and equipment investments and, 5) the revenue streams now includes the payment for the new technology developed and digital projectors (Figure 3). Stakeholder alignment becomes the utmost priority because the supply chain is now conditioned to achieving the ecosystem goal (Figure 3).

Studios took the leadership to accelerate the digital cinema introduction due to the high printing and shipping costs they were paying (Adner, 2012). As the author states, it was clear that one player in the ecosystem was not perceiving high benefits and was causing a bottleneck in the introduction process: the movie theaters. This actor had to make the highest inversion cost by buying the digital projectors and supporting hardware and software for an upgraded projection room. Additionally, there was unclarity on format standards. Thus, there was a problem with the adoption risk explained by Adner (2012).

In this example, studios took the initiative to find a better proposition to share the surplus with theaters and make adoption more attractive (Adner, 2012). Thus, a new financial model was created in the sector, including a virtual print fee (paid by studios) and the inclusion of a new actor in the ecosystem: the digital theater integrator, who would pay the initial outlay for the equipment and assist with technology integration and maintenance (Adner, 2012).

Figure 3 Business Model changes for suppliers and complements



*This is a representative but not complete canvas for the suppliers' and complementors' business model.

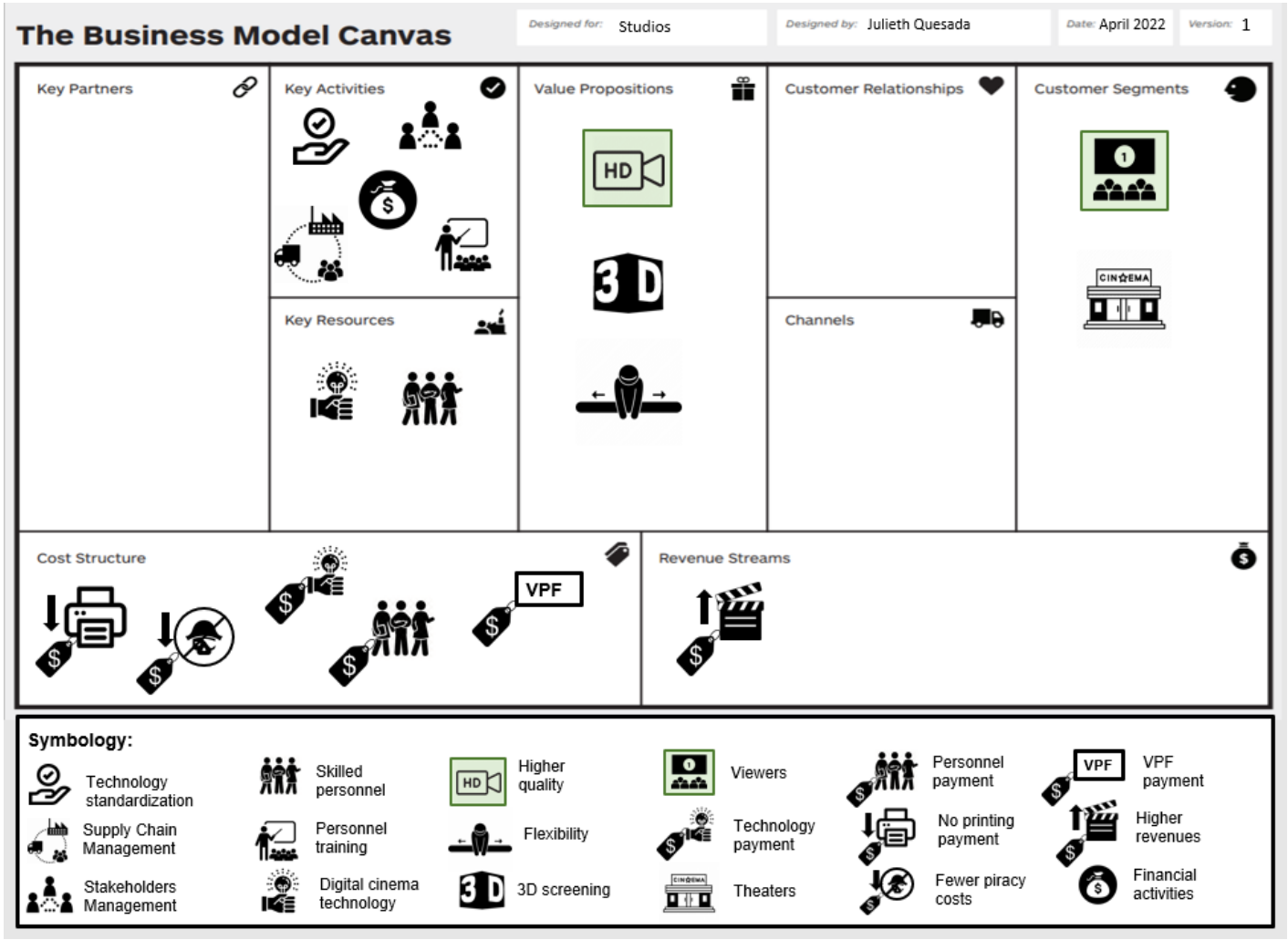
Source: The author, using the Canvas template from Osterwalder and Pigneur (2010)

The major changes in the Studios business model are: 1) value proposition now offers higher-resolution picture quality (especially for viewers), the potential for 3-D screening and the flexibility of programming (for both customers: theaters and viewers), 2) new key activities such as technology standardization, financial initiatives, stakeholder's management, and supply chain management to accelerate the technology adoption, and personnel training to be able to produce movies with new digital cinema technologies, 3) new resources such as integration of new digital cinema technologies and skilled personnel, 4) a new cost structure lead by no printing or shipping costs and, fewer piracy costs, payment for the technology acquired and trained personnel, and the virtual print fee (VPF) to subsidize the high cost of digital cinema adoption in theaters, and 5) the revenue streams now include higher revenues due to more video productions (Figure 4).

Theaters were the bottleneck in the digital cinema integration process. Their motives were to keep capturing value with the same value proposition offered for decades. Introducing high costs into its cost structure was not a priority for them. They were not in the conditions (monetary and skilled personnel) nor disposal to get into the ecosystem. However, once the studios create the financial model, the idea becomes more attractive and convinces them to join. This willingness appears mainly because the value is better distributed among the actors (Adner, 2012).

In the case of theaters, the major changes in their business models are: 1) value proposition now offers higher-resolution picture quality, the flexibility of programming (more options and quicker) and the potential for 3-D screening for viewers, 2) new key activities include supply chain management, stakeholder's management, personnel training for new hardware and software acquisitions, demand analysis (to identify hits), and efficiency activities (to easily operate and maintain the projection equipment), 3) key resources now include the digital projectors acquisition, fewer and trained staff to maintain the project equipment, a new projection room, and the lease-to-own contract with the digital integrator, 4) a new cost structure including the payment for the digital projector trough the lease-to-own arrangement with the theater integrator, and trained personnel payment, 5) the revenue streams now include more revenues due to higher tickets prices and the virtual print fee (VPF) paid by studios, and 6) studios convert from a supplier to a key partner (Figure 5).

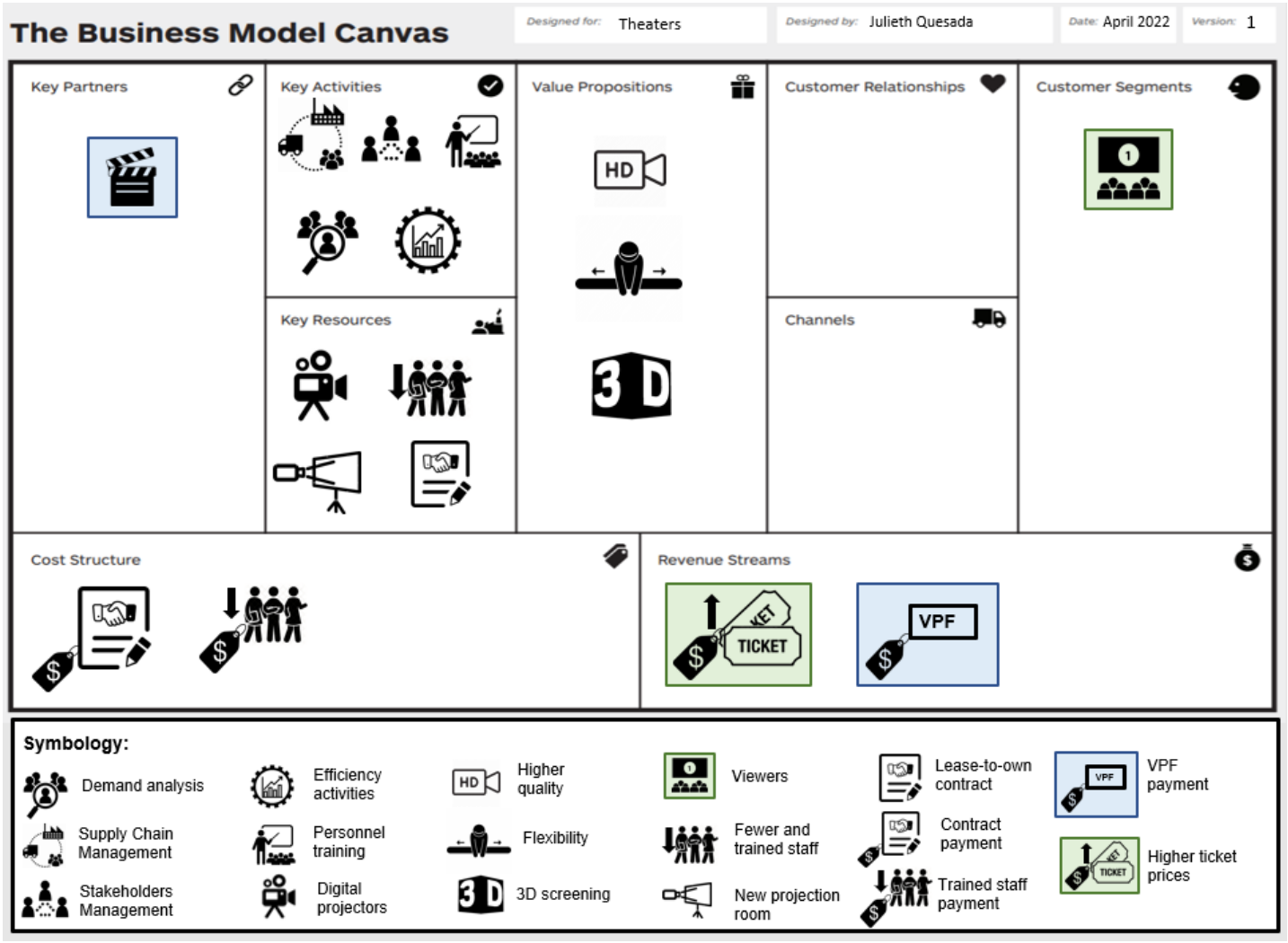
Figure 4 Business Model changes for studios



*This is a representative but not complete canvas for the studio's business model.

Source: The author, using the Canvas template from Osterwalder and Pigneur (2010)

Figure 5 Business Model changes for theaters



*This is a representative but not complete canvas for the theater's business model.

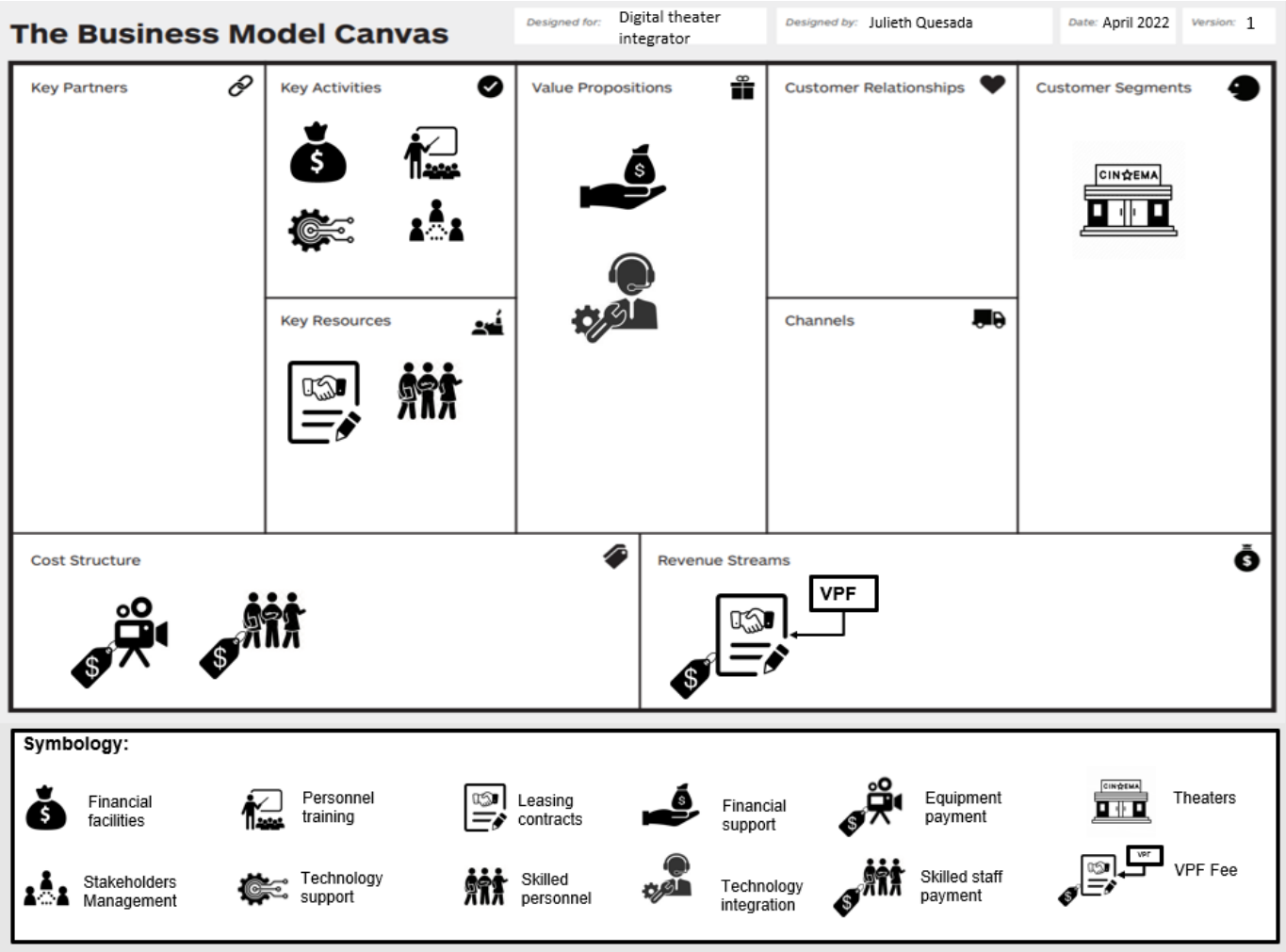
Source: The author, using the Canvas template from Osterwalder and Pigneur (2010)

There is one more actor in this ecosystem, the digital theater integrator. Under the VPF model, this new third-party integrator pays the initial outlay for the equipment and assists with technology integration and maintenance instead of theaters being forced to cover all the costs (Adner, 2012). According to the author, the integrator's profits come from a five to ten-year lease-to-own arrangement with the theaters, which the VPF subsidizes.

The value proposition offered by this figure is to provide financial support and facilitate technology integration for theaters. The major activities are financial facilities, personnel training, stakeholders management, and technology support. The major key resources are the leasing contracts and the skilled personnel. Regarding cost structure, this actor pays the initial outlay for the equipment and skilled personnel. Finally, revenue streams are constituted by the fee indicated in the lease-to-own contract (Figure 6).

As explained in this case, the role of the leader was needed to successfully overcome the adoption chain risks described by Adner (2012). Once the studios identified the bottleneck and the root cause was understood, the restriction was solved and the ecosystem aligned. In this case, the action taken was a financial model that allowed a better value distribution within the ecosystem.

Figure 6 Business Model changes for Digital Theater Integrator



*This is a representative but not complete canvas for the digital theater integrator's business model.

Source: The author, using the Canvas template from Osterwalder and Pigneur (2010)

Case 2 Healthadvisor case

Digital transformation has encompassed disruptive industry changes, and the Healthcare sector is not the exception. One particular example is Artificial Intelligence (AI) in Healthcare.

AI is considered a critical factor in the healthcare evolution since it has changed how value is created (Kulkov, 2021). According to early research, some AI capabilities actively used in healthcare are diagnostics, therapy, healthcare management, and drug development (Ivan and Velicanu, 2015; Fleming, 2018; Hamet and Tremblay, 2017).

AI refers to the simulation of human intelligence (Rich, 1985). It is the science of teaching computers to do something that a person can do more successfully at the moment. It combines machine learning (algorithms applied in order to identify patterns) and other techniques to data, processing a high volume of information in a brief period. Thus, AI might solve human tasks, such as analyzing patient data for diagnostics, treatment, and recovery processes (Kulkov, 2021).

Some of the benefits that AI provides include improved access to healthcare, responsiveness, and privacy (Kulkov, 2021). For example, AI solutions support specialists' decisions, reducing physicians' burnout and workloads. Moreover, value is generated by data processing speed, reducing costs, and providing hospitals and insurance companies with predictable results (Kulkov, 2021).

Traditional healthcare ecosystem

According to Bessant et al. (2012), the traditional healthcare ecosystem comprises five principal actors: patients, providers, suppliers, payers, and regulators.

Based on Adner's (2017) ecosystem as a structure approach, the starting point for the ecosystem is the value proposition definition, which in this case is to help patients heal. Table 2 indicates the actor's activities and links. Complementary, Secundo et al. (2019) suggest that the motivations of each actor are one of the major components that affect players' activities since they can modify the influence of each actor in the ecosystem.

Table 1 Health care ecosystem activities, actors, links, and motives

Actors	Activities	Links	Motives
Patients	Beneficiaries of care service	Transfer of: health status information to the providers and payers, funds to the payers	Improving life conditions, reducing the time of hospitalization
Providers (health professionals: doctors, nurses, etc.)	Provide care in the hospitals	Transfer of: professional care to patients	Improving patient life conditions, reducing the time of hospitalization, improving working conditions and efficiency
Suppliers (Research Institutions, Universities, pharmaceuticals, and medical companies)	R&D, development of new products and treatments	Transfer of information (R&D), materiel (new products) to providers	Improve research activities, increase profits
Payers (statutory or private health insurers)	Payment for care service	Transfer of funds to providers	Reducing costs, monitoring hospital efficiency.
Regulators (Ministries, committees, etc.)	Set regulatory guidelines	Transfer of funds and regulatory information to providers, suppliers, and payers	Supply efficient services, costs reduction, guidelines monitoring

Source: The author based on actors proposed by Bessant et al. (2012) and motives presented by Secundo et al. (2019)

As indicated in the table, patients are the beneficiaries of the care service. Their motives are improvement of life conditions and reducing the time of hospitalizations (Secundo et al., 2019). To receive medical assistance, the patient has to communicate the health status to the provider so the doctor can take the necessary actions to heal the patient (medical records, resources allocation, physicians' skills and specializations, medical equipment, etc.).

Regarding payers, patients have two options, apply for statutory insurance provided by the government, or look for a private insurance provider. Patients have to share their health condition with the payers to identify the health risk and select the respective insurance category to be paid since payers look for cost optimizations.

On the other hand, suppliers continuously work to improve research activities and profits. Research institutes and Universities work state-of-the-art to tackle medical inquiries (acquire research funding, create new technologies and ideas, train new talent, etc.) to provide more effective healing alternatives (Bessant et al., 2012). Also, medical and pharmaceutical companies look for new product developments that complement the healthcare service provision.

Finally, regulators set the regulatory guidelines to manage the healthcare service provision accordingly. They provide research funding, infrastructure, policies, and rules (legislation, taxes) (Bessant et al., 2012).

The last paragraphs show a general explanation of how the traditional healthcare ecosystem works. The next part presents a case where the introduction of product innovation drives changes in all the ecosystem actors.

Healthadvisor Case

Ai4medicine is a German company founded in 2018. It is a science-driven organization that enables data translation into medical solutions (www.ai4medicine.com). The company develops solutions based on machine learning and deep learning models. Dr. Dietmar Frey is the founder of the company. He is a board-certified neurosurgeon who worked at Charité Berlin. He founded the Charité Lab for Artificial Intelligence in Medicine (an interdisciplinary group of machine learning engineers, medical doctors, and scientists who use AI methods to tackle various use cases in medicine) (Charité, 2022).

Ai4medicine partners with some public and private organizations focused on AI applications in medicine, such as the German Research Center for Artificial Intelligence (DFKI), Charité Hospital from Berlin, and the Technological University Dublin (TU Dublin) (www.ai4medicine.com).

For the last years, Ai4medicine has advanced stroke treatment in the clinical setting and created a powerful personalized AI-based solution for personalized stroke prevention (www.ai4medicine.com). Stroke is still a leading cause of death and severe long-term disability globally (Stevens et al., 2019). Thus, stroke prevention continues to be a priority. The solution developed by Ai4medicine is called Healthadvisor, which consists of an application that empowers the patient to reduce the risk of stroke by behavior change (www.ai4medicine.com).

Healthadvisor calculates the individual stroke risk. It supports behavioral changes by making targeted and individualized recommendations for action that have been proven to reduce the risk of stroke. The app shows the patient the different factors that can directly influence the stroke risk (for example, the number of sleep hours, steps per day, alcoholic beverages, cigarettes per day, etc.). The artificial intelligence used in this app allows the recognition of patterns from many patients' past information. It can predict what will happen to each patient if any factors are modified (www.ai4medicine.com).

Figure 7 The Healthadvisor App

Source: www.ai4medicine.com

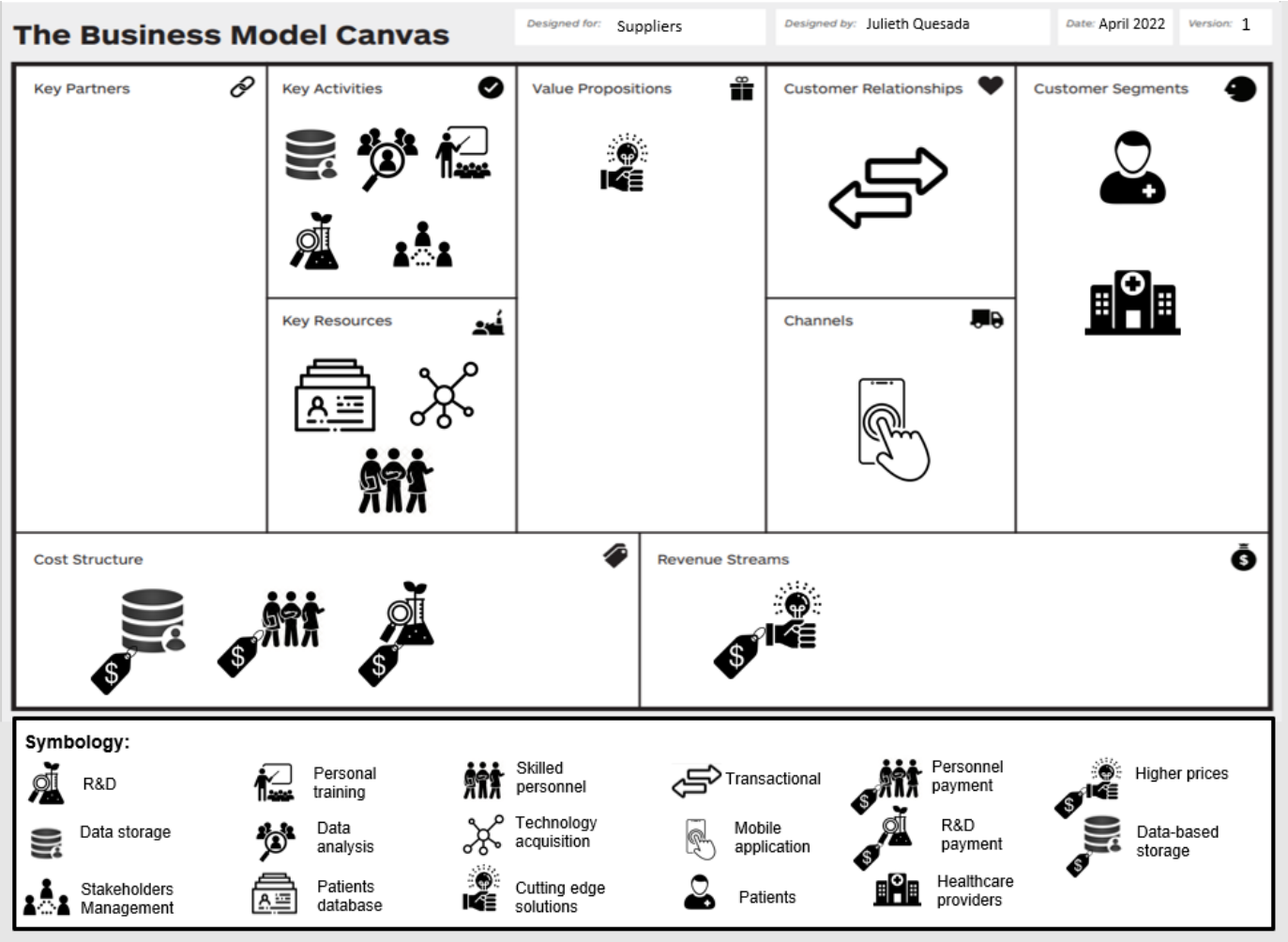
With Healthadvisor, there are essential changes in the healthcare ecosystem. First, the patient becomes a source of value and receives benefits from value. They now have the responsibility for monitoring health status and preventing disease by monitoring themselves during the day. The information gotten from the patient is now shared with other actors, such as research institutions, healthcare providers, and insurance providers.

Research institutions benefit from the application by securely aggregating the data in order to gather further knowledge for the medical field. For the insurance industry, it is a tool to improve the quality of life for their customers and can reduce healthcare costs. The Healthadvisor becomes a patient companion and complements the conversation with the doctor. Hence, the medical appointment is not only the doctor giving diagnosis and recommendations but also the patient becomes an active participant in their health status.

The principal changes in suppliers, providers, and payers are explained in the following paragraphs from the business model's perspective.

In the case of suppliers (Research Institutions, Universities, pharmaceuticals, and medical companies), these are the major changes: 1) the value proposition now is focused on cutting edge solutions for patients diagnosis and prevention based on real-time patients information, 2) key activities now include patients data storage, data analysis, personnel training, R&D activities with updated patients data and stakeholder’s management (to be able to align on ecosystem strategies), 3) new key resources such as patients database, technology acquisition, and skilled personnel able to translate data gathered into new solutions, 4) cost structure now includes data-based storage, skilled personnel, and R&D activities payment, 5) revenue streams now includes new attractive solutions with higher prices, 6) there is now a transactional customer relationship with patients (no direct contact, only through the application), 7) the new channel is the mobile application. The detail is shown in Figure 8.

Figure 8 Business Model changes for health suppliers



*This is a representative but not complete canvas for the health suppliers' business model.

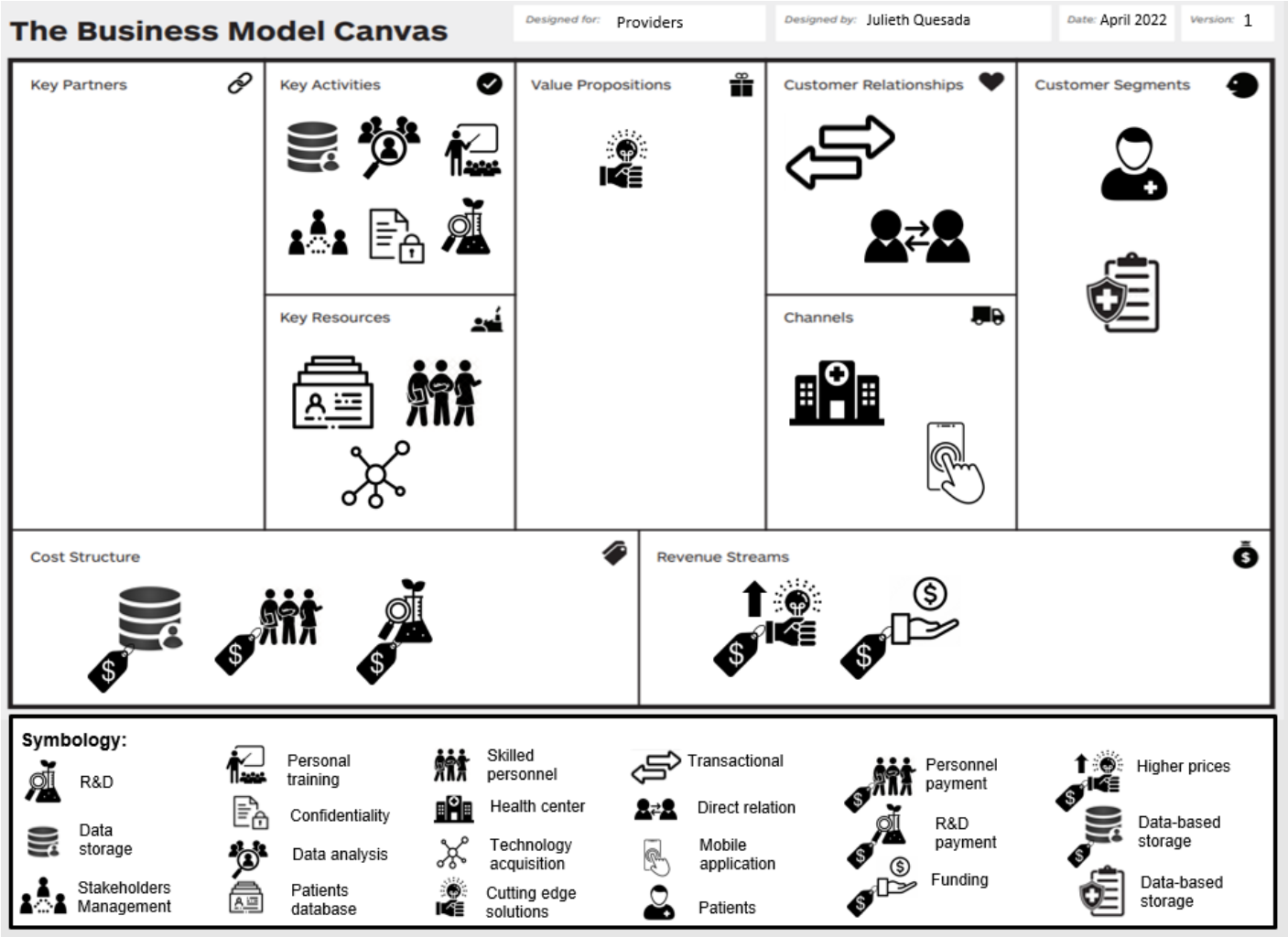
Source: The author, using the Canvas template from Osterwalder and Pigneur (2010)

The Healthadvisor improves workload conditions and efficiency for health providers. The major changes in this actor business model are: 1) the value proposition now is focused on health care diagnosis and prevention based on real-time patients information, 2) key activities now include patients data storage, data analysis (including provider´s workload analysis), personnel training, stakeholder's management, patient information confidentiality, and R&D activities, 3) new key resources such as patients database, technology acquisition, and skilled personnel, 4) cost structure now includes data-based storage, skilled personnel, and R&D activities, 5) revenue streams now include higher prices based on the use of a cutting-edge application, and funding to support R&D activities, 6) there is now a transactional and direct customer relationship, 7) there are now two channels, the mobile application, and the health provision center. The detail is presented in Figure 9.

The last actor to be analyzed in this case is the insurance payer. It is crucial to indicate that payers are the most interested actors in integrating the Healthadvisor into the ecosystem. Mainly because they will significantly reduce cost since the patient now collaborates with the illness prevention and treatment. Even though the complete case has not been applied in reality, the logical procedure would be that payers take the leadership role to incentivize health providers and patients to integrate the Healthadvisor into the ecosystem.

The major changes in this actor's business model are: 1) the value proportion now offers a fast health risk assessment and respective insurance category selection, 2) key activities now include patients data storage, data analysis (including patients health risk assessment), personnel training, technology integration, and stakeholder's management, 3) new key resources such as patients database, technology acquisition, and skilled personnel, 4) cost structure now includes a significant reduction on health cost services for patients, the data-based storage and skilled personnel payment, and the inclusion of incentive strategy for patients and health providers integrate the application effectively, 5) revenue streams now include the payment for the cutting-edge service provision (higher prices), and 6) there is now a transactional customer relationship. The detail is presented in Figure 10.

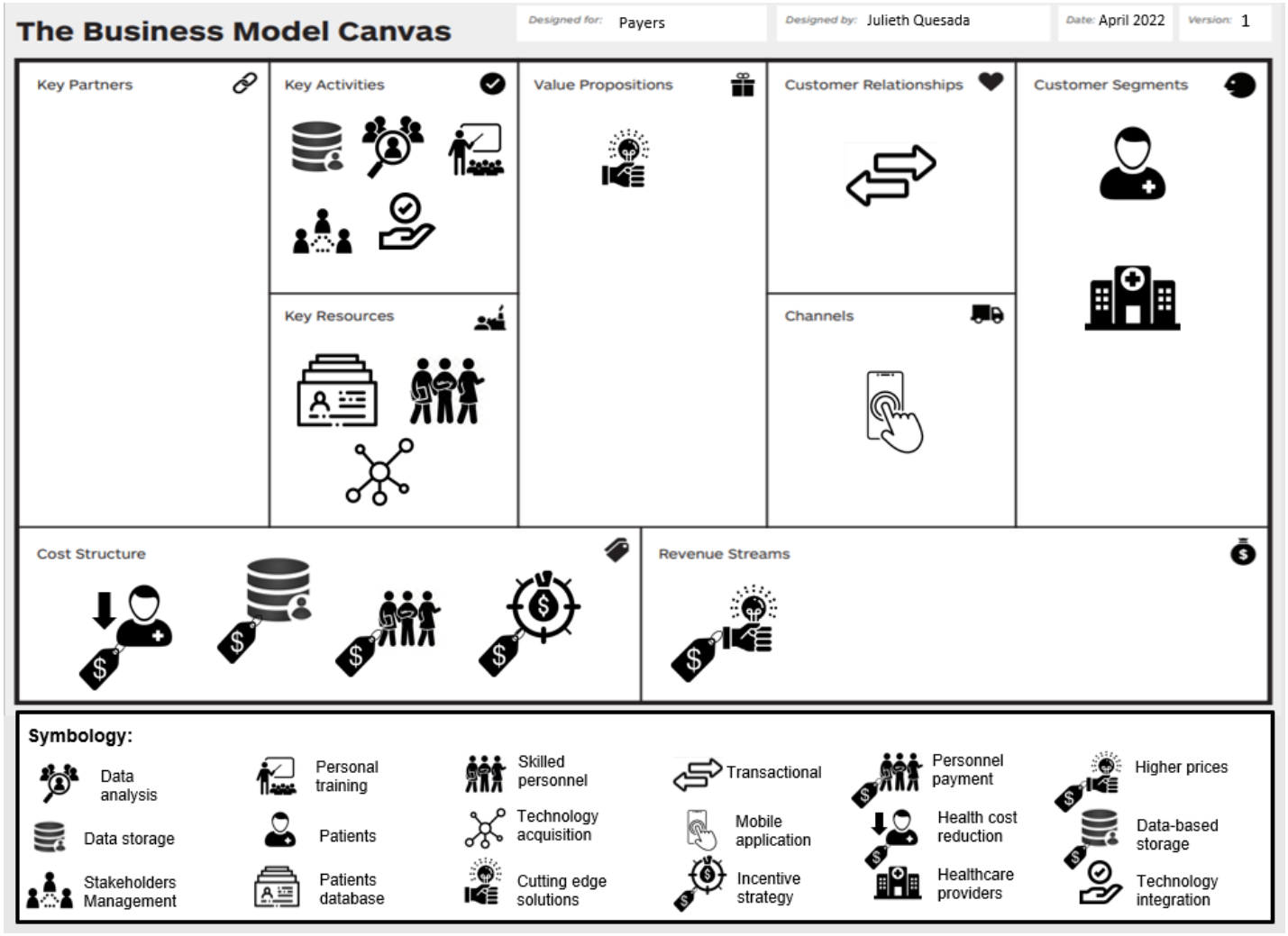
Figure 9 Business Model changes for health providers



*This is a representative but not complete canvas for the health providers' business model.

Source: The author, using the Canvas template from Osterwalder and Pigneur (2010)

Figure 10 Business Model changes for payers



*This is a representative but not complete canvas for the payers' business model.

Source: The author, using the Canvas template from Osterwalder and Pigneur (2010)

As explained in the first case, and corroborated with this second one, the actor that is perceiving more value, or the one that is most interested in the ecosystem alignment, needs to take the leadership role (payers in this case) to identify the other actors' requisites to join. Once the bottleneck is recognized and the root cause is understood, the leader takes the initiative to solve the restriction.

Analysis and discussion

In this section, the analysis and discussion are presented based on the findings from the case studies. Since the research question is to understand how the evolution of a business model can be managed within an ecosystem, I presented two study cases where digital technologies provoked the ecosystem alignment to analyze the major actions taken by the actors. In this research, I explore the changes from the business model perspective.

Results from the case studies

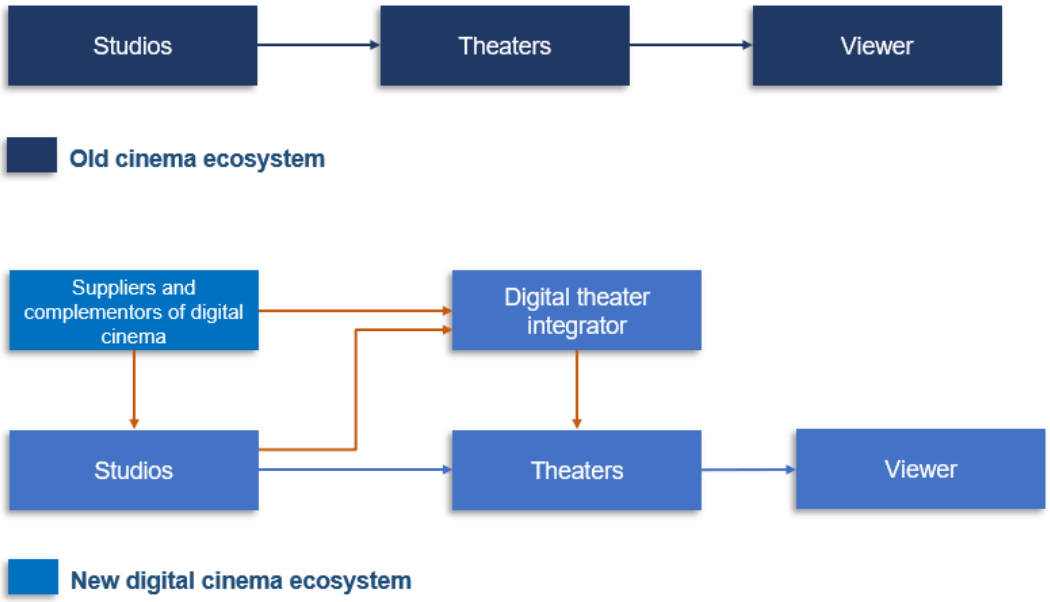
Case 1: Digital cinema

Ecosystem perspective

In the first case study (the digital cinema), a digital technological phenomenon started the ecosystem evolution since changes in activities, actors, positions, and links were needed, corroborating Adner's (2012) ecosystem definition.

There were only three actors in the cinema ecosystem for decades: studios, theaters, and viewers. However, the technological innovation and the birth of the digital cinema allowed the following changes: 1) new activities were taken to achieve the shared value proposition: the new digital cinema integration, 2) new actors were added to facilitate the integration: suppliers and complementors of digital cinema and the digital theater integrator and 3) new links were needed to achieve the correct flow of funds and information: the flow of funding between studios to digital integrator and theaters (VPF), flow of information between suppliers and complementors and the digital theater integrator. Figure 11 represents the changes in the cinema ecosystem.

Figure 11 Cinema ecosystem changes



Source: The author, considering the actors proposed by Adner (2012)

Business model perspective

Considering the changes in the cinema ecosystem becomes necessary to understand what specific changes in the actors' business model were needed to achieve the ecosystem alignment. As stated before, actors took several actions to be able to react to the ecosystem changes. Consider table 2, where changes in each actor building block are summarized.

Table 2 Changes in the actor's business model: Digital Cinema

Canvas building block	Changes in the actors' business model	Specific leader initiatives
Value proposition	Inclusion of the value offered by the new technology.	
Key activities	Supply chain management, stakeholder management, personnel training, R&D, demand analysis, and efficiency activities	Technology standardization and financial initiatives
Key resources	New skilled personnel, equipment/technology acquisition, and lease-to-own contract.	Lease-to-own contracts related to the financial initiatives
Cost structure	Payment of skilled personnel, R&D, new equipment/technologies, and lease-to-own contract.	Payment of the subsidizing strategy (VPF)
Revenue streams	Increased revenues led by the new product/service offered and subsidizing strategy (VPF).	
Key partners		Partnering strategy

Source: The author

In the case of the value proposition, the main change was the inclusion of the value offered by the new technology. Now, suppliers and complementors, studios, and theaters present the digital cinema features (high-quality resolution, flexibility of programming, the potential for 3-D screening, etc.) as part of their value offer to their customers.

In regard to key activities, were added: 1) supply chain management: now actors have to negotiate new raw materials, supplies, accessories, with vendors and coordinate the respective warehousing and delivery activities, 2) stakeholder management: this becomes a priority because the technological changes are disrupting the usual way in which actors used to relate before, so now it is needed more communication and conciliation between them, 3) personnel training of new technologies: since the change is driven by technology innovation, it becomes necessary to investigate and train the team to be able to integrate the technology within the business, 4) R&D activities to better integrate and complement the new technologies, 5) demand analysis: based on the flexibility of the technology, now actors can introduce a new skill related to data analysis to be able to better understand their customer's behavior, and 6) efficiency activities: the technological changes allow actors to improve their internal processes.

The new key resources added by the actors are 1) new skilled personnel: since the technology becomes key in the value proposition offered to the customers, the skilled personnel trained to develop, install or maintain the new technology becomes key for the company, 2) equipment or technology acquisition: the technology itself becomes a key resource for the company since value proposition and key activities are built around it, and 3) the addition of contracts: in this case, the lease-to-own contract is the financial mechanism to achieve a faster technology integration.

The cost structure is dependent on the added key resources. In this case, the payment for the new skilled/trained personnel, the equipment/technology acquisition, and the payment of the new contracts.

Finally, revenue stream changes are led by the new product/service offered (allowing price increases) and subsidizing strategy (VPF for the theaters specifically).

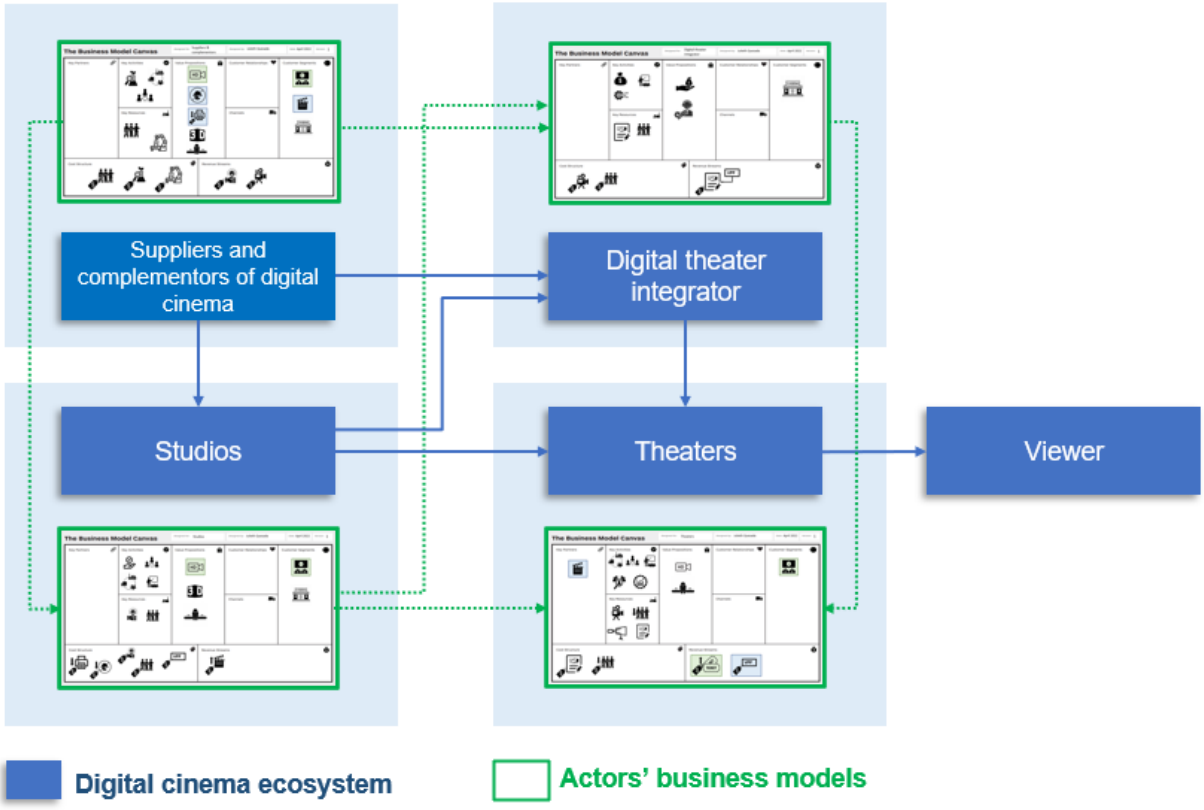
In the case of the leader role, there were specific actions taken. In this case, studios added the following key activities: 1) technology standardization: as studios were the most interested in making the transition to the digital cinema, it was a priority the definition of the standard technology, supplies, accessories, etc. to facilitate the technology adoption, and 2) financial initiatives: studios analyzed the ecosystem to understand other actors' necessities and create financial mechanisms that allow a more equative benefits distribution. Besides, key resources now include the lease-to-own contract related to the financial initiatives, and the cost structure includes the payment of the subsidizing strategy (VPF). Finally, studios also applied partnering strategies to achieve the target goal with the theaters.

Business models interdependency

As stated before, the ecosystem evolution implies actors' business model changes. As Adner and Feiler (2019) pointed out, there is a conjunctive interdependence within the actors since each actor's success now depends on the successful execution of other actors. The following blueprint shows how the ecosystem interdependence implies actors' business model interdependence (Figure 12).

The digital ecosystem is shown in the blue boxes (suppliers and complementors, studios, theaters, the digital theater integrator, and viewer). The green boxes correspond to each actor's business model. Then, this proposed model visualizes how the ecosystem alignment is achieved only through each actor's building block changes, and a change in one actor directly affects the rest of the ecosystem actors.

Figure 12 Ecosystem and actors' business models interdependence: Digital Cinema Case



Source: The author, considering the actors proposed by Adner (2012)

Case 2: Healthadvisor

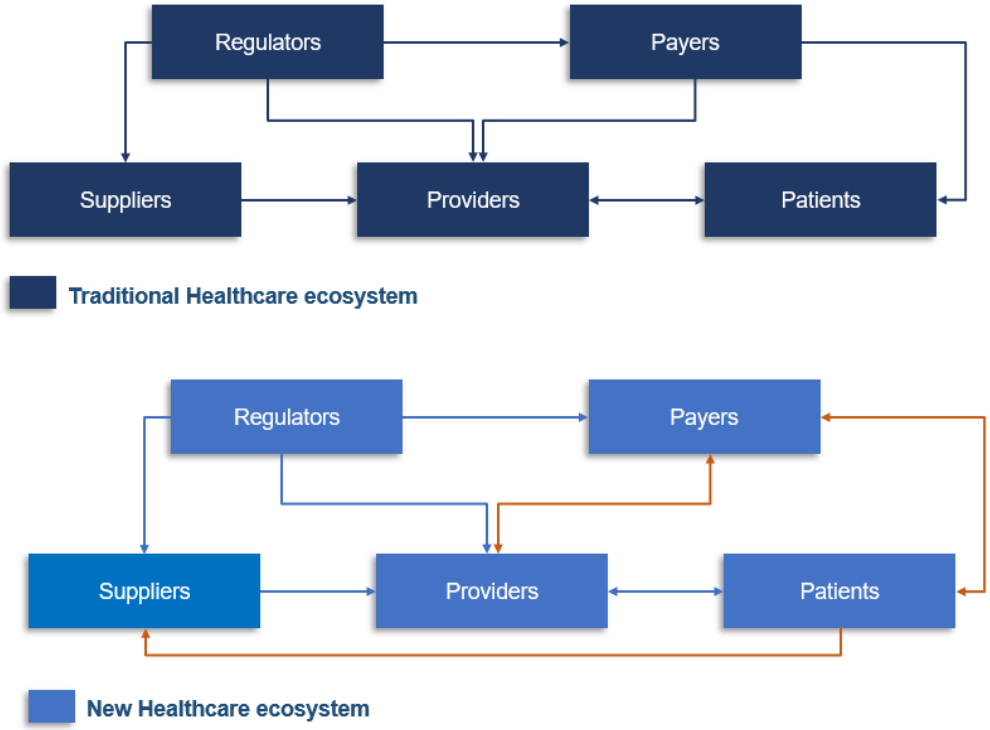
Ecosystem perspective

There was also a digital technology innovation in the second case study: the healthadvisor. This application (based on artificial intelligence algorithms) provokes the evolution of the healthcare ecosystem since changes in activities, actors, positions, and links were also needed.

As explained before, the traditional healthcare ecosystem comprises five actors: suppliers, regulators, providers, payers, and patients. In the traditional healthcare ecosystem, the patient has to communicate the health status to the provider, so he takes the necessary actions to heal him. Payers have to assess the patient to identify the health risk and select the respective insurance category. Suppliers and regulators remain separate from the patient.

However, the healthadvisor opened new possibilities and facilitated the communication within the ecosystem, allowing the following changes: 1) new activities were taken to achieve the shared value proposition, such as patients' data storage and analysis, 2) actors changed how they offered their service because with patients information they can better diagnose, predict and categorize the health status and medical recommendations and 3) new links were needed to achieve the correct flow of information: now patients automatically share their health status and records with providers, payers, and even the suppliers through the app. Figure 13 represents the changes in healthcare.

Figure 13 Healthcare ecosystem changes



Source: The author, considering the actors proposed by Bessant et al. (2012)

Business model perspective

Considering the changes in the healthcare ecosystem becomes necessary to understand what specific changes in the actors' business model were needed to achieve the ecosystem alignment. As stated before, actors took several actions to be able to react to the ecosystem changes. Consider table 3, where changes in each actor building block are summarized.

Table 3 Changes in the actor's business model: Healthadvisor Case

Canvas building block	Changes in the actors' business model	Specific leader initiatives
Value proposition	Inclusion of the value offered by the new technology (cutting edge solutions)	
Key activities	Data storage, data analysis, stakeholders' management, R&D activities, patient information confidentiality, and personnel training	Technology integration and financial incentives
Key resources	Patients database, skilled personnel, and technology acquisition	
Cost structure	Payment of data-based storage, skilled personnel, technology acquisition, and R&D activities	Payment of the incentive strategy
Revenue streams	Increased revenues led by the new service offered and funding to support R&D activities	
Channels	The new digital channel added: the mobile	
Customer relationship	A transactional relationship with the customer	

Source: The author

In the case of the value proposition, the main change was the inclusion of the value offered by the new technology: health care diagnosis and prevention based on real-time patients' information.

Regarding key activities, were added: 1) data storage and data analysis: since the application will provide high amounts of patients' data, 2) stakeholders' management: this becomes a priority because the technological changes are disrupting the usual way in which actors used to relate before, 3) R&D activities to better integrate and complement the new technologies, 4) patient information confidentiality: becomes a high priority to manage the information correctly gathered to avoid any confidentiality issue, and 5) personnel training of new technologies: since the change is driven by technology innovation, it becomes necessary to investigate and train the team to be able to integrate the technology within the business.

The new key resources added by the actors are 1) patients database: now providers, payers, and suppliers have a vast source of information that allows them to make a better diagnosis, treatment, and developments, 2) skilled personnel: since the technology becomes key in the value proposition offered to the customers, the skilled personnel trained to develop, install or maintain the new technology becomes key for the company, 3) equipment or technology acquisition: the technology itself becomes a key resource for the company since value proposition and key activities are built around it.

The cost structure is dependent on the added key resources. In this case, the payment for the database storage, skilled personnel, the technology acquisition, and the R&D activities.

The revenue stream changes are led by the new service offered (allowing price increases) and funding to support R&D activities.

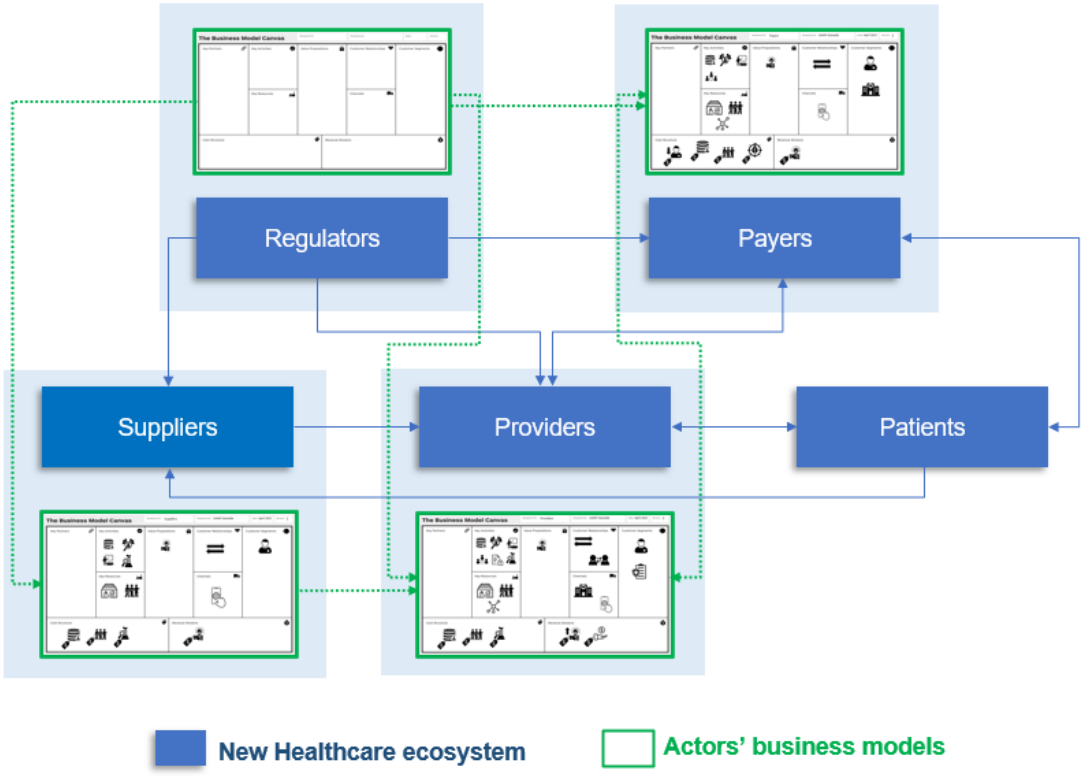
A new digital channel is added since the patient can now be served through the mobile app or the health provider center. Finally, a transactional relationship with the customer is added.

In the case of the leader role, there were specific actions taken. In this case, payers include the following key activities: 1) technology integration: since payers are the most interested in the technology adoption, they have to take the necessary actions to accelerate the process, and 2) financial incentives: payers had to analyze the ecosystem to understand other actors' necessities and create financial mechanisms that allow a more equative benefits distribution. Additionally, payment of the incentive strategy is now included in the cost structure.

Business models interdependency

As stated before, the ecosystem evolution implies actors' business model changes. The healthcare ecosystem is shown in the blue boxes (suppliers, providers, regulators, payers, and patients). The green boxes correspond to each actor's business model. Then, this proposed model visualizes how the ecosystem alignment is achieved only through each actor's building block changes. A change in one actor directly affects the rest of the ecosystem. Regulators are not analyzed in this case. The following blueprint shows how the ecosystem interdependence implies actors' business model interdependence (Figure 15).

Figure 14 Ecosystem and business models interdependence: Healthadvisor Case



Source: The author, considering the actors proposed by Bessant et al. (2012)

Ecosystem changes

This study has shown that digital transformation provokes ecosystem alignment, meaning changes in the ecosystem's actors, activities, and links. Principal changes are: 1) New activities to achieve the shared value proposition: technology integration, stakeholders management, financial support, and data management, 2) actors adaptation to offer the new service/product and addition of actors in the ecosystem to facilitate the activities: suppliers, complementors, and financial support entities, 3) new links to achieve the correct flow of funds and information: the flow of funding from the leader to the restrictive actor(s) and flow of information between customer to the rest o the actors' ecosystem.

Building blocks changes

Based on the case study analysis, an ecosystem alignment implies actors' business model-specific changes. Some changes need to be adopted by all ecosystem actors. Some specific actions are taken by the leader, and others exclusively by the restrictive actor (the one perceiving the least benefit in the ecosystem) (Table 4).

Table 4 Business model changes to be considered in an ecosystem alignment drove by a technological innovation

Canvas building block	All actors' business model changes	Leader actor business model changes	Restrictive actor business model changes
Value proposition	Inclusion of the value offered by the new technology		
Key activities	Data management, stakeholders' management, supply chain management, R&D, and personnel training	Technology integration (standardization) and financial incentives (subsidizing, leasing contracts, funding)	
Key resources	Technology acquisition, skilled personnel, contracts, and customer database.	Contracts related to the financial incentives (leasing)	
Cost structure	Payment of technology acquisition, skilled personnel, data management, contracts, and R&D	Incentives mechanism payment	
Revenue streams	Increased revenues led by the new product/ service offered		Financial incentives for technology adoption (subsidizing, leasing contracts, funding)
Channels	Digital channels addition		
Relationship	Transactional and direct relationship with customers		
Key partners		Partnering strategy	

Source: The author

All actor's business model changes

Seven building blocks need to change in actors that constitute an ecosystem evolving by digital technologies.

The first block is the value proposition. This block has to include the value offered by the new technology, enhancing the alignment within the ecosystem since every actor is now considering the new technology as its focus. This statement is confirmed by Adner (2017) when it indicates that partners within an ecosystem need to interact in order for a focal value proposition to materialize.

The second block is the key activities. Here the digital transformation requires the addition of five specific activities: 1) data management: data storage, analysis, and confidentiality become crucial. This statement is corroborated by Vial (2019) since technological disruption is mainly based on the

collection, sharing, and selling of data provided by multiple parties in the ecosystem. 2) stakeholders' management: this is vital to understand other actors' necessities and get to conciliations and priorities alignment within the ecosystem. 3) supply chain management: actors have to negotiate new raw materials, supplies, accessories, with vendors to integrate the new technology successfully. 4) R&D: Research and development are crucial to promoting continuous improvement and new technologies understanding. 5) personnel training: actors need to ensure the correct installation and maintenance of the new technologies, achieved through a training plan for all the team. Technological transformation implies a cultural change that needs to be assimilated by all company members. This activity is confirmed by Hoch and Brad (2021) when they identified that training centers were needed to integrate digital technologies into a business model.

The third block corresponds to key resources. Four resources need to be integrated: 1) technology acquisition: the technology itself becomes an essential resource for the company since the value proposition and key activities are built around it. 2) skilled personnel: the qualified personnel trained to develop, install or maintain the new technology becomes key for the company. 3) contracts: financial mechanisms are crucial to faster technology integration. 4) customer database: customers' information becomes a rich source of value that improves the decision-making process and data flow.

The fourth bock is cost structure, which includes payment of technology acquisition, skilled personnel, data management, contracts, and R&D.

The fifth block is the revenue streams. All actors need to map an increase in revenues led by the new product/ service offered. The growth would be mainly through price increases that can be launched in the short, mid, or long term.

The sixth block corresponds to channels, including digital channels (mobile, website, etc.) with customers to improve communication.

Finally, the seventh block is relationships, including transactional (through the new channels) and direct (customized service) customer relationships.

Leader business model changes

To introduce this section, I mention Adner's (2017) statement: partner alignment is achieved first by recognizing gaps and second creating the conditions (for example, resource allocation) for closing these gaps. As stated by the author, these actions need to be taken by the leader, which could be one or several companies.

Leaders need to adopt four specific building blocks: key activities, key resources, cost structure, and key partners.

Regarding key activities: technology integration and financial incentives become crucial. The first one refers to the activities the leader needs to take to ensure or facilitate technology adoption, such as the standard definition of processes, suppliers, accessories, etc. The second one refers to the actor's financial strategies to equilibrate the benefits within the ecosystem and ensure every actor wins, for instance, subsidizing plans, leasing contracts, and funding. This is necessary to convince the restrictive actors to align.

The second block is key resources, in which contracts related to the financial incentives become crucial. Then, the following building block is the cost structure which includes the payment of financial incentives/mechanisms.

Finally, partnering strategies are added to the key partners' building block since it is part of the incentive strategies.

Restrictive actor business model changes

There is one building block that will change specifically for the restrictive actors. This is the revenue stream since these actors (or actor) will receive financial incentives to ensure faster technology adoption and make the innovation more attractive—for instance, a subsidizing plan, leasing contracts, funding, etc.

Business models interdependency

The study presents a blueprint visualization that shows ecosystem interdependency. The blueprint shows how the ecosystem alignment is achieved only through each actor's building block changes. A change in one actor directly affects the rest of the ecosystem actors. This result is achieved by visually linking the ecosystem (actors and links) with the respective actor's business model. The blueprint allows understanding the general ecosystem view and the specific internal changes actors need to apply to achieve the ecosystem alignment.

Conclusion

Digital transformation has provoked a pervasive change in business since the way firms generate value has drastically changed in the last decade.

This research has explained that digital transformation is a recent, fast, multifaceted phenomenon that triggers individual, organizational, and societal changes. These changes emerge through combinations of information, computing, communication, and connectivity technologies such as big data, automation, and artificial intelligence, addressing new ways of living, doing business, and overcoming societal challenges.

The complexity of recent technological developments has created the necessity for companies to position themselves in a digital ecosystem, allowing multi-stakeholder interactions and competitive dynamics development to adopt digital transformation. Those who do not adapt and seize a digital transformation process lose competitiveness and leave an open opportunity for more agile competitors.

The ecosystem creates an interdependent world since a focal actor's success is dependent not only on its own ability to execute the task, but on the successful execution of other tasks by other actors.

Current literature regarding ecosystems has focused on the general changes the major actors make, including or modifying actors, links, and positions. Still, it has not considered the internal changes each actor must apply in its business model. Contrarily, business model literature has been focused only on the principal changes for the focal actor without considering the rest of the members of the ecosystem it is embedded.

To date, there is a gap in the literature since existing approaches fail to address the specific business model changes a company should consider in embracing the digital transformation within an ecosystem. Thus, this research aims to understand how the evolution of a business model can be managed within an ecosystem. The study looks to identify the consequences for firms' operation in the ecosystem and the major changes business needs to take internally to remain competitive considering the digital transformation changes.

A case study is applied to address the research question. Since it is a "how" question, there is little or no control over behavioral events, and the focus of the study is a contemporary phenomenon (Yin, 2018). The study is focused on two different examples: the digital cinema ecosystem (as this example will help to clarify the theory of ecosystems explained by Adner (2012)) and the healthcare ecosystem since it is known that improvements in healthcare have always been of utmost priority in society.

Research findings

This study has shown that digital transformation provokes ecosystem alignment, meaning changes in the ecosystem's actors, activities, and links. Principal changes are: 1) New activities to

achieve the shared value proposition: technology integration, stakeholders management, financial support, and data management, 2) actors adaptation to offer the new service/product and addition of actors in the ecosystem to facilitate the activities: suppliers, complementors, and financial support entities, 3) new links to achieve the correct flow of funds and information: the flow of funding from the leader to the restrictive actor(s) and flow of information between customer to the rest o the actors' ecosystem.

Additionally, the study presents a blueprint visualization that shows ecosystem interdependency. The blueprint shows how the ecosystem alignment is achieved only through each actor's building block changes. A change in one actor directly affects the rest of the ecosystem actors. This result is achieved by visually linking the ecosystem (actors and links) with the respective actor's business model. The blueprint allows understanding the general ecosystem view and the specific internal changes actors need to apply to achieve the ecosystem alignment.

Some changes need to be adopted by all ecosystem actors. Some specific actions are taken by the leader (the actor or actors that perceive the most benefit with the ecosystem alignment), and others exclusively by the restrictive actor (the one perceiving the least benefit in the ecosystem).

The findings indicate that seven building blocks need to change in actors that constitute an ecosystem evolving by digital technologies: value proposition, key activities, key resources, cost structure, revenue streams, channels, and customer relationship.

The first block is the value proposition. This block has to include the value offered by the new technology, enhancing the alignment within the ecosystem since every actor is now considering the new technology as its focus. This statement is confirmed by Adner (2017) when it indicates that partners within an ecosystem need to interact in order for a focal value proposition to materialize.

The second block is the key activities. Here the digital transformation requires the addition of five specific activities: 1) data management: data storage, analysis, and confidentiality become crucial. This statement is corroborated by Vial (2019) since technological disruption is mainly based on the collection, sharing, and selling of data provided by multiple parties in the ecosystem. 2) stakeholders' management: this is vital to understand other actors' necessities and get to conciliations and priorities alignment within the ecosystem. 3) supply chain management: actors have to negotiate new raw materials, supplies, accessories, with vendors to integrate the new technology successfully. 4) R&D: Research and development are crucial to promoting continuous improvement and new technologies understanding. 5) personnel training: actors need to ensure the correct installation and maintenance of the new technologies, achieved through a training plan for all the team. Technological transformation implies a cultural change that needs to be assimilated by all company members. This activity is confirmed by Hoch and Brad (2021) when they identified that training centers were needed to integrate digital technologies into a business model.

The third block corresponds to key resources. Four resources need to be integrated: 1) technology acquisition: the technology itself becomes an essential resource for the company since the value proposition and key activities are built around it. 2) skilled personnel: the qualified personnel trained to develop, install or maintain the new technology becomes key for the company. 3) contracts: financial mechanisms are crucial to faster technology integration. 4) customer database: customers' information becomes a rich source of value that improves the decision-making process and data flow.

The fourth bock is cost structure, which includes payment of technology acquisition, skilled personnel, data management, contracts, and R&D.

The fifth block is the revenue streams. All actors need to map an increase in revenues led by the new product/ service offered. The growth would be mainly through price increases that can be launched in the short, mid, or long term.

The sixth block corresponds to channels, including digital channels (mobile, website, etc.) with customers to improve communication.

Finally, the seventh block is relationships, including transactional (through the new channels) and direct (customized service) customer relationships.

Regarding the specific leader activities, the actor (or actors) needs to consider a change in four specific building blocks: key activities, key resources, cost structure, and key partners.

Regarding key activities: technology integration and financial incentives become crucial. The first one refers to the activities the leader needs to take to ensure or facilitate technology adoption, such as the standard definition of processes, suppliers, accessories, etc. The second one refers to the actor's financial strategies to equilibrate the benefits within the ecosystem and ensure every actor wins, for instance, subsidizing plans, leasing contracts, and funding. This is necessary to convince the restrictive actors to align.

The second block is key resources, in which contracts related to the financial incentives become crucial. Then, the following building block is the cost structure which includes the payment of financial incentives/mechanisms.

Finally, partnering strategies are added to the key partners' building block since it is part of the incentive strategies

Moreover, the restrictive actor (or actors) also needs to consider one specific change in its business model: the revenue streams, since the actor will receive financial incentives to ensure faster technology adoption and make the innovation more attractive (subsidizing plan, leasing contracts, funding).

Managerial implications

From the firm's perspective, it is crucial to consider that digital transformation is a natural phenomenon that is in continuous evolution. Thus, introducing a company within an ecosystem can facilitate the development of competitive capabilities to react to environmental changes quickly. However, firms should consider that an ecosystem requires alignment to achieve the shared value proposition. This alignment also implies business model changes in the building blocks proposed by Osterwalder and Pigneur (2010). Firms' managers should consider the prompt adoption of the changes proposed in this research and also analyze that to be part of an ecosystem, it is needed to accept the existence of a leader, that any firm can be a restrictive actor, and that the ecosystem will always be in continuous evolution.

From the government and policymakers' perspective, it is essential to note that digital transformation is not a temporal mode but a phenomenon that is in continuous evolution. This phenomenon opens enormous opportunities for new ways of innovation and technological advances that would directly impact the countries' economies and peoples' way of living. Thus, educational models focused on data management (data storage, analysis, confidentiality, and maintenance) and digital technologies (such as cloud computing, the internet of things, big data architectures, artificial intelligence, etc.) become a priority in preparing the future citizens proactively. Also, new policies facilitating the ecosystem's evolution can generate a significant impact in countries since digital transformation would be promoted. For instance, fewer taxes pay for businesses pursuing digital transformation or cutting-edge equipment acquisitions. Moreover, the government can create a space to facilitate and encourage public and private institutions' collaboration and alignment and even make the next five years' country's agenda regarding digital transformation.

As this study has shown, new policies, educational models, and collaborations between public and private institutions must be aligned to the technological necessities to facilitate digital transformation. This alignment has become a critical factor to be considered by governments, scholars, firms, policymakers, and public and private institutions. Hence, by combining the learnings and methodologies mentioned in this research, it is defensible that digital transformation can be fostered.

Limitations and directions for future research

This research is subject to some limitations. First of all, the analysis is based on only two case studies, which limits the results' generalizability. Second, the changes found in the actors' business models could be biased by the author's perspective and knowledge.

Future investigations should focus on empirical studies that deeply analyze the specific actions taken by actors within an ecosystem that aligns the value proposition due to technological innovation.

Moreover, it would be essential to understand the significant changes that each specific technology would need, for instance, artificial intelligence, the internet of things, virtual reality automation, etc. Besides, future studies should identify particular capabilities that firms, regions, and nations need to develop to embrace digital technologies at a macro level successfully.

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