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Player three has joined the game: Industry platforms as facilitators for disruptive innovations

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MASTER'S THESIS

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Abstract

Spotify, Netflix, and Airbnb successfully introduced, or are in process of introducing, disruptive innovations in their industries. Interestingly, their product offerings differ fundamentally in one respect from classic examples used to exemplify disruptive innovation. Christensen described the cases of mechanical shovel manufacturers being disrupted by the hydraulics technology, and the steel industry being disrupted by the mini-mills. In these two examples, the disrupters built their product offerings entirely in-house. That action resulted in having every technological component, used to create the final product, developed exclusively inside the organization. However, recent developments in the digital sector coupled with the rise of business ecosystems draw attention on a thought-provoking phenomenon. Namely, the concept of modularity and component reusability evolved from the level of internal products to reach industry level. In other words, external innovators which are pursuing a disruptive strategy can build their solution on top of a technological industry platform and reuse its components. This action provides a great advantage for future-to-be disrupters allowing them to focus on their core business, resulting in increasing the number of disruptive innovations and reducing development time. Under this context, our paper is arguing that industry platforms entered the disruption game by facilitating and easing the emergence of disruptive innovations. We conducted an inductive study analyzing data coming from four emerging industry platforms in the realm of Internet of Things (IoT) in order to better understand how technological industry platforms facilitate disruptive innovations. Our results distinguished between three different types of industry platforms. Furthermore, each of these categories exhibits unique characteristics which makes them better equipped to facilitate certain types of disruptive innovations over others.

Key words: technological platforms, disruptive innovation, Internet of Things

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Chapter 1. Introduction

In April 2015, Spotify announced raising capital at a $8 billion valuation, Netflix's market value in 2015 was $33 billion, and in March 2015, Airbnb secured a new round of funding at a $20 billion valuation. Adding up the numbers will reveal that the combined value of the three companies exceeds the Gross Domestic Product (GDP) of Luxembourg.

More interestingly, Spotify, Netflix, and Airbnb are not traditional players in their industries, instead, they successfully reimagined the way markets were being served. Additionally, they accomplished that while building their product offerings on top of Amazon Web Services platform. Furthermore, in two Amazon case study reviews from 2013, Emil Fredriksson, Operations Director for Spotify, and Nathan Blecharczyk, Cofounder of Airbnb, agreed on the Amazon platform's instrumental role in the success of their companies. Consequently, it can be implied that without a platform-based company similar to Amazon, it would be more difficult, if not impossible, for companies like Spotify, Netflix, or Airbnb to emerge. Grinding and time-consuming tasks such as database replication and scaling, provisioning capacity, whether it is storage, servers, or networks are all reduced through Amazon's platform to a basic API (Application Programming Interface) call. As a result, companies are able to devote their resources and attention to their core business.

This backstage actor, namely Amazon Web Services cloud platform, seems to offer fertile ground for organizations to innovate and challenge industries' traditional competing rules. The problem however, is that it seems to be doing that in the background, especially in the particular context of facilitating innovation that challenges established competing rules. Therefore, if this process can be understood, controlled, and conducted consciously, then the number of companies similar to Spotify, Netflix, or Airbnb can be greater than before, significantly increasing the created value.

1.1 Problem Statement

According to their website (http://aws.amazon.com/about-aws/), Amazon Web Services (AWS) platform offers a set of on-demand cloud computing services which operate from twelve geographical regions across the world. Amazon Web Services platform seems to be playing the role of an industry platform leader, providing low level access to computing resources, while high level services, such as facilitating configuration, management, and monitoring are provided by complementors. For example, RightScale, a third party external organization, offers tools for automation, control and portability for applications deployed on the Amazon Web Services platform. This makes it easier for other companies to reuse this common set of assets provided by the industry platform (platform leader & complementors) to freely innovate and create their own products, services, or technologies for serving different markets (e. g. Spotify, Netflix, or Airbnb).

This paper defines industry platforms as follows:

> "*Industry platforms are products, services, or technologies that act as a foundation upon which external innovators, organized as an innovative business ecosystem, can develop their own complementary products, technologies, or services*"
>
> (Gawer & Cusumano, 2013).

Conducted research classify Airbnb (Guttentag, 2013; Zervas, Proserpio, & Byers, 2013), Netflix (Cunningham, Silver, & McDonnell, 2010), and Spotify (Hogan, 2015) as being disruptive innovations. Spotify, Netflix, and Airbnb, and other companies that employ disruptive innovation as a strategic choice, are fighting fierce battles in their industries against the traditional established players. In some cases, these clashes turn into a fight for the incumbent companies' very existence as attackers are innovating through new business models or technologies which the former find hard to adopt in the beginning. As these business models or technologies mature over time, they prove to be superior and replace traditional ways of serving the market (e.g. Bower & Christensen, 1995).

With such high stakes at risk, a significant research stream was dedicated to identify, understand, and exploit situations for new entrants that have potential to pose a significant threat and maximize their chances to replace the incumbents (Christensen & Rosenbloom, 1995). On the other hand, extensive work was conducted to understand and develop strategies for helping established players successfully defend their position (Charitou & Markides, 2003).

However, while most of the academic research had traditionally focused on *the battlefield, where the bullets are being fired,* trying to find better ways to attack or to defend, an equally important role in this confrontation, is left out, namely, the role of the facilitator. Which, in this context, seems to be played by industry platforms. Amazon Web Services, and other similar industry platforms leaders, allow external autonomous agents to innovate, but no specific research efforts have been made to improve and facilitate their emergence, especially in the context of disruptive innovations where the scale and impact are dramatic. One reason for this research gap is the incipient stage of existing research about how industry platform facilitate disruptive innovation. More fundamentally, despite its growing importance, our understanding of the concept of industry platforms is still in a very early stage (Cusumano, 2010; Gawer, 2014).

Consequently, the focus of this paper will weld existing knowledge of technological platforms and disruptive innovation theory by improving our understanding regarding industry platforms' facilitator role in the emergence of disruptive innovations.

1.2 Statement of Research

To address the research gap, this paper introduces the notion of *industry platforms as facilitators for disruptive innovations*. The idea here is that the continuous process of disruption should not be considered merely as a two players game, between the disrupter and *disruptee* that needs to defend. With the rise of the platform business model: player three has just entered the game in the disruptive innovation process, by introducing the role of the facilitator.

Furthermore, this research indicates that instead of following the "disrupt or be disrupted" mantra, a company can choose a third position and provide a system that brings together a set of common technological components to make it easier for organizations to build solutions for disrupting industries, or to defend their incumbent positions.

However, this does not necessarily imply that being a powerful platform leader makes a company immune to being disrupted (Gawer & Cusumano, 2013). While a platform leader still needs to pay attention and look for signs of its own disruption, this paper is arguing that, in the same time, it can facilitate the emergence of companies that bring disruptive innovations to other industries.

The facilitator position offers interesting perspectives, as it does not seem the share the high risks associated to being a disrupter. With lot of things that can go wrong unless pursued correctly, not all disruptive innovations succeed, keeping the risk rate high for adopting this strategy. In addition, the facilitator position cannot be associated with the difficulties that an incumbent is facing when confronted with disruptive innovation. Christensen's dedicates a lot of space to this phenomenon in his book *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. His work elaborates on how established organizations are puzzled about investing resources in sustaining innovation or disruptive innovation, when is the best timing to adopt disruptive innovation, and even if they decide to adopt disruptive innovation, which one should be chosen (Christensen, 1997). Making it clear that being an established player confronted with disruptive innovation is not a comfortable position for a company to find itself in. Given the context, this paper argues that there is a third position that a company can adopt in the disruptive innovation game, and which, despite its attractiveness, the current knowledge does not allow companies to confidently and consciously undertake it.

Consequently, the question to be answered in this research is:

RQ: *How do industry platforms facilitate disruptive innovation?*

Research question has four major components that need to be clearly defined:

1. *industry platforms* – we align with Gawer and Cusumano (2014, 2003) definition of industry platforms.
2. *disruptive innovation* – we align with Christensen (1997) definition of disruptive innovation.
3. *facilitating disruptive innovation* – the concept of *facilitation* inherently means removing barriers or providing favorable conditions aimed to ease the circumstances surrounding the emergence stage of an entity or a process. In the current context the characteristics of disruptive innovations will be extracted from literature and analyzed for identifying what barriers need to be removed or what supportive conditions need to amplified.

Subsequently, a theoretical framework, that brings together knowledge on industry platforms and disruption innovation theory is introduced with focus on industry platforms' role as facilitators for emerging disruptive innovations. The empirical context chosen to study this phenomenon and answer our research question is the emerging Internet of Things (IoT) paradigm. According to which many of the objects that we find in our environment at the moment, will be connected to the internet in one form or another (Gubbi, Buyya, Marusic, & Palaniswamia, 2013). The assumption is that the Internet of Things represents a major technological change (i.e. a paradigm shift) that has the potential to lead to emerging disruptive innovations in different industries. Therefore, industry platforms built to support IoT companies have the potential to facilitate disruptive innovations.

This work differs from previously conducted research as it introduces a new perspective over connecting existing literature on industry platforms and disruptive innovation. The suggested angle of study is the theoretical possibility that industry platforms can facilitate the emergence of disruptive innovations. The structure of this thesis is as follows: Chapter 2 gives a comprehensive theoretic background of the two major concepts employed in this research, namely, industry platforms and disruptive innovation, as well as the work done so far to connect these two research streams. Chapter 3 describes the empirical context and elaborates on the research design and methodology. Next, the data analysis, empirical results, and discussion are elaborated in Chapter 4. Conclusions are drawn in Chapter 5, along with contributions, limitations, and indications for future research.

Chapter 2. Theoretical background

In order to capture and understand the facilitator role of platforms in emergence of companies which challenge industries' established rules, a clear view on the concept of "platform" is required as well as understanding differences between different types of platforms. Secondly, a firm understanding on the type of innovation that Spotify, Netflix, or Airbnb brought to their markets is required.

Amazon Web Services is often referred to as being a platform – but, what exactly is a *platform*? The answers seem to vary considerably based on the context in which the term is being used. In the research domain of business economics, the evolution of platform thinking can be traced back in the 1990s when the concept *product platform* was first introduced.

The *product platform* term was used to describe how companies can achieve cost savings and benefit from adopting an in-house modular architecture for their product development process (Cusumano, 2010). In addition, a product platform allowed companies to increase the efficiency rate for designing and creating derivative products that share a common structure (Gawer & Cusumano, 2013). As a result, the role of a product platform was to serve as a foundation around which a company can develop a series of related products by reusing common components (Cusumano, 2010).

According to Parker and Van Alstyne (2012), platforms *require a non-traditional business model and a different way of working.* Furthermore, platforms do not have standard linear supply chains, instead, they are ecosystems with many cross dependencies (Parker & Van Alstyne, 2012).

2.1 Industry platforms

Later on, researchers observing the evolution of technology and rise of the Internet, derived the concept of *industry platform* (Gawer & Cusumano, 2002). Similar to an in-house product platform, an industry platform offers a common base (often technological) that an organization can reuse in different product variations (Cusumano, 2010). However, the parts of an industry platform are not exclusively provided by a single organization nor is the usage kept in-house. Instead, due to increased scale and impact, industry platforms' technological components are likely to be added by different external autonomous agents called *complementors* (Gawer & Cusumano, 2013). For example, Microsoft Windows and the personal computer engaged multiple companies to work together for providing industry wide platforms for information technology (Cusumano, 2010).

Refining the understanding on industry platform, researchers revealed the constitutive parts of an industry platform as following: the platform leader (organizations that lead industry wide innovation) and external complementors (companies that innovate on top of the platform and expand the platform's value) (Cusumano & Gawer, 2003). In addition, an industry platform provides little to no value to the end consumers without the complementary products or services (Cusumano, 2010). The industry platform concept is illustrated in Figure 1.

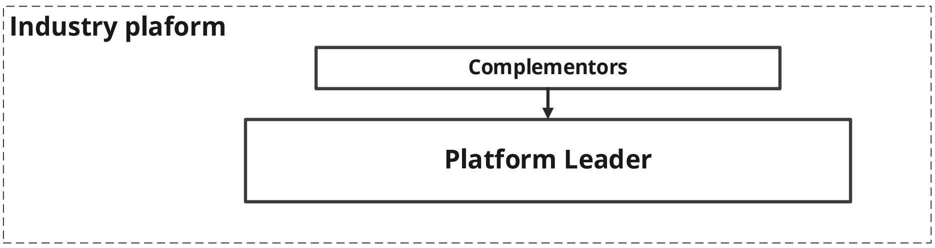

Figure 1 - Industry platform concept developed by Gawer and Cusumano (2002)

Furthermore, two recent research streams added more dimensions to our understanding of industry platforms by considering two different approach angles.

The economic perspective, focused on platform competition, views platforms as multi-sided markets (Hagiu & Wright, 2015; Hagiu, 2006; Harles, Ean, Rochet, & Tirole, 2001; Rochet, 2016). In addition, two-sided network effects are an important component of multisided platforms. Two-sided network effects are used to analyze and explain strategic pricing behavior and product design decisions in two-sided markets (Parker & Van Alstyne, 2005, 2012). Furthermore, extensive work has been conducted on identifying challenges and working strategies for multisided platforms (Eisenmann, Parker, & Alstyne, 2006; Hagiu, 2014; Muzellec, Ronteau, & Lambkin, 2012). However, following a multi-sided platform strategy is not a generic answer for every company's strategic questions and the multi-sided platform model should not be considered inherently superior to traditional models (Hagiu & Wright, 2013). Although it may seem very attractive, research has proved that it can be often a recipe for failure, making a seemly secure business susceptible to a disrupter from either end (Hagiu & Wright, 2013). Therefore, managers should not blindly adopt the multisided-platform model without any considerations for their competitive landscape (Hagiu & Wright, 2013).

Secondly, the engineering design perspective, concerned with platform innovation, views platforms as technological architectures (Baldwin & Woodard, 2008; Chesbrough, 2003; Hatchuel et al., 2010). This research stream established that platforms systems are evolvable due to a combination of stability and variety made possible by their "*stable, yet versatile*" interfaces (Baldwin & Woodard, 2008).

As a more holistic view on the technological platform concept was needed, the two theoretical perspectives were integrated into one comprehensive framework that refers to platforms as evolving organizations, and distinguishes between three main different categories: internal platforms, supply chain platforms, and industry platforms (Gawer, 2014). This integrative framework states that internal platforms are used exclusively within one firm and governed by internal managerial authority, while a supply chain platform is shared by partners within a supply chain organizational structure having the coordination mechanisms enforced by contractual relationships. According to the same framework, industry platforms are seen as operating at ecosystem level, and having specific ecosystem governance mechanisms.

Another criterion used by the framework to differentiate types of platforms is given by the access that platforms have to innovative capabilities, or the degree of which external agents, or complementors can innovate on top of the platform. For internal platforms (e.g. Black and Decker), no external agents are allowed to access the platform, constraining the innovation capabilities to the firm's own abilities. In the case of supply chain platforms, the platform's interfaces are shared exclusively with the company's supply chain partners (e.g. Renault–Nissan, Boeing), limiting the platform's innovation capabilities.

In contrast, industry platforms offer potentially unlimited external innovative capabilities. Amazon Web Services platform provided for companies like Spotify, Netflix, and Airbnb, an option to reimagine, challenge traditional rules, and serve any potential market. Therefore, the first point of interest for this research is represented by industry platforms and their ability to allow external agents to innovate without restrictions. The main differences between the three types of platforms are centralized in the organizational continuum of technological platforms (Gawer, 2014) presented in Figure 2.

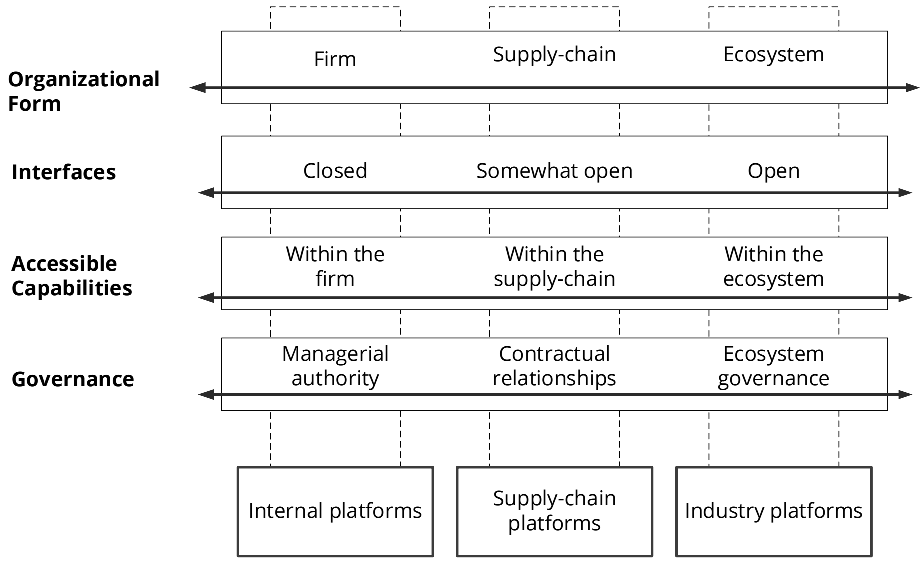

Figure 2 – Adaption after the organizational continuum of technological platforms (Gawer, 2014)

However, we are still in the early stages of understanding how common and important industry platforms really are (Cusumano, 2010).

2.2 Disruptive Innovation Theory

The ability to freely innovate on top of the platform represents only half of the issue that this paper aims to address, leaving one important component uncovered, namely, the type of innovation that is created in this process. As the term *innovation* has a broad meaning, researchers offered a framework for defining innovation, distinguishing between four fundamental types: incremental, modular, architectural, and radical (Henderson & Clark, 1990). The four types of innovation are illustrated in Figure 3.

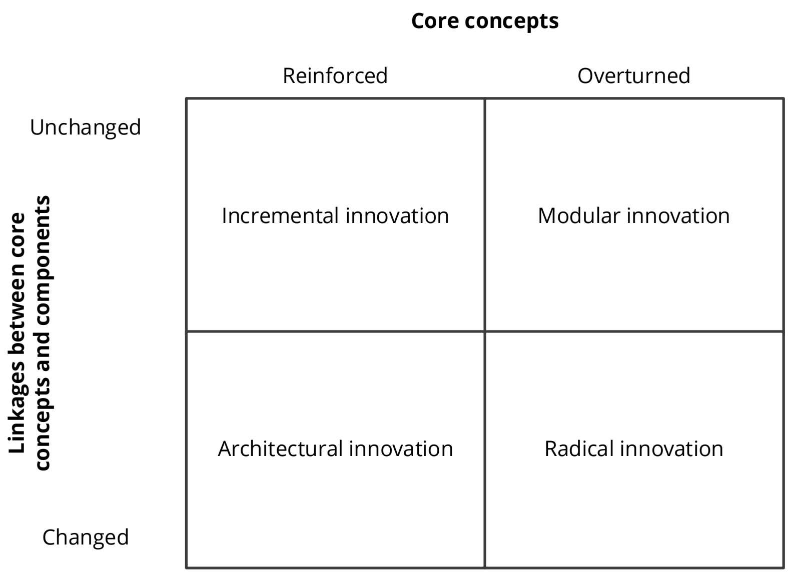

Figure 3 - A framework for defining innovation (Henderson & Clark, 1990)

According to the work conducted by Henderson and Clark (1990), radical and incremental innovation are the extreme points of their resulting framework. Furthermore, they acknowledge that radical innovation imposes a new dominant design and a new set of core design concepts, while incremental innovation only enhances and makes advances on an already established design. Moreover, in defining incremental innovation, they agree that *improvement occurs in individual components, but the underlying code design concepts, and the links between them, remain the same* (Henderson & Clark, 1990). When referring to the last two types of innovation, Henderson and Clark (1990) set the boundaries for modular innovation as only changing the relationships between design concepts of a technology. Lastly, architectural innovation changes the core design concepts of a technology (Henderson & Clark, 1990).

Later on, our understanding of innovation was expanded with the addition of two more dimensions, namely, the attributes valued by customers for assessing product performance and the time dimension to differentiate between sustaining and disruptive technological innovations (Bower & Christensen, 1995; Christensen, 1993, 1997). This new emerging theoretical concept, named *disruptive innovation,* received a lot of attention from academics which expanded and refined its definition. Disruptive innovation has a series of characteristics which clearly sets it apart from the types of innovations identified by Henderson and Clark (1990). Disruptive innovation characteristics with respect to (Christensen, Verlinden, & Westerman, 2002) are presented in Table 1.

Table 1 - The set of attributes which defines disruptive innovation (Christensen et al., 2002).

Disruptive innovation characteristics	
1.	In the beginning, the available functionality is insufficient to meet customer needs in mainstream tiers of the market
2.	The functionality provided by incumbents over shoots what customers in lower tiers of the market can utilize and are willing to pay for
3.	The basis of competition in those tiers of the market that are over-served in functionality changes. Speed to market, and the ability to conveniently customize features and functions become competitively important
4.	Product architectures facilitate competition on new dimensions
5.	In those tiers of the market in which overshooting have occurred, the industry tends to disintegrate; existing incumbents are being replaced
6.	Because the pace of technological progress proceeds faster than the ability of customers in given tiers of the market to absorb it, the sequence of events in steps 1–5 above recurs, in each progressively more demanding tier of the market

Later on, Christensen and Raynor (2003) distinguished between two types of disruptive innovations, namely, low-end disruptions and new-market disruptions. Low-end disruptions are directed at overserved and least profitable customers at the lower end of the market. This type of disruption does not create new markets, instead, it concentrates on creating and profiting from low-cost business models that are positioned to capture the least attractive of the existing firm's customers (Christensen, Johnson, & Rigby, 2002; Christensen & Raynor, 2003).

2.3 Platforms and disruption innovation theory

Our literature review chapter cannot be complete without considering prior work which connected platform research stream with the disruptive innovation research stream. Previous efforts to materialize this connection focused on two main directions.

Firstly, some studies tried to include platform thinking in evaluating incumbent performance. Their focus was on how established companies are able to keep their dominant positions with respect to emerging disruptive innovations (Ansari & Krop, 2012; Brown, Hendry, & Harborne, 2007; Rodrigues, Chimenti, Nogueira, Hupsel, & Repsold, 2014).

Secondly, the research conducted focused on identifying successful strategies for disrupting existing incumbents in different industries involving platform-based business models (Kenagy & Christensen, 2002; Sapsed, Grantham, & DeFillippi, 2007; Soleimani & Zenios, 2011; Walsh, 2004).

However, despite all the great contributions made by previous research, there is still little known about how industry platforms facilitate disruptive change – in line with Christensen (1997, 1995) definition of the term. And yet, if research could expose more about this phenomenon, it would provide a great value for platform-based companies and for platform external innovators as well. The current research suggests a unique approach angle. This study aims to merge platform thinking and disruptive innovation research streams by assessing the theoretical that a certain type of platforms, namely, industry platforms, can play an important role in facilitating emerging disruptive innovations.

Chapter 3. Empirical study

3.1 Empirical Context

Technological platforms, at industry level, are steadily and confidently becoming the dominant business model of the 21 century (Hoelck & Ballon, 2015). It provides no surprise that the value of industry-led technological platform concept and its applicability start to get attention of researchers from very diverse fields, stretching from neuroscience to connected cars and even governmental policies that concern whole national economies.

In the neuroscience field, technological platforms could play a key role particularly in tasks associated with collecting, analyzing, and sharing very large datasets, leading the effort to reduce costs and increase efficiency (Sandrini, 2015). In the same time, but concerning an entirely different sector, Audi Connect, BMW ConnectedDrive, and Mercedes Connect Me technological platforms are used to boost industrywide innovation (Mikusz, Jud, & Schäfer, 2015). Furthermore, a study from 2013 was conducted to understand and learn from Russia's experience in creating technology platforms for solving the problems of supporting innovation in key sectors of the economy. The study concluded that, in the near future, technology platforms will completely shape Russia's domestic national innovation system, as well as its organizational and investment mechanisms (Zlyvko, 2013).

These recent studies acknowledge and draw attention to the increasing incidence and impact of technological platforms on industry level innovation. Focusing on very specific parts of this wider theoretical concept, this paper is aiming to research industry platforms' facilitator role in the arise of a particular type of innovation, namely, disruptive innovation.

The opportunity to study this theoretical possibility is provided by an emerging technological paradigm shift that has the potential to impact almost every industry, and will force organizations to rethink how entire markets are being served. The researchers identify this novel technological paradigm swift using the phrase *Internet of Things.* Furthermore, this novel paradigm provides fertile ground for technological platforms to emerge and has the demonstrated ability to introduce and support disruptive innovations. These two components make it the optimal empirical context for conducting the current study. Next, a clear definition of this concept must be first determined, before it can serve as an empirical component for the current study.

3.2.1. Internet of Things (IoT) definition

The phrase *Internet of Things* came to life in 1999. The circumstances of this event are both intriguing and thought-provoking, as the term was not introduced by academic scholars as a result of an extensive and comprehensive empirical study. Instead, *Internet of Things* was the title of an internal presentation that Kevin Ashton, back then an assistant brand manager at Procter & Gamble (P&G), gave to executives regarding the usage of Radio-frequency identification technology (RFID) to improve P&G's supply chain (Ashton, 2009).

However, despite non-academic circumstances surrounding its birth, this theoretical term's popularity exploded as it was adopted by researchers and business community alike. A simple search on Google Scholar, on the exact phrase "Internet of Things" will return more than 90,000 scientific papers and books on this subject. In the past years, the concept was rigorously defined (Fleisch, 2010), explored in depth (Atzori, Iera, & Morabito, 2010), and enriched with new viewpoints and future directions for development (Gubbi et al., 2013). Making it today one of the most attractive and impactful research areas for future work, especially when converged with other synergistic research streams such as *Big Data* (Alberti, Reis, Righi, Mu, & Chang, 2015).

This paper aligns with research that coins *Internet of Things* (IoT) as a novel technological paradigm which argues that objects – such as Radio-Frequency IDentification (RFID) tags, sensors, actuators, mobile phones, etc. – using unique addressing schemes and modern wireless telecommunication technology, are able to interact with each other and cooperate to reach common goals (Atzori et al., 2010). It is worth mentioning another theoretical concept that emerged in parallel with *Internet of Things* called *spime*, which enhances our understanding of IoT term. A *spime* is defined as a manufactured object that is uniquely identifiable, sustainable, enhanceable and which can be precisely tracked through its entire lifespan, being user-alterable at any moment, while providing an extensive and rich informational support (Sterling, 2005).

Other attention-grabbing and extensive studied components of the IoT concept are its high scalability and large impact. Previous research established that for accomplishing a complete IoT vision, efficient and scalable computing and storage technological systems are essential (Gubbi et al., 2013). Furthermore, as improving the connection between human factor and objects will generate a huge quantity of data, for managing this information, researchers suggested that technological systems' scalability component is a key requirement for supporting the current growth of IoT (Gomes, da Rosa Righi, & da Costa, 2014).

Secondly, in January 2016 in a press release referring to the impact of IoT, Gartner argued that by 2020, more than half of major new business processes and systems will include some elements of the Internet of Things vision. Moreover, McKinsey & Company published in July 2015, in Fortune magazine, the results of a research study which concluded that IoT total economic impact could be as high as $3.9 trillion to $11.1 trillion per year in 2025. In addition, GSM Association, representing the interests of nearly 800 mobile operators worldwide, conducted its own study on IoT's potential impact. The study revealed that, in the next years, IoT will expand and evolve making it imperative for industry actors to cooperate on interoperability in order to avoid fragmentation, maximize its potential, and ensure that different devices and services are able to communicate with each other seamlessly (Bouverot, 2015).

While a certain degree of hype around Internet of Things is obvious (Haller, 2010), there are a large number of empirical studies that offer solid ground for stating that the IoT has potential to severely impact and transform the current business environment (Harris, Wang, & Wang, 2015; Uckelmann, Harrison, & Michahelles, 2011).

As a result, a significant number of large organizations are already building solutions for implementing Internet of Things visionary future. Intel, working with its ecosystem partners, defined a system architecture specification (SAS) for connecting almost any type of device to cloud, whether it has native Internet connectivity or not. Furthermore, IBM Watson technology platform extends the power of cognitive computing to the Internet of Things. Similarly, Microsoft Azure IoT platform helps connecting devices, analyze previously-untapped data, and integrate business systems. In addition, Google Brillo project introduces an Android-based embedded OS that brings the simplicity and speed of mobile software development to IoT hardware to make it cost-effective to build a secure smart device, and to keep it updated over time.

Intel, IBM, Microsoft, and Google they all refer to their IoT technological systems as *platforms*. Furthermore, research conducted identifies them as *technological industry platforms*. (Gawer & Cusumano, 2013; Gawer & Henderson, 2007; Gawer & Phillips, 2013). Moreover, extensive work has been conducted on connecting technological platforms with Internet of Things (O Mazhelis & Tyrvainen, 2014; Oleksiy Mazhelis, Luoma, & Warma, 2012; Mineraud, Mazhelis, Su, & Tarkoma, 2015; Westerlund, Leminen, & Rajahonka, 2014). Furthermore, Internet of Things has been acknowledged as having potential to generate disruptive innovations in line with Christensen's definition of the term (Ebersold & Hartford, 2015). Additionally, significant work strengthens the idea that Internet of Things offers fertile ground for developing disruptive innovations (Ma & Zhang, 2011; Milito, 2014).

Therefore, the empirical setting offered by IoT is highly appealing for studying industry platforms' facilitator role in the emergence of disruptive innovations.

3.2 Research Design

The methodological fit, referring to internal consistency among the defined research question, prior work, research design, and theoretical contribution, is increasing in importance in the field of management research (Edmondson & Mcmanus, 2007; Scadura & Williams, 2000). Therefore, special attention was given to the research design process. For understanding the facilitator role of industry platform in the emergence of disruptive innovation, this paper employs an inductive approach, namely, the case study research methodology.

Case study is an inductive research strategy which focuses on understanding the dynamics present within single settings (Eisenhardt, 1989; Yin, 1994). Case studies can involve either single or multiple cases, and numerous levels of analysis and typically combine data collection methods such as archives, interviews, questionnaires, and observations (Eisenhardt, 1989). Case studies can be used to generate theory and can rely only on qualitative data for reaching results (Eisenhardt, 1989).

This research will employ a complete roadmap for executing this type of research. This framework is summarized in Table 2.

Table 2 - Process of Building Theory from Case Study Research (Eisenhardt, 1989; Yin, 1994)

Step	**Activity**	**Reason**
Getting Started	Definition of research question	Focuses efforts
	Possibly a priori constructs	Provides better grounding of construct measures
	Neither theory nor hypotheses	Retains theoretical flexibility
Selecting Cases	Specified population	Constrains extraneous variation and sharpens external validity
	Theoretical, not random, sampling	Focuses efforts on theoretically useful cases-i.e., those that replicate or extend theory by filling conceptual categories
Crafting Instruments and Protocols	Multiple data collection methods	Strengthens grounding of theory by triangulation of evidence
	Qualitative and quantitative data combined	Synergistic view of evidence
	Multiple investigators	Fosters divergent perspectives and strengthens grounding
Entering Field	Overlap data collection and analysis, including field notes	Speeds analyses and reveals helpful adjustments to data collection

	Flexible and opportunistic data collection methods	Allows investigators to take advantage of emergent themes and unique case features
Analyzing Data	Within-case analysis	Gains familiarity with data and preliminary theory generation
	Cross-case pattern search using divergent techniques	Forces investigators to look beyond initial impressions and see evidence thru multiple lenses
Shaping Hypotheses	Iterative tabulation of evidence for each construct	Sharpens construct definition, validity, and measurability
	Replication, not sampling, logic across cases	Confirms, extends, and sharpens theory
	Search evidence for "why" behind relationships	Builds Internal validity
Enfolding Literature	Comparison with conflicting literature	Builds internal validity, raises theoretical level, and sharpens construct definitions
	Comparison with similar literature	Sharpens generalizability, improves construct definition, and raises theoretical level
Reaching Closure	Theoretical saturation when possible	Ends process when marginal improvement becomes small

Case study inductive research strategy is suitable for times when little is known about a phenomenon, current perspectives seem inadequate because they have little empirical substantiation, or they conflict with each other or common sense (Eisenhardt, 1989; Yin, 1994). Or, sometimes, serendipitous findings in a theory-testing study suggest the need for a new perspective (Eisenhardt, 1989). In these situations, theory building from case study re- search is particularly appropriate because theory building from case studies does not rely on previous literature or prior empirical evidence (Eisenhardt, 1989).

Very little is known about the role of industry platforms in facilitating the emergence of disruptive innovations: current perspectives seem inadequate because they have little (or none) empirical evidence. In this particular case, theory building from case study research is appropriate because theory building from case studies does not rely on previous literature or prior empirical evidence. An elaboration on the steps described in the framework proposed by Eisenhardt (1989), and employed in the current research is presented in Table 3.

Table 3 – Describing the process of building theory from case study research developed by Eisenhardt (1989).

Step	Description
Getting Started	**Definition of research question**: • without it, researcher may become overwhelmed by the data. • it permits more accurate measurements **Possibly a priori constructs**: • early identification of the research question and possible constructs is helpful • the research question may shift during the research • no initial construct is guaranteed a place in the resultant theory **Neither theory nor hypotheses**: • theory-building research is begun as close as possible to the ideal of no theory under consideration and no hypotheses to test • preordained theoretical perspectives or propositions may limit the findings
Selecting Cases	**Specified population**: • crucial concept, as it defines the set of entities from which the research sample will be extracted **Theoretical, not random, sampling**: • this step is uncommon when building theory from case studies • random selection is neither necessary, nor even preferable in this context • theoretical case sampling is used to replicate or extend the emergent theory
Crafting Instruments and Protocols	**Multiple data collection methods**: • multiple data collection methods are used, such as interviews, observations, archival sources, and even quantitative. **Qualitative and quantitative data combined:** • can involve qualitative data only, quantitative only, or both. **Multiple investigators**: • multiple investigators enhance the confidence and creative of the study • one strategy is employing multiple investigators to visit sites in teams • another strategy is to give individuals on the team unique roles • another tactic is to create multiple research teams, with teams being assigned to cover some case sites, but not others
Entering Field	**Overlap data collection and analysis, including field notes:** • implies frequent overlap of data analysis with data collection **Flexible and opportunistic data collection methods**:

- overlapping data analysis with data collection gives a head start in analysis
- overlapping data analysis with data collection allows flexible data collection
- gives the autonomy to make adjustments during the data collection stage
- the adjustments can be the addition of cases to validate and verify particular theoretical concepts which emerge

Analyzing Data

Within-case analysis:
- it is the heart of building theory from case studies
- it is both the most difficult and the least codified part of the process
- the importance of within-case analysis is driven by a staggering volume of data
- typically involves detailed case study write-ups for each site
- become intimately familiar with each case as a stand-alone entity
- allows unique patterns of each case to emerge before investigators push to generalize patterns across cases

Cross-case pattern search using divergent techniques:
- it is coupled with within-case analysis
- the key to good cross-case analysis is looking at data in many divergent ways
- it is forces investigators to go beyond initial impressions

Shaping Hypotheses

Iterative tabulation of evidence for each construct:
- involves measuring constructs and verifying relationships
- compares systematically the emergent frame with the evidence from each case

Replication, not sampling, logic across cases:
- one step in shaping hypotheses is the sharpening of constructs
- refines the definition of the construct
- builds evidence which measures the construct in each case
- uses constant comparison between data and constructs so that accumulating evidence from diverse sources converges on a single, well defined construct

Search evidence for "why" behind relationships:
- verifies that emergent relationships fit with the evidence in each case
- a relationship may be confirmed by the case evidence or may be revised, disconfirmed, or thrown out for insufficient evidence
- qualitative data is particularly useful for understanding why or why not emergent relationships hold

Enfolding Literature

Comparison with conflicting literature:
- ignoring conflicting literature decreases the confidence in the findings
- conflicting literature represents an opportunity to adopt a more creative, frame-breaking mode of thinking

Comparison with similar literature:
- it ties together underlying similarities in phenomena normally not associated with each other
- the result is often a theory with stronger internal validity, wider generalizability, and higher conceptual level.

Reaching Closure

Theoretical saturation when possible:
- researchers should stop adding cases when theoretical saturation is reached
- the iteration process stops when the incremental improvement to theory is minimal

3.2.1. Case selection

A first important step in the data analysis process was to initially define the research question. As without a research question, at least in broad terms, it is easy to become overwhelmed by the volume of data (Eisenhardt, 1989). However, although early identification of the research question and possible constructs is useful, it is equally important to understand that the research question may shift during the research (Eisenhardt, 1989; Yin, 1994).

Next, the research process continued with defining the population from which the cases will be selected to participate in the study. When defining the population two major aspects were considered. Firstly, the companies must operate according to a technological platform-based business model. Furthermore, they were classified as *technological platforms* in line with Gawer's (2014) technological platforms integrative framework. Secondly, they must conduct business in one of the identified IoT related areas. These specific areas could be, but not necessarily limited to, network for IoT, sensors for collecting data, infrastructure for assuring the data flow. processing and analysis (Atzori et al., 2010).

After the study population was defined, the list of potential participants contained more than thirty platform-based organizations conducting business in the IoT area. However, due to resource constraints a smaller sample set needed to be selected for further analysis. Eisenhardt (1989) warns that in case study research random selection is neither necessary, nor preferable, instead, theoretical sampling should be used. Consequently, theoretical, not random, sampling was necessary to draft the sample.

The additional theoretical criteria that was used to separate our sample from the rest of the population was provided by Gawer's (2014) work on defining the concept of *industry platforms.* According to this work, industry platforms share a set of characteristics which set them apart from other types of platforms, such as internal platforms, or supply chain platforms. As this paper focusses exclusively on industry platforms, it is important to use existing theory to ensure that the selected companies are a real world representation of the theoretical notions considered. According to Gawer (2014) the industry platform concept is composed of a platform leader and external complementors which can use the platform's open interfaces to innovate without restrictions.

The theoretical sampling process applied to our identified population resulted in the selection of four companies which were accepted to take part in our case study research. This number is considered to pass Eisenhardt's (1989) rigors regarding develop theory form case studies. The companies chose to remain unidentified, therefore, any sensitive information was left out, and the study was conducted assuring the complete anonymity of the participants. However, the research process and the results of the current study were not affected in any form by this step. Table 4 offers a description of each of the four selected companies.

Table 4 – Four companies were selected to take part in our case study research

Company	Headquarters	Size	Year founded
Company A - Industry platform for capturing, processing, visualizing and controlling enormous amounts of Internet of Things data in real-time	Finland	51-200 employees	2001
Company B - Internet of Things platform for connecting devices with proximity awareness to the cloud	Poland	51-200 employees	2013
Company C - Cloud-based data analytics platform for the Internet of Things	United States	1-10 employees	2011
Company D - A business unit of a large multinational set up to develop solutions under the Internet of Things context	The Netherlands	10,001+ employees*	2014**

* This is the total number of employees of the large organization and not of only the Internet of Things dedicated business group.
** This represents the year the business group focused on internet of things was founded within the larger organization.

Company A technological platform provides new ways to capture, process, visualize and control enormous amounts of data in real-time, which can help businesses in various industries improve what they do, and how they do it. Company A service is a next generation SaaS (Software as a Service) suite that enables customers to gather system, network and cloud measurement data and arrange the information in a context that is relevant to businesses and their customers. Company A service displays the data in an easily understandable, concise and relevant way, real-time, and historical. A unified view of status and performance can be seen at a glance, not limited only to infrastructure but also applications and services.

Company B helps build technological proximity solutions. To properly understand the "proximity technology", a clear view on the term needs to be drafted, for that, we are using the data collected from our case study. Company B uses *beacons* to deploy its proprietary proximity solution. A beacon is a fundamentally a very simple piece of hardware. They are small, generally very short ranged, battery power devices that broadcast a unique signal at regular intervals, over Bluetooth radio. Because Bluetooth is very short ranged it rarely detects a signal beyond 30-40 meters - this is not a flaw, it is a feature. When the signal is detected the signal that means that a person or an object is in proximity of wherever the device is. Proximity is valuable because it can identify where the device is travelling by seeing what Bluetooth beacons (these are stationary) detect. And it is a variety of ways in which proximity data can be used, and of course, to some extent this may seem very similar to what GPS does, except that GPS is an actual physical location data and GPS requires a lot of battery power to work. The proximity information is only valuable only if the location where the beacon is broadcasting is known. In generally, beacons can be installed in a fixed location and their signal is captured by a beacon reader device that is changing its location freely. In some cases, the beacon reader devices are installed in a fixed location and the beacons move around. In one way or the other, a fixed reference point is needed for the proximity solution to work. However, this enablement of leveraging proximity technology also comes with a restriction, namely, solutions that do not use this technology are not a fit for the platform, therefore, should not be built on top of Company B platform.

Company C is cloud-based data analytics platform for the Internet of Things that provides real-time decision making capabilities to users and devices. It has been built with big-data tools to manage large amounts of devices and data streams with very high frequency sample rates. Also, company C data analytics platform was designed to allow IoT entrepreneurs and developers to start with small test projects and scale to capture millions of streams of data coming in from sensors, apps, and other fixed and mobile devices across the globe. Company C patented its data analytics platform component which gives immediate access to stream data, roll-up data, and up to 140 statistics per stream. It is designed as a horizontal platform to be used across all industries.

Finally, company D digital platform represents a new era in connected health care for both patients and providers, as healthcare continues to move outside the hospital walls, and into patients' homes and everyday lives. Company D platform, supported by salesforce.com, is an open, cloud-based platform, which collects, compiles and analyzes clinical and other data from multiple devices and sources. Health systems, care providers and individuals can access data on personal health, specific patient conditions and entire populations—so care can be more personalized and people more empowered in their own health, wellbeing and lifestyle. Connecting solutions from the hospital to the home, can enable a path to healthier living and wellbeing, throughout the health continuum.

3.2.2. Research instruments and protocols

In line with the inductive case study research strategy a qualitative data collection process was conducted. In this process, semi structured-interviews were used and, instead of a rigid structure, this flexibility allowed creating interviews around *industry platform* and *disruptive innovation* theoretical concepts. The researcher conducting the interviews was opportunistic with respect with collecting information. Furthermore, during the interviews, the researcher exploited on ad-hoc basis certain paths which he considered that may enrich the data collection process.

A special attention was given to the idea of collecting an even and balanced amount of data regarding both themes from each interview. Therefore, all interviews were split in half, firstly, questions were asked about industry platform, secondly, the interviewees were asked about disruptive innovation.

However, the exact boundaries and characteristics of *disruptive innovation* concept are still debated and scattered in many different perspectives. Despite the fact that the concept was introduced by Christensen in 1995 and it was continuously refined since then, it did not reach the required maturity to be used without confusion. In the HBR (Harvard Business Review) magazine edition issued in December 2015, Christensen published an article titled "*What Is Disruptive Innovation?*". In that article, he warned about the dangers of misusing the terminology around disruptive innovation.

The risk for our data collection process was that the interviewees may had a poor understanding of what disruptive innovation is - in Christensen sense of the term. In most of the cases, disruptive innovation gets easily mistaken with any radical innovation. Consequently, a special strategy was adopted to mitigate this risk. The interviewing strategy consisted in not asking direct questions about *disruptive innovation.* Instead, this concept was broken down into atomic parts on which misinterpretation cannot occur.

Furthermore, compulsory access to the highest level of management in the case study organizations was imposed by the nature of the theoretical concepts analyzed in this paper. These concepts are relevant at a company's strategic level. Therefore, all the interviewees taken into account in this study were required to have access to such a level in the company's organizational hierarchy.

Due to the fact that the companies are from different continents, interviews were held through the use of Skype. The timetable for the data collection process is presented in Table 5.

Table 5 - The timetable for the data collection processes

Company	Interviewees level in the company	Date of collection
Company A	C-level	November 2015
Company B	Senior management	December 2015
Company C	VP level	December 2015
Company D	Senior management	December 2015 - January 2016

Before entering the field, the data collection process was designed to be flexible and opportunistic. Furthermore, the data collection process was overlapped with the data analysis process. The length of the interviews was at least one hour, with some of them, exceeding one hour and twenty minutes.

Chapter 4. Empirical results

4.1 Data Analysis

Traditionally, theory can be developed by combining previous literature, experience, and common sense in analyzing data (Eisenhardt, 1989). Glaser and Strauss agree that development of a testable, reliable, and valid theory is conditioned by a close connection with empirical reality, but Perrow and Pfeffer, draw attention to the fact that the links between actual data and conclusions are often slender (Eisenhardt, 1989).

Therefore, a special attention was given in this thesis to the sub-processes that start with analyzing data and end with reaching results. According to the research methodology employed, the gap between data and conclusions has been filled by following a systematic process. The process of analyzing data and reaching conclusions from case study research is a highly iterative one. The process itself involves constant iteration backward and forward between data analysis, shaping hypothesis, and enfolding literature reaching closure when marginal improvement becomes insignificant. This process starts with the step of analyzing data, which is seen as the heart of building theory from case studies, but, at the same time, it is the most difficult and least transparent part of the process (Eisenhardt, 1989). In most of the cases, the difficulty lies with the question of how to code and interpret the transcripts once the interviews have been completed (Burnard, 1991).

Each interview from our four case studies was recorded in full, transcribed in full, and coded using a generic form of open-coding. The interviews transcripts are shown in Appendix A. In this document, for confidentiality reasons, interviewees remain anonymous. The interviews transcriptions were analyzed using a method of thematic content analysis. This method is particularly suitable for semi-structured interviews that have been recorded and transcribed in full (Burnard, 1991). More specifically, each of the semi-structured interviews were handled using the following methodical backbone:

1. Interview recordings were transcribed as literally as possible and each recording was listened to a second time and compared to what was transcribed in the first attempt – small issues were corrected in this step in order to improve quality of transcription.
2. Next, each transcript was coded using a generic form of open-coding, meaning that the categories were freely generated. The aim, here, was to produce a detailed and systematic recording of the themes and issues addressed in the interviews and to link the themes and interviews together under a reasonably comprehensive category system (Burnard, 1991).
3. For validation purposes a second, more experienced, researcher was asked to evaluate the coding. Emerging discrepancies were then discussed to reach consensus.

After the interviews were transcribed as literally as possible, they were thoroughly read and side notes were made concerning the two major themes of this research paper:

a. Platform thinking (first part of the interviews)
b. Disruptive innovation (second part of the interviews)

The purpose, here, was to become immersed in the data. This process of immersion was used to become more fully aware of the “outside world” of the respondent and to enter the other person’s “frame of reference” (Burnard, 1991).

Next, transcripts were read through again and as many codes as necessary were generated to label all aspects of the content of each interview. The issues that were not related to the themes of interest, namely, “Platform thinking” and “Disruptive innovation”, were intentionally left out. The categories were freely generated at this stage. As certain categories were occurring more than once, the emerging coding labels were, then, ranked based on the number of their appearances. Codes which appeared more than once were considered to be recurring themes.

Company A

#amazon_customers_building_their_own_platforms
#amazon_IoT_is_expensive
#paradigm_change
#fault_tolerance_platform
#modular_structure_platform

Company B

#proximity_relevant_for_many_industries
#serve_side_A
#proximity_technology_is_disruptive
#adding_value_beyond_hardware
#proximity_platform

Company C

#serve_side_A
#platform_simple_and_easy_to_use
#data_analytics
#side_A_can_build_solutions_for_any_industry
#software_interface_is_important

Company D

#analytics
#focus_on_healthcare_market
#preventive_medicine
#serve_side_B_directly
#Iot_platform_for_healthcare

Figure 4 – Showing the top five most occurring categories for each case

The complete list of interview codes ranked based on their occurrences can be found in Appendix B.

Next, the emergent list of categories was grouped together under higher-order concepts: in order to reduce the numbers of categories, similar labels were grouped into broader themes. Following a repetitive process, a new category catalog was developed and very similar headings were removed to refine and produce a final list. Interview transcripts were read again together with the final list of categories in order to establish the degree to which the categories cover all aspects of the interviews. Adjustments were made as necessary in line with the stage-by-stage method of analyzing qualitative interview data proposed by Burnard (1991).

Final list of broader themes (containing grouped categories) for each case:

Table 6 – Final list of broader themes for each case

Company A	**Company B**	**Company C**	**Company D**
modular structure	proximity technology	advanced backend	analytics
open platform	serve verticals directly	customers pull solutions	focus on healthcare
fault tolerant platform	proximity platform	analytics	fast deployment
linear scalability	analytics	fast deployment	platform for healthcare
service level agreement	hardware platform	platform security	multitenancy platform
multitenancy platform	software platform	simplicity	open platform
shift from fire and forget	open platform	easy to use	hardware agnostic
no external dependencies	platform complementors	serve different industries	preventive medicine
serve verticals directly	available across industries	platform complementors	serve verticals directly
continuously feeding data	proximity technology	software platform	special regulations
serve different industries	broadly applicable	open platform	agile

fast deployment platform	real time visualization	generic capabilities
data repository platform	scalability	real time flexible
data retrieval platform	serve verticals directly	complementors
data visualization platform	stay horizontal	platform reliability
disruption as a service	user experience is critical	artificial intelligence
platform complementors		modular structure
		platform security
		multi layered platform
		evolve from internal
		part of a bigger group

Following the completion of the interview coding process, the highly iterative process of systematically comparing the emergent theoretical constructs from cases with existing literature was undertaken. The main aim of this exercise is to constantly compare theory and data iterating toward generating theory which is tightly linked to the data.

4.2 Results

The first iteration started by analyzing the data. A first sub-step in the data analysis process was: analyzing within-case data in order to become intimately familiar with each case individually as a stand-alone entity (Eisenhardt, 1989). This step allowed unique patterns from each case to emerge before cross-case patterns were developed, accelerating also cross-case comparison (Eisenhardt, 1989). Next, within-case analysis was coupled with cross-case analysis in search for patterns in the data. However, it is worth pointing out that Eisenhardt warns about the danger of reaching premature and even false conclusions as a result of information-processing biases, and one way to avoid this is to look at the data in many divergent ways. The divergent tactic employed in this study is selecting categories or dimensions, and then looking for within-group similarities coupled with intergroup differences (Eisenhardt, 1989).

The researcher mindset used to approach the data analysis process was split according to the two major themes of this paper, namely, “platform thinking” and “disruptive innovation”. For clarity and simplicity in analyzing the data, at the beginning of first iteration the researcher mindset was only concerned with revealing insights about the first theme: “platform thinking”. It seemed naturally to start the analysis in this manner as the literature review chapter developed a theoretical backbone which first exposed the evolution of the industry platform concept. Subsequently, it recognized platforms' ability to enable reusability of components at industry level in order to facilitate disruptive innovations.

The constructs that emerged from data analysis in the first iteration of the data analysis steps are:

Table 7 – Theoretical constructs that emerged from the first iteration of the data analysis step

Company A Platform	**Company B Platform**	**Company C Platform**	**Company D Platform**
Platform allows solutions for multiple industries	Can serve any industry, broadly applicable	Serve customers from different industries	Platform for developing healthcare solutions
Modular, repository, retrieval and visualization platform	Proximity Technology	Advanced technological backend, and user interface	Advanced generic analytics

Some of the industry platforms considered in this study chose to allow companies to develop product offerings on top of their platform for addressing any industry. And without imposing any major technological restriction, this is the case of Company A and Company C.

Other industry platforms considered in this study are built around one particular technology, in the case of Company B, the proximity technology. And they allow companies to leverage this technological capability through their platform enabling them to develop solutions that can serve any industry.

Finally, in the case of Company D, the technology restriction is not present, instead, their platform seems to impose a constraint on the industry which the solutions built on top of the platform need to address. Their platform has a clear focus on healthcare, and will only accept solutions that serve the healthcare market.

To refine our findings, it can be observed that two dimensions emerged:

1. *technologies that the platform allows to be leveraged*

- The possible values for this dimension range from *generic* to *specific* (specific indicating that the platform offers for reusability one particular technology or technological component which has a more specific and narrow scope and applicability)

2. *industries that the platform allows to be served*
    - The possible values for this dimension range from *one* (indicating the focus of the platform on one particular industry) to *many* (indicating that the platform supports solutions on top of it ready to serve multiple different industries).

These two emerging concepts seem to introduce a new perspective to look at industry platforms and separate the four analyzed platform cases in three scenarios. Firstly, Company A and Company C seem to offer through their platform a very generic technological component that can be reused by external companies to build solutions that address any industry. Secondly, Company B allow companies to reuse a very specific technology, namely, proximity technology. But their platform permits companies to use proximity technology in order to create solutions for a broad range of industries. Thirdly, Company D is restricting their platform to serve the healthcare industry, while the technology offered for reusability through their platform is generic.

Next, an essential feature of theory building is comparison of the emergent concepts, theory, or hypotheses with the existing literature (Eisenhardt, 1989). Linking results to literature is particularly important in theory building research from case studies because the findings rely on a limited number of cases (Eisenhardt, 1989). Moreover, when comparing findings with existing literature it is important to consider both literature that supports the findings as well as literature that contradicts the findings (Eisenhardt, 1989). Considering and linking literature that conflicts with the findings strengthens the confidence in the results, while literature that discusses similar findings is important because it connects underlying similarities in theory normally not associated with each other (Eisenhardt, 1989).

The findings from the end of the first data analysis iteration are the two dimensions which allowed to distinguish between the four cases:

1. Two cases offer no explicit limits for industries that can be served and offer a generic technological component for reusability.

2. One case offers no limits for industries that can be served, but allows a particular technology to be reused through the platform (e.g. proximity technology).
3. Finally, the last case imposes a clear restriction regarding the target industry (e. g. healthcare) for solutions developed on top on the platform, however, the technological components offered for reusability are generic.

The dimensions which unlocked this perspective are: *technologies that the platform allows to be leveraged* and *industries that the platform allows to be served*.

The first attempt to confront this result with existing literature started by revealing the alignment with the work conducted on defining and shaping the concept of *industry platforms*. Firstly, it recognizes and strengthens the importance of two of the four levers of platform leadership identified by Gawer and Cusumano (2003 & 2008). Namely, *scope* and *product technology* platform levers. According to these concepts, platforms must decide about the extent of innovation the platform does internally and how much it encourages outsiders to do, as well as, the architecture, level of modularity, and degree of openness for platform interfaces (Cusumano & Gawer, 2003; Gawer & Cusumano, 2008). The result of the first data analysis iteration, which revealed the two dimensions, reinforces these theoretical concepts. In particular, one of these dimensions: “technologies that the platform allows to be leveraged”, offers a clear backing for at least two of the four levers and strategies of platform leadership identified and refined by Gawer and Cusumano (2003, 2008, 2010 & 2013).

Moreover, our finding shares consistent traits with certain attributes of the business model innovation patterns, applicable in the context of industry platforms. This set of business model patterns was identified after a study on the connected car sector (Mikusz et al., 2015). According to the study, there are five clusters of possible industry platforms business model innovations for the connected car sector:

Table 8 - Business model patterns for the connected car sector (Mikusz et al., 2015)

Composite Pattern / Cluster	**Business Model Pattern**
Complementary Solution	Add-On Cross-Selling Solution Provider
Digital Customization	Digitalization Layer Player Long Tail Mass Customization
Open Commerce	E-Commerce Open Business Model Revenue Sharing
Digital Lock-In	Freemium Lock-In Razor and Blade
Data Orchestrator	Leverage Customer Data Orchestrator Two-Sided Market

Our two dimensional view over industry platforms offers interesting theoretical intersections with the information presented in Table 8. Especially with the digital lock-in cluster of business models, where our technology focus dimension could, also, imply that an industry platform which is offering for reusability a specific technology will be more interested in a digital lock-in mechanism for its customers.

Other studies suggest that the more commoditized the solution offered by a given platform, the more open the platform must be (Parker & Van Alstyne, 2012). Our findings back this statement, revealing that platforms which make available generic technological components through their interfaces are indeed more open. They impose less restrictions for complementors to innovate by not limiting the target industries nor the technology used to develop solutions on top of the plat-form. However, there are platforms which decide to make their components more specific. For instance, a platform targeting the healthcare industry will not allow solutions aiming to serve agriculture industry to be built on it and will only attract complementors that can add value in the context provided by the healthcare industry. Similarly, the degree of genericity of technological components that are made available by platform interfaces can influence the complementors ability to innovate (e.g. a company that does not intend to use proximity technology will not build its solution on top of a platform which makes available proximity technology component to be used).

Furthermore, the ramifications of our finding reached the intensively researched area which revealed the emerging idea that industry architecture can play an important role in success or failure of industry platform strategies (Hatchuel et al., 2010; Parker & Van Alstyne, 2012; Tee & Gawer, 2009; Thomas, Autio, & Gann, 2014). The industry architecture concept focuses on the ways in which activities along the value chain get divided between industry participants, paying particular attention to interdependencies, and the ways in which firms attempt to shape the industry's division of labor (Tee & Gawer, 2009). The Figure 5 is showing the relation and interactions between the concepts of industry architecture and industry platform in a framework developed by Tee and Gawer (2009):

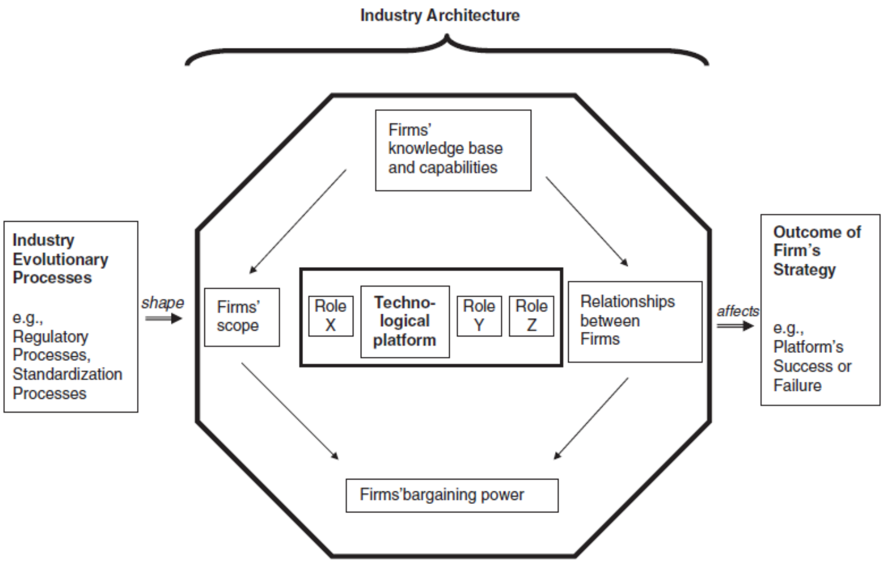

Figure 5 - Platform – industry architecture interaction framework (Tee & Gawer, 2009)

Therefore, the industry architecture seems to represent the larger context in which an industry platform operates. Our finding comes to build up on this work, as our result suggests that technological platforms may position themselves along the two dimensions deciding to focus on one industry, offer a specific technology for reusability or stay flat by offering generic technology and allowing any industry to be served. In this way, their platform can be connected in different ways to the existing industry architecture, and this action is influencing their success or failure.

Finally, our results from the first iteration are consistent with the findings from studies aimed to unify the existing theory on technological platforms into an integrative framework (Gawer, 2010, 2014). This work which aims to create a general theory of technological platforms, identified platforms as evolving organizations or meta-organizations, in which the platform's interfaces are not stable, and platform's constitutive agents, buyers or complementors, do not play a fixed role over time. Instead, this conceptualization recognizes that the roles played by the platform's constitutive agents can be multiple and evolve over time (Gawer, 2014). Figure 6 shows the dynamics of this relations:

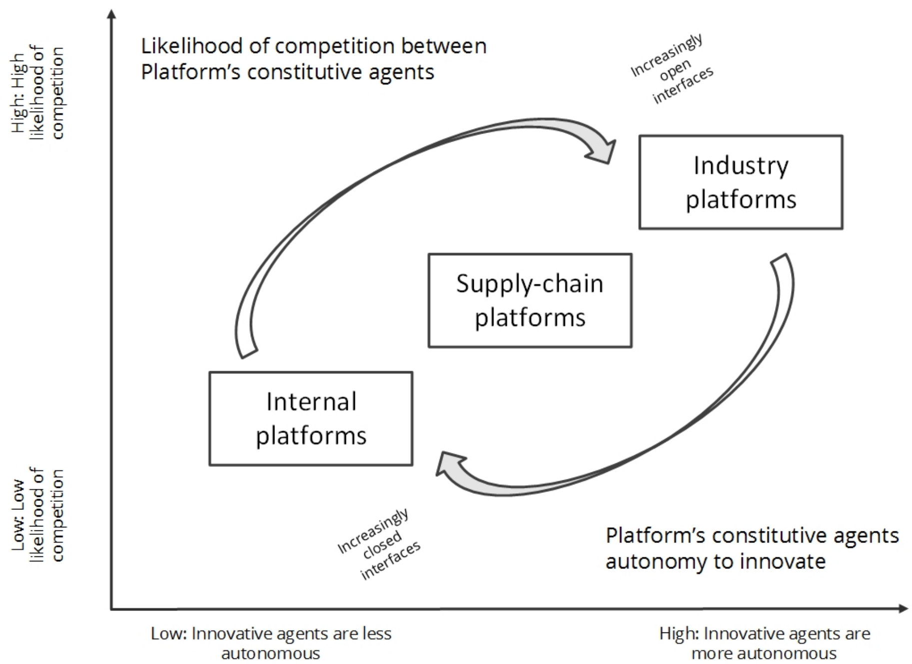

Figure 6 - Platform innovation and competition (Gawer, 2014)

Our two-dimensional perspective of industry platforms is aligned with the work conducted by Gawer (2010, 2014), in the sense that contributes to this theory of seeing platforms as organizations which find themselves in a state of constant change and continuous evolution. Although the work in this paper was not focused on the dynamics study area of industry platforms, our results, identified in the first iteration, still offer support for Gawer's integrative theory of technological platforms. Our two dimensions, namely, 1 - technologies that the platform allows to be leveraged and 2 - industries that the platform allows to be served, support the idea that platforms are constantly evolving organization which theoretically can change their focus and scope. At least in the direction of technology that they allowed to be reused through their platform and the industry's that can be served by solutions developed on top of the platform.

After the first iteration through data analysis is completed, a new iteration can start by going back to data and extract more information. The first iteration revealed the two dimensions: *technologies that the platform allows to be leveraged* and *industries that the platform allows to be served*, that allowed us to separate the three cases in three different scenarios. The second iteration will build on this finding and will try to extract more in depth information about each of these three scenarios. Drilling down into these scenarios seems the natural thing to do, because after the first iteration, the results, although valuable, may be considered to operate at a very high level. Therefore, in this second iteration the aim will be to increase the depth and give a solid foundation for the findings from the first iteration.

Going back to the data, only this time, we have the grouping of cases based on the result from the first data analysis iteration. Therefore, study cases are grouped in three data buckets, before we continue with data analysis:

1. *Company A platform and Company C platform*
2. *Company B platform*
3. *Company D platform*

As a result, instead of four distinct buckets of data, which were present when the first data analysis iteration started, the data collected data from

Company A and Company C cases was merged into one data bucket. From this point on, this will be considered one entity in the data analysis process, and, based on results from first iteration, the data coming from Company A and Company C will be analyzed as it would have been taken from one single case study. This is made possible by the findings in the first iteration of the data analysis process which introduced two dimensions that collapsed our perspective over the four cases, and made it clear that they can be grouped and analyzed in three different scenarios.

For extracting in-depth data regarding the three scenarios, each bucket of data was reconsidered, and also, the mindset of the researcher looking for emerging theoretical concepts was changed. While in the first iteration, the focus was on the first component of this research, namely, "platform thinking", the second iteration must dig in more and strengthen the findings by proving more substance. Consequently, the second iteration started with researcher looking for information about both concepts: "platform thinking" and "disruptive innovation".

The constructs that emerged from data analysis in the second iteration of the data analysis steps are:

Table 9 - Theoretical constructs that emerged from the second iteration of the data analysis step

Scenario I No industry focus Technology focus	**Scenario II** No industry focus No technology focus	**Scenario III** Industry focus No technology focus
Specific platform technology	No specific technology	Focus on one industry
Offers hardware as well	No hardware offered	No hardware offered
Passively collect proximity information	General Service Level Agreements offered	Patent protected software analytics
Directly serve the market	Low price	Directly serve the market
	Directly serve the market	Established player

Next, the emerging concepts from the second iteration, presented in Table 9, need to be compared and linked with existing literature. In order to complete this step, literature from both research streams is taken into account: “platform thinking” and “disruptive innovation”.

The comparison between results exposed in Table 9 with the academic literature on “platform thinking” and “disruptive innovation” revealed three points of juncture with existing work. First two points linked our results to the existing research through the *business model innovation* and *platform innovation* perspectives over the “platform thinking” concept. The last point of juncture is using our results to bridge the “platform thinking” and “disruptive innovation” research streams.

First of all, we found similarities with the research stream which contributes to the platform thinking by considering the *business model innovation* perspective. The business model approach angle for studying the platform thinking theoretical concepts has got quite some attention from researchers which expanded it in different directions. Some of the most important areas covered are: how to design a winning business model (Eyring & Johnson, 2005), identify and avoid common pitfalls for executing platform strategies (Cennamo & Santalo, 2015; Chen, Zhang, & Xu, 2009; Frery, Lecocq, & Warnier, 2015; Markus & Loebbecke, 2013), and putting platforms in context by considering the concept of architectural leverage (Thomas et al., 2014). In this environment, our findings have synergies with respect to one of the platform traps identified by Cennamo and Santalo (2015), namely, *pursuing an intermediate approach between the mass market and a niche.* According to their findings, a platform-based company which is trying to conquer the main stream customer segment, and, at the same time, win a niche segment will have a hard time winning either of the two markets. Our results, interpreted in the form of the three scenarios (industry focus, technological focus, and no specific focus generic platforms) are aligned with Cennamo and Santalo (2015) supporting the idea that platforms must target either mass market or a niche market in order to be successful. Specifically, our findings provide supporting evidence which comes from the separation of our study cases in three scenarios, as well as the in-depth descriptions of those scenarios. In the second scenario there is no particular focus, and every company is welcomed on the platform (the platform is targeting a mass market), while in the other two scenarios, the platform chose to either concentrate on one industry vertical or on one particular technology. In the last two scenarios, the platforms are specializing in taking over niche markets. Interestingly, they are doing that by leveraging different dimensions: while in the third scenario the platforms are interested in specializing in an industry vertical, in the second scenario they chose to focus on one particular niche technology.

Moreover, another section where our findings are relevant in the platform thinking literature is represented by the *platform innovation* research stream branch (Gawer & Cusumano, 2008; Hall, 2008; Lu, Wang, & Hayes, 2012; Mäkinen, Seppänen, & Ortt, 2014). Contextually, our findings are potentially stimulating when used in combination with the work conducted in the area of how platform external collaborators should be organized in order to improve platform innovation. Two scenarios were proposed for organizing platform external innovators: as competitive markets or as collaborative communities (Boudreau & Lakhani, 2009). Our findings suggest that, in all three identified scenarios, platforms were willing to directly serve industry verticals, if they had the opportunity to do so. This could possibly extend the work conducted by Boudreau and Lakhani (2009), and raise new questions, such as: when organizing external innovators as competitive markets or collaborative communities, how should the platform behave when deciding to serve a particularly industry vertical? Our results suggest that is a hard decision to be made by platform-based companies. Moreover, if all of our 4 case studies the platform chose to directly serve the industry vertical only when it was free of competitors. One driver of such a decision was the novelty of technology (IoT) and the absence of a comparable solution in the existing markets.

Finally, and most importantly, our findings have common roots with literature on *disruptive innovation* research stream. Since the development of the disruptive innovation theory (Christensen & Bower, 1995; Christensen & Rosenbloom, 1995; Christensen, 1993) its popularity among researchers increased steadily and, consequently, the need for its enhancement and refinement grew considerably. Markides (2006) initiated important forward steps in that direction. Firstly, he classified as a "mistake" the usage of Christensen disruption theory in a generic way by putting different types of disruptive innovations in the same container and then treating them in the same way. Christensen (2013) separated disruptive innovations based on the market where they originated, namely, low-end market disruption and new market disruption. However, a need grew to differentiate between types of disruptive innovations based on their diverse competitive effects and the unalike markets that they created, in order to analyze them as distinct, standalone entities (Charitou & Markides, 2003; Dang, School, & Mathews Z. Nkhoma, 2013; Gilbert & Bower, 2002; Guercini & Runfola, n.d.; Markides, 2006). According to this perspective, which built on Christensen work and which quickly gained solid ground, researchers distinguish between three different forms of disruptive innovation.

The three distinct kinds of disruptive innovations identified are:

1. *business-model* innovation
2. *product (new-to-the world)* innovation
3. *technological* innovation

Markides (2006) points out that, although the three categories share many similarities, they still need to be considered different phenomena as they rise radically different challenges for established firms, and have radically different implications for executives. He continues by arguing that progress can be made only when the topic of disruptive innovation is divided between these better-quality categories.

Under this context, the result our second data analysis iteration facilitates a mapping process between our three identified scenarios and their details, on the one hand, and the existing literature on different types of disruptive innovation on the other hand. This mapping process will be presented in more detail in the section Results.

After the second iteration was completed, and since the incremental improvement was significant, the process of data analysis will continue with the third iteration. Since marginal improvement of the previous iteration is not insignificant, we need to continue with iterating through data for extracting new concepts.

Table 10 - Theoretical constructs that emerged from the third iteration of the data analysis step

Scenario I No industry focus Technology focus	**Scenario II** No industry focus No technology focus	**Scenario III** Industry focus No technology focus
Specific platform technology	No specific technology	Focus on one industry
	Low price	No hardware offered
	Directly serve the market	Established player

It can be observed in Table 10, the results of iteration three did not bring new valuable insights or reveal new theoretical concepts. However, for providing an extra layer of security over the fact that we extracted everything from our data, another attempt will be made to extract information from the collected data. This time we will try to see if something new can be revealed if we reverse the grouping made at the beginning of iteration two, where data from Company A and Company C was placed in the same bucket.

Table 11 - Theoretical constructs that emerged from the fourth iteration of the data analysis step

Scenario I No industry focus Technology focus	**Scenario II** No industry focus No technology focus	**Scenario III** Industry focus No technology focus
Specific platform technology	No specific technology	Focus on one industry
Directly serve the market	No hardware offered	

Another attempt was made to extract more data, but, similar to the third iteration, the marginal improvement was insignificant and mostly reiterated and reconfirmed constructs that were already extracted in previous iterations. According to the research methodology employed, this is a signal to stop the data analysis process. Consequently, our data analysis process will stop, and in the next section, the final results will be refined and presented.

The data analysis process produced unrefined results which, according to the research methodology employed, were linked with supporting and conflicting literature for strengthening their emergence. In this section, the findings were polished and presented in two steps. Firstly, a high level recap of the data analysis process is shown. Secondly, the final emerging theoretical concepts will be presented in a visual way.

Due to its highly iterative nature, the data analysis process may prove to be difficult to understand, resulting in failing to convey its message. Therefore, a simple summary of this process is presented in Table 12:

Table 12 – Summary of the data analysis process

Iteration	Iteration steps	Iteration result
First iteration	1. Analyzing Data 2. Shaping Hypothesis 3. Enfolding Literature	adds dimensions: technology and industries served
Second iteration	1. Analyzing Data 2. Shaping Hypothesis 3. Enfolding Literature	adds scenario specific in-depth details, allows mapping with different types of disruptive innovations
Third iteration	1. Analyzing Data	adds insignificant incremental value, mostly reconfirms findings from previous iterations
Fourth iteration	1. Analyzing Data	adds insignificant incremental value, mostly reconfirms findings from previous iterations
➔ **Reaching closure**		

As it can be observed in Table 12, only the first two iterations brought significant contributions in revealing insights from existing data. Because the third and fourth iterations did not provide significant contributions, the last two steps of the iterative process, namely, shaping hypothesis and enfolding literature, were left out as they were considered unnecessary in these cases. Furthermore, iterations three and four failures to provide new insights caused the data analysis process to reach closure.

Given the pylons which served as a foundation for this study: platform thinking, disruptive innovation, and Internet of Things serving as empirical context, our results can be separated in two major components. Firstly, the two dimensions revealed at the end of the first data analysis iteration, can be used to visualize the four study cases in a 2X2 matrix. The two axes of the matrix are labeled:

- *industries served by platform*
- *technological solution that can be reused through platform*

The first dimension is used for assessing the fact that some platforms may target specific industries. In supporting this construct, our study revealed that, in one particular case, external innovators were only allowed to use the platform for creating solutions which target the healthcare industry. Taking into consideration also the industries served by the other cases analyzed, we were able to draft the range of possible values for this dimension. The range for this dimension starts with *one industry* and ends with *many industries*.

The second dimension, namely, *technological solution that can be reused through platform,* is concerned with what technology can be reused by external innovators that are using the platform. The range of possible solutions for this dimension was drafted using the same process used for the first dimension. Specifically, after analyzing and considering all the companies and their behavior with respect to this dimension. The result was that some platforms specialize and allow for reusability a certain technology (in our case proximity technology) which can be used in very specific contexts of use. On the other hand, other platforms offer for reusability a more generic technology for their external innovators.

The resulting 2X2 matrix can be seen in Figure 7:

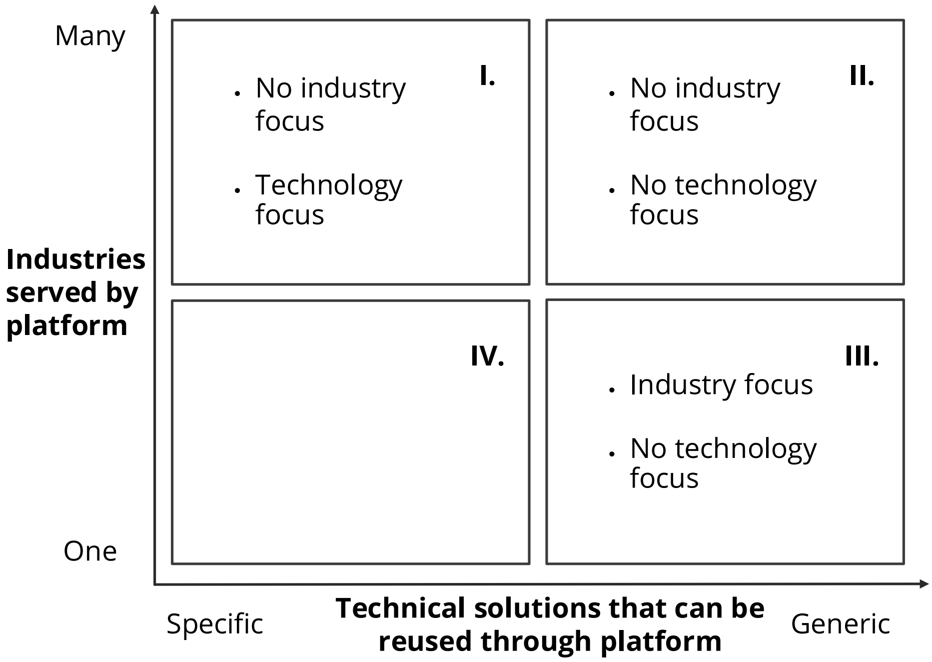

Figure 7 – 2X2 matrix centralizing scenarios which emerged from the data analysis process

The 2X2 matrix provided a simple, but powerful, visualization tool which helped inserting our four study cases within three quadrats of this matrix. The description of each of the three quadrants which were populated with companies from our case study is as follows:

- Quadrat / Scenario I:
    1. Contains technological industry platforms which offer a very specific technology to external innovators for reusability;
    2. The technological component can be employed to create solutions to serve any potential industry;

- Quadrat / Scenario II:
    1. Contains technological industry platform which offer a generic technology to external innovators for reusability;

2. The technological component can be employed to create solutions to serve any potential industry;

- Quadrat / Scenario III:
    1. Contains technological industry platform which offer a generic technology to external innovators for reusability;
    2. The technological component can be employed to create solutions to serve a particular industry (or set of industries);

Secondly, our findings enabled a mapping process between existing research regarding different types of disruptive innovations and the three scenarios. Initially, an attempt was made to map our findings directly with the existing literature which distinguishes between three types of innovation: business model, radical product, and technological disruptive innovation (Charitou & Markides, 2003; Dang et al., 2013; Danneels, 2004; Gilbert & Bower, 2002; Guercini & Runfola, n.d.; Markides, 2006).

However, as creating a clear mapping proved to be a difficult thing to do, we observed that the mapping process can be more reliable if the literature on radical (new-to-the world) product and technological disruptive innovation is merged. Therefore, we decided to consolidate these tow research streams and consider them one entity in our mapping process. The literature separating and classifying types of disruptive innovations based on their different competitive effects and divergent markets that they created is centralized in Table 13.

Table 13 – Existing literature for different types of disruptive innovation: business model and radical product technological (Charitou & Markides, 2003; Dang et al., 2013; Danneels, 2004; Gilbert & Bower, 2002; Guercini & Runfola, n.d.; Markides, 2006)

	Business model disruptive innovation	Radical product disruptive innovations & Technological disruptive innovations
Meaning	Business model innovation is the discovery of a fundamentally different business model in an existing business	These are the disruptive innovations whose disruptive tendencies stem from the advancement in the technological component of the innovation they may result in a new to the world products or disruptive technological improvements to the already existing products
Main aspects	The new business model is disruptive if: (a) extend the economic pie by attracting new customers; (b) expand	New products or technologies are disruptive to consumers because they perturb prevailing consumer habits and behavior in a major way

	the existing market by convincing existing customers to consume more Do not implies the launch of a new product or a new service, but the redefinition of what a product or service is and how it is provided to the customer Requires a different and conflicting value chain from the ones of incumbent company	Disruptive product innovation results from a supply push process rather than demand pull approaches; In the case of radical product disruptive innovation, the early pioneers that create it are very rarely the ones that capture the market, while latecomers' products are general preferred by the average consumer The new technology changes the traditional attributes along firms compete The new technology makes the product cheaper and broadly available
Level of disruptiveness	For an incumbent is very difficult to make the two (new and established business models) coexist and herein the dilemma for them is whether to accept it or not	The new technology undermines the competencies and complementary assets on which existing competitors have built their success
Main differences	It is not true that, as in the case of technological innovation, the only way to face with disruption is to accept it and find new ways to exploit it. Rather firms may invest in their existing model to compete more aggressive with the new business model	To exploit disruptive product innovations established companies should not attempt to create such innovation but should give the\ task to small or start-up firms. In other words, established firm may consequently create and nurture a network of feeder firms While the disk drive featured advancement or changes in technology, the business model employed in taking it to the market from one disk drive generation to another was not significantly different. The innovation involved was also neither radical nor new to the world.
Examples	No frills business models in airlines; Internet banking and Internet brokerage; Internet bookstores	Car; Television, Personal Computers, Mobile phones; Disk drive; Digital cameras; minicomputer.

The mapping process resulted in a theoretical framework which brings together knowledge on industry platforms and disruption innovation theory is presented in Figure 8.

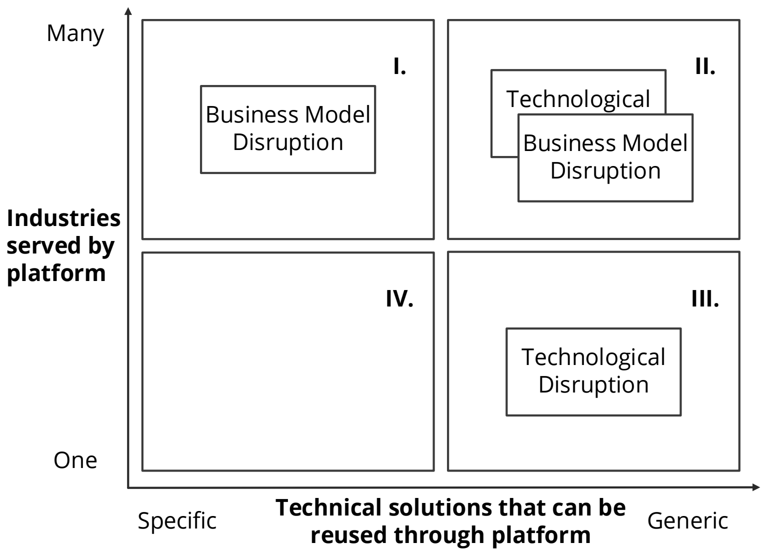

Figure 8 - Types of disruptive innovation facilitated by different quadrants - a theoretical framework which brings together knowledge on industry platforms and disruption innovation theory

According to our result, presented in Figure 8, we draft three theoretical hypotheses:

1. Industry platforms which have technological focus, but have no industry focus, are more likely to facilitate business model disruptive innovations
2. Industry platforms which have no technological focus, but have industry focus, are more likely to facilitate technological disruptive innovation (including radical new-to-the world product)
3. Industry platforms which have no focus with respect to our two dimensions, namely, industry and technological, do not distinguish between different types of disruptive innovation.

The mapping process which served as the foundation for Figure 8 is illustrated in Table 14:

Table 14 – Mapping process between our findings and existing literature on disruptive innovation from Table 13 (Charitou & Markides, 2003; Dang et al., 2013; Danneels, 2004; Gilbert & Bower, 2002; Guercini & Runfola, n.d.; Markides, 2006)

Resulting scenarios and their particularities	**Centralized literature regarding different types of disruptive innovation**
Scenario I Specific platform technology Offers hardware as well Collect proximity information Directly serve the market **Scenario II** No specific technology No hardware offered General SLAs offered Low price Directly serve the market	**Business model** Attracting new customers or convincing existing customers to consume more Implies a redefinition of what a product or service is and how it is provided to the customer Requires a different and conflicting value chain from the ones of incumbent company For an incumbent is very difficult to make the two business models coexist
Scenario III Focus on one industry No hardware offered Patent protected software analytics Directly serve the market Established player	**Radical product & technological** They perturb prevailing consumer habits and behavior in a major way They result from a supply push process rather than demand pull approaches In the case of radical product disruptive innovation, the early pioneers that create it are very rarely the ones that capture the market The new technology changes the traditional attributes along firms compete The new technology makes the product cheaper and broadly available The new technology undermines the competencies and complementary assets on which existing competitors have built their success To exploit disruptive product innovations established companies should not attempt to create such innovation but should give the\ task to small or start-up firms.

It is important to restate that the context for this mapping is the following: we consider industry platforms and, based on their identified attributes, we assess their ability to allow their external innovators to pursue a particular type of disruptive innovation. Specifically, the innovation created in this process will disrupt the markets served by the industry platform's external innovators.

The mapping process detailed:

Scenario I was mapped with *business model innovation* based on the following connections:

- Specific platform technology:
  - If the platform allows a specific technology to be reused by external innovators that implies that external innovators can only have less control of technology and more space to innovate in the business model area.
- Offers hardware as well:
  - Offering hardware (on top of the software product offering) strengthens these platforms commitment to focus on one particular technology. Therefore, this is limiting the platform external innovators attempts to pursue a pure technological disruptive innovation, and this opens more possibilities for innovation in the business model area.

Scenario II was mapped with *business model innovation* and *radical product and technological innovation* based on the following connections:

- No specific technology, no hardware offered, general SLAs offered, and low price:
  - In this case, there was no indication that the platform will empower external innovators to pursue a certain type of disruptive innovation over the other.

Scenario III was mapped with *radical product and technological innovation* based on the following connections:

- Focus on one industry:
  - In this case, the platforms limit the business model innovation perspective by focusing on one industry.
- No hardware offered:

    - Because there is no technology focus, and no hardware is offered this opens the possibility for technological disruptive innovation.
- Patent protected software analytics:
    - As these software analytics algorithms are generic, they strengthen the match between platform external innovators and technological disruptive innovations.

Another interesting finding is given by the fact that in all studied cases we found that industry platform was willing to, or they were doing it already, build solutions to serve directly the end customer. They did that without the help of external innovators. The driving force behind this seems to be getting market share in sectors where the competition is insignificant or there is no competition.

Next, we need to consider how well are our findings answer the research question proposed in this paper.

RQ: How do industry platforms facilitate disruptive innovation?

Given our findings, we are able to say the following with respect to the research question:

1. Some industry platforms chose to pursue an industry or technology strategic focus, while others stay generic (Table 9).
2. Industry platforms pursuing a technological focus have a higher affinity for facilitating business model disruptive innovation (Table 10). Their strategy had the following particularities:
    a. On top of software, they also offered hardware
    b. They focus and perfect a very specific technology through their platform, which allows them to passively collect proximity information
3. Industry platforms pursuing an industry focus have a higher affinity for facilitating technological disruptive innovation (Table 10). Their strategy had the following particularities:
    a. They did not find beneficial to strengthen their software offering by also provide hardware
    b. They strengthen their software by patented protected software analytics

   c. The platform, although a separated business unit, was part of a larger organization (a significant difference in size from the other study cases).
4. Industry platforms stay generic with respect to industries that external innovators can target and the technology which can be reused through the platform. They do not seem to offer better conditions for one particular type of disruptive innovation over another (Table 10). Their strategy had the following particularities:
   a. They tried to take a clear portion of the risk involved by providing General Service Level agreements to their external innovators.
   b. Their product offering is characterized by being available at a relatively low price
5. Under certain circumstances, characterized by absence of competition, all the industry platforms from this study chose to directly serve the end market. And this is a task normally carried out by external innovators.

4.3 Discussion

This study aimed to understand industry platforms' facilitator role in emerging disruptive innovations. Interestingly, this work was trigger by observing a real world phenomenon, namely, the remarkable business accomplishments, in a relatively short time frame, from companies like Airbnb, Spotify, and Netflix. However, the most intriguing part was that these organizations credited Amazon Web Services cloud platform with playing an instrumental role in enabling their success stories. As the literature review chapter revealed, Amazon Web Services (AWS) cloud platform can be labeled as an *industry platform* - more specifically AWS is an industry platform leader. Furthermore, the innovation introduced by Airbnb, Spotify, and Netflix in their industries can be classified as *disruptive innovation* in line with Christensen's (1995, 1997) definition of the term. Consequently, this study was tailored for investigating the theoretical possibility according to which industry platforms can facilitate disruptive innovations.

To answer the suggested research question, an inductive research approach was employed. Due to the exploratory nature of this paper and its aim to unveil new theoretical concepts a qualitative data collection process was undertaken. Conducting an inductive study seemed to offer a good fit with the study's nature, aim, and requirements.

The initial population of companies which were potential candidates for this study was as large as thirty-three companies. However, after the theoretical sampling process was completed, only four companies were finally invited to take part in this study. Without being a criterion for selection, invited companies are based in different countries, even two different continents. We believe that this geographical dispersion can strengthen the generalization of our findings. Furthermore, the interviewees were C-level or senior managers which had access to the strategic level in the studied companies. Because of that, they were able to provide relevant insights regarding cases data.

The results can be divided in two major components. Firstly, the 2x2 matrix, presented in Figure 7, reveals a new perspective which differentiates between three diverse types of industry platforms emerging in the IoT realm. This simple, but powerful visualization tool informs about how platform position themselves along two dimensions: *technologies that the platform allows to be leveraged* and *industries that the platform allows to be served.* According to this model, Amazon Web Services platform would fit in the second quadrat, where there is neither industry nor technology focus. Furthermore, the Amazon platform offers a generic technological component which innovators can reuse.

However, it is interesting to observe that our 2x2 matrix has a quadrat that is empty. Our interpretation of this model cannot be considered complete without addressing also the 2x2 matrix's fourth scenario. The industry platforms which are potentially operating inside this quadrat should have a focus on both, an industry and a technology at the same time. This offers an intriguing perception on why our study was not able to map any of the studied cases with this quadrat. A completely exhaustive and mutually exclusive solution for understanding why the fourth quadrant is empty, is that the scenario is empty by chance or it is empty for a reason. Firstly, one possible interpretation could imply that that our sample was simply not big enough to cover platforms which may operate in this particular, and perhaps, rare setup.

Secondly, another potential explanation could originate from an unusual research area, namely, the study of anthropology and biology. The work conducted in those fields concerning the evolutions of species, revealed an idea which rapidly had become a very popular belief among academics: overspecialization leads to extinction. According to this conception, some species evolved up to the stage where their overspecialization along certain dimensions contributed decisively to their extinction. In our resulting 2x2 matrix, the second quadrat means that industry platforms chose to position their product offering as generic. On the exact opposite of this there is quadrant four, in which industry platforms can be considered as overspecialized with respect to the two dimensions of our model. Therefore, one possible interpretation is that organizations stay away from this scenario because they *sense* that is not good position to be in. This hypothesis may even imply that there are no organizations under this particular setup. However, an important element to consider here is the maturity of the markets. Due to its incipient stage, market demand for IoT-based produce offerings it is still in emerging stage. As a result, extreme specialization might start to become a desirable solution for platform-based organizations only after the markets become more mature and the number of competitors increases.

The 2x2 matrix helped developing our second and more important component of our result, namely, mapping industry platforms with different types of disruptive innovations. According to this finding, industry platforms which are offering a more specialized component for reusability are more inclined to facilitate a particular type of disruptive innovation. In contrast, industry platforms which remained generic along the dimensions in our 2x2 matrix (Figure 7) do not distinguish between different types of disruptive innovation which they can facilitate. This is represented by the quadrat two in our 2x2 matrix.

However, quadrant one and three offer a thought-provoking view on how industry platforms positioning may facilitate different types of disruptive innovations. Firstly, industry platforms operating in quadrant one concentrate their product offering on one or a specific collection of technologies. Because of that, our study revealed that they are expected to provide fertile ground for business model disruptive innovations. It is important to mention that, in quadrant one, industry platforms are better equipped to facilitate the emergence of a business model disruptive innovation more than other types of disruptive innovations. The main reason is that, as the industry platform focuses on technology, they would control its evolution and development. Therefore, the only complementary disruptive innovation that shows a good fit with this scenario is an external business model disruptive innovation. This type of innovation can reuse a technological component offered by the industry platform and wrap it in a disruptive business model which can address any potential market. Furthermore, it would be risky, as an external innovator, to attempt a technological disruptive innovation by reusing a technological component which they do not entirely control. Instead, pursuing a business model disruptive innovation would offer a better success perspective as the business model is not tied to a precise technological platform. And this flexibility can allow external innovators to switch between platforms, or in extreme cases, try to build their own technological platforms.

On the one hand, quadrant three is comprised of industry platforms which focus on one or a particular set of industries. Specifically, this means that they allow external innovators to create solutions which can serve only a particular collection of industries, or even a single industry. Consequently, the facilitation of business model disruptive innovations is restricted due to the relatively low number of industries in which the business model innovation can be applied. A single particular industry does not offer a very wide space for multiple and different disruptive business model innovations to co-exist. And certainly not in a relatively short time frame. However, the situation changes when we consider the possibility to facilitate technological disruptive innovations. Industry platforms operating in quadrant three are offering a more fertile ground for technological disruptive innovations due to their focus and advanced knowledge in that particular industry. They facilitate the emergence of technological disruptive innovations by offering for reusability a generic technological component which can be used to develop solutions for a very specific industry.

However, our findings do not suggest that technological disruptive innovations are completely excluded from being facilitated by industry platforms operating in quadrant one. In the same time, they do not imply that business model disruptive innovations are entirely left out from being enabled by platforms operating in quadrat three.

Instead, our result offers an explanations regarding which scenario has a better fit for helping certain disruptive innovations emerge. And this can be important for real life business managers as our findings can be read starting from two different perspectives. Firstly, the external organizations' ability to innovate on top of the platform is crucial for the platform success. As a result, our findings can help industry platforms decision makers in understanding how they position themselves with respect with facilitating a particular type of innovation, namely, disruptive innovation. And what types of disruptive innovations are likely to be attracted on their platform if they decided to change from a generic platform to a one which focuses on one industry or one technology.

Secondly, our work can be relevant for external innovators which decided to pursue a disruptive innovation strategy. Specifically, our model can help them understand, based on what type of disruptive innovation is created, which industry platform would be more suitable for developing their product or service. For example, prior to our model, an external innovator aiming to develop a disruptive business model solution targeting the healthcare market, could develop its product offering on top of industry platforms in any quadrant. However, our model informs about the fact that using industry platform which operate in quadrant three – industry focus – may not be the optimal solution.

Finally, because of lack of data the current study could not make a statement regarding how quadrant four connects industry platforms and disruptive innovations. We believe this particular set up needs to be the subject of future investigations before any conclusion are drawn.

Another intriguing finding was that in all of the studied cases, under certain circumstances, the industry platforms decided to develop their own vertical solutions in different industries and directly serve the end customers. In this way eliminating external innovators, and contradicting the very purpose of an industry platform. However, their motivation can be justified by the fact that the industry verticals were not served by any competitor, and it seemed like a facile approach to rapidly grab market share and gain traction for their platform.

Furthermore, our results are easily generalizable and can be applied to any case of industry platforms and disruptive innovations. Moreover, the geographical dispersion of the cases, four different countries from two continents, is a strong argument for supporting the fact that our findings can be applied for any industry platform and external innovator operating on the world market.

Chapter 5. Conclusions

It was impossible to let the success stories of Netflix, Spotify, and Airbnb pass by unobserved without curiosity calling to *dissect* their ascension course in order to reveal more about this highly interesting phenomenon. Consequently, this paper aimed to unveil new insights about how to control this process and facilitate the emergence of more companies similar to Netflix, Airbnb, and Spotify. These companies followed roughly the same path to become leaders in their sectors by fundamentally changing how the markets were being served. However, their rise to become market leaders and incumbents, it is not a simple innovation story. As our study revealed, they are categorized as *disruptive innovations* in line with Christensen (1997, 1995) definition of the term.

An inquiry for trying to understand what stands behind these success stories exposed an intriguing fact. According to this finding, all three companies which shook entire industries, acknowledged the fundamental role played by an external organization in their emergence. This organization, which apparently acted as an enabler, was the Amazon Web Services platform. After confronting this real-life construct with existing academic literature, we were able to conclude that it exhibits all the characteristics of an *industry platform* (Gawer, 2014). In other words, industry platforms can offer fertile ground for disruptive innovations. And this is perfectly aligned with existing literature as industry platforms are reliant on external innovators to create solutions for serving the end users. This paper aimed to focus on the facilitation aspect made available by industry platforms to one particular case of innovation, namely, disruptive innovation.

Our inductive study analyzed the data coming from four emerging industry platforms in the realm of Internet of Things (IoT) in order to better understand how technological industry platforms facilitate disruptive innovations. Concluding results distinguished between three different types of industry platforms, namely, industry focus, technological focus, and generic. Furthermore, each of these categories exhibits unique characteristics which makes them better equipped to facilitate certain types of disruptive innovations over others.

The current study is advancing a new role in the disruption game, namely, the role of the facilitator. In our research, this part was played by technological industry platforms. With establishing industry platforms as facilitators for emerging disruptive innovations, we can conclude that player three has enter the disruption game. This new role carries a great strategic importance for platform-based companies and external innovators alike. One of the most explicit graphics used to explain how industry platforms connect with each other and with external innovators is presented in Figure 9.

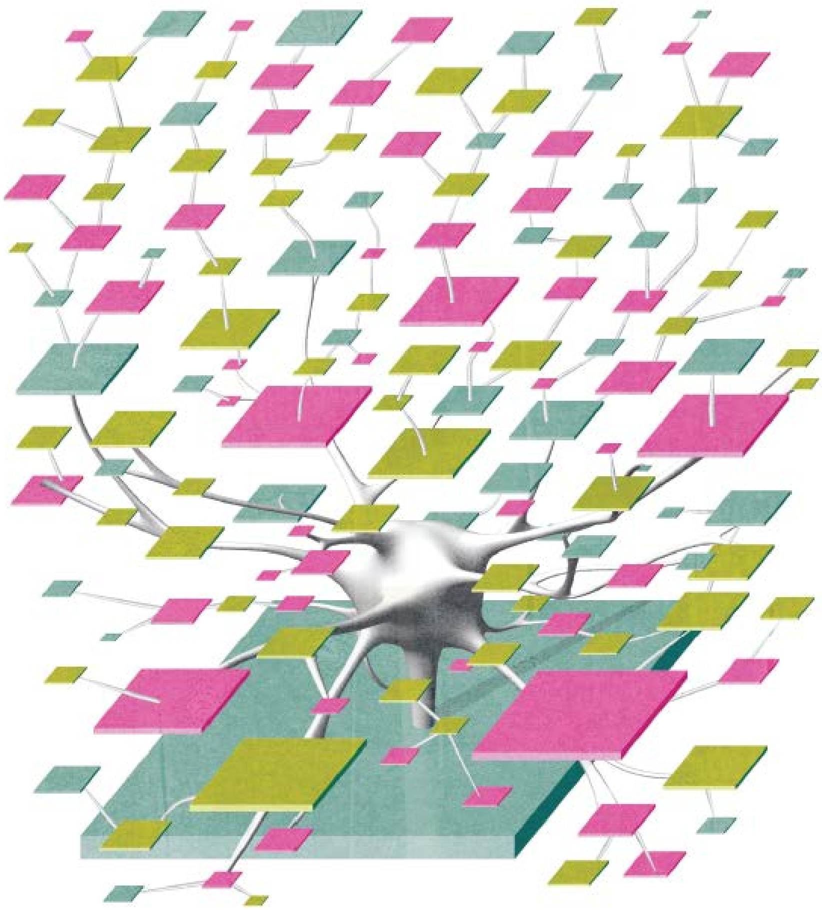

Figure 9 – Visual for the industry platform theoretical concept (Cusumano, 2010)

5.1 Limitations

Nevertheless, the current study has a number of limitations.

First of all, our results are constrained by the current study's exploratory nature. The findings need further elaboration and competing views. Another particular limitation is given by the number of cases considered. This paper collected and analyzed data coming from four different companies. Although, this number is considered acceptable by the employed research methodology, we believe that more cases would revalidate and strengthen our findings. Further empirical studies, need to go beyond this first exploratory study and provide deeper insights and refine the initial results.

Furthermore, another limitation is the fact that only qualitative and anecdotal data was used to draw the conclusions of this exploratory study. Gathering quantitative data would have implied stretching the current study over its assigned time frame with a significant impact. Instead, we attempted to first explore this theoretical possibility with an inductive research based on a qualitative data collection process. This approach produced valuable results which have to be validated by a second quantitative study.

Another important limitation of the study is the theoretical sampling process. This method helped the study focusing on industry platforms in IoT, however, this also implies that the results of the study can only be generalized to other industry platforms operating in IoT realm. Future work may find beneficial to aim to understand how industry platforms facilitate disruptive innovations under different empirical contexts. Some of these context can be:

5.2 Future work

The current work opens stimulating possibilities for future work. Naturally, due to the fact that this study heavily relied on qualitative data, a quantitative study should follow in order to strengthen and reconfirm the resulting theoretical concepts. Furthermore, another research direction should attempt to establish why industry platforms stay away from over-specialization. In other words, answering why the quadrant four in our 2x2 model is empty. Future work must establish if emerging industry platforms decide not to overspecialize, and if this is true, what are the reasons they consider when that decision is made.

Furthermore, a potential research fertile area will be to establish when an industry platform should pursue an industry or a technology focus and when it would be optimal to stay generic – with respect to facilitate disruptive innovation. Moreover, as industry platforms are evolving organizations (Gawer, 2014) a roadmap for guide industry platforms to move from one quadrant to another can provide great value.

Finally, the current model can be improved by future work if we consider the perspective of external innovators. As they are the one creating disruptive innovations, future work could elaborate on the four scenarios identified in this paper. The aim would be to help external innovators to choose the suitable industry platform to build their product offering based on the type of disruptive innovation that they chose to create.

References

Alberti, A. M., Reis, E. S., Righi, R. R., Mu, M., & Chang, V. (2015). Converging Future Internet , " Things ", and Big Data : A Specification Following NovaGenesis Model.

Ansari, S., & Krop, P. (2012). Incumbent performance in the face of a radical innovation: Towards a framework for incumbent challenger dynamics. *Research Policy*, *41*(8), 1357–1374. http://doi.org/10.1016/j.respol.2012.03.024

Ashton, K. (2009). That ' Internet of Things ' Thing. *RDIF Journal*, *22*(7), 97–114.

Atzori, L., Iera, A., & Morabito, G. (2010). The Internet of Things: A survey. *Computer Networks*, *54*(15), 2787–2805. http://doi.org/10.1016/j.comnet.2010.05.010

Baldwin, C. Y., & Woodard, C. J. (2008). The Architecture of Platforms: A Unified View. *Working Papers -- Harvard Business School Division of Research*, 1–31. http://doi.org/10.2139/ssrn.1265155

Boudreau, K. J., & Lakhani, K. R. (2009). How to Manage Outside Innovation. *MITSloan Management Review*, *50*(50413), 68–77. http://doi.org/Article

Bouverot, A. (2015). GSMA : The Impact of the Internet of Things. *The Connected Home*, *20*.

Bower, J. L., & Christensen, C. M. (1995). Disruptive Technologies: Catching the Wave. *Harvard Buisness Review*, (January), 43–53. Retrieved from http://web.b.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=5&sid=4cd9ee2f-4a98-451c-a60f-813c333eaf54@sessionmgr112&hid=106

Brown, J., Hendry, C., & Harborne, P. (2007). Developing Radical Technology for Sustainable Energy Markets: The Role of New Small Firms. *International Small Business Journal*, *25*(6), 603–629. http://doi.org/10.1177/0266242607082524

Burnard, P. (1991). A method of analysing interview transcripts in qualitative research. *Nurse Education Today*, *11*(6), 461–466. http://doi.org/10.1016/0260-6917(91)90009-Y

Cennamo, C., & Santalo, J. (2015). How to Avoid Platform Traps. *MIT Sloan Management Review*, *57*(1), 12–15. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=110208932&site=ehost-live

Charitou, C. D., & Markides, C. C. (2003). Responses to Disruptive Strategic Innovation. *Sloan Management Review*, *44*(2), 55–63. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=8955604&site=ehost-live

Chen, J., Zhang, C., & Xu, Y. (2009). The Role of Mutual Trust in Building Members' Loyalty to a C2C Platform Provider. *International Journal of Electronic Commerce*, *14*(1), 147–171. http://doi.org/10.2753/JEC1086-4415140105

Chesbrough, H. (2003). Open Platform Innovation: Creating Value from Internal and External Innovation. *Intel Technology Journal*, *07*(03), 7. http://doi.org/10.1535/itj.1001

Christensen, C. M. (1993). The Rigid Disk Drive Industry: A History of Commercial and Technological Turbulence. *Business History Review*, *67*(04), 531–588. http://doi.org/10.2307/3116804

Christensen, C. M. (1997). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Boston: MA: Harvard Business School Press.

Christensen, C. M., & Bower, J. L. (1995). Customer power, strategic investment, and the failure of leading firms, *17*(September 1993).

Christensen, C. M., & Rosenbloom, R. S. (1995). Explaining the attacker's advantage: Technological paradigms, organizational dynamics, and the value network. *Research Policy*, *24*(2), 233–257. http://doi.org/10.1016/0048-7333(93)00764-K

Christensen, C. M., Verlinden, M., & Westerman, G. (2002). Disruption, disintegration and the dissipation of differentiability. *Industrial &*

Corporate Change, *11*(5), 955–993. http://doi.org/10.1093/icc/11.5.955

Cunningham, S., Silver, J., & McDonnell, J. (2010). Rates of change: Online distribution as disruptive technology in the film industry. *Media International Australia*, (136), 119–132.

Cusumano, M. (2010). Technology strategy and management: The evolution of platform thinking. *Communications of the ACM*, *53*(1), 32. http://doi.org/10.1145/1629175.1629189

Cusumano, M., & Gawer, A. (2003). The elements of platform leadership. *IEEE Engineering Management Review*, *31*(1), 8–8. http://doi.org/10.1109/EMR.2003.1201437

Dang, D. P. T., School, S. P., & Mathews Z. Nkhoma. (2013). Information Systems : Transforming the Future 24 th Australasian Conference on Information Systems , 4-6 December 2013 , Melbourne Proudly sponsored by Contextual Difference and Intention to Perform Information Security. *24th Australasian Conference on Information Systems 4-6 Dec 2013, Melbourne*, (December), 4–6.

Danneels, E. (2004). Disruptive technology reconsidered: A critique and research agenda. *Journal of Product Innovation Management*, *21*(4), 246–258. http://doi.org/10.1111/j.0737-6782.2004.00076.x

Ebersold, K., & Hartford, T. (2015). The Impact of Disruptive Technology: The Internet of Things. *Issues in Information Systems*, *16*(Iv), 194–201.

Edmondson, A. C., & Mcmanus, S. E. (2007). Fit in Methodological Management. *Academy of Management Review*, *32*(4), 1155–1179.

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review*, *14*(4), 532–550. http://doi.org/10.5465/AMR.1989.4308385

Eisenmann, T., Parker, G., & Alstyne, M. W. Van. (2006). Strategies for Two- Sided Markets. *Harvard Business Review*, *84*(10), 12. http://doi.org/10.1007/s00199-006-0114-6

Eyring, M. J., & Johnson, M. W. (2005). Spotlight on business model innovation, (February).

Fleisch, E. (2010). What is the Internet of Things? : An economic perspective. *Economics, Management, and Financial Markets*, *5*(2), 125–157. http://doi.org/10.1109/MCOM.2013.6476854

Frery, F., Lecocq, X., & Warnier, V. (2015). Competing With Ordinary Resources. *MIT Sloan Management Review*, (Spring), 1–14. http://doi.org/http://search.proquest.com/docview/1670982106?accountid=28962

Gawer, A. (2010). Towards a general theory of technological platforms. *Druid Summer Conference*, 1–40. http://doi.org/10.1108/S0733-558X(2010)0000029022

Gawer, A. (2014). Bridging differing perspectives on technological platforms: Toward an integrative framework. *Research Policy*, *43*(7), 1239–1249. http://doi.org/10.1016/j.respol.2014.03.006

Gawer, A., & Cusumano, M. A. (2002). *Platform leadership: How Intel, Microsoft, and Cisco drive industry innovation.* Harvard Business School Press Boston.

Gawer, A., & Cusumano, M. A. (2008). How Companies Become Platform Leaders. *MIT Sloan Management Review*, *49*(2), 28–35. http://doi.org/Article

Gawer, A., & Cusumano, M. a. (2013). Industry Platforms and Ecosystem Innovation. *Journal of Product Innovation Management*, *31*(3), 417–433. http://doi.org/10.1111/jpim.12105

Gawer, A., & Henderson, R. (2007). Platform owner entry and innovation in complementary markets: Evidence from Intel. *Journal of Economics and Management Strategy*, *16*(1), 1–34. http://doi.org/10.1111/j.1530-9134.2007.00130.x

Gawer, A., & Phillips, N. (2013). Institutional Work as Logics Shift: The Case of Intel's Transformation to Platform Leader. *Organization Studies*, *34*(8), 1035–1071. http://doi.org/10.1177/0170840613492071

Gilbert, C., & Bower, J. L. (2002). Disruptive Change. *Harvard Business Review*, *80*(5), 94–101. http://doi.org/10.1002/rwm3.20019

Gomes, M., da Rosa Righi, R., & da Costa, C. A. (2014). Internet of things scalability: Analyzing the bottlenecks and proposing alternatives. In *2014 6th International Congress on Ultra Modern Telecommunications and Control Systems and Workshops (ICUMT)* (pp. 269–276). http://doi.org/10.1109/ICUMT.2014.7002114

Gubbi, J., Buyya, R., Marusic, S., & Palaniswamia, M. (2013). Internet of Things (IoT): A Vision , Architectural Elements , and Future Directions, (1), 1–19. http://doi.org/10.1016/j.future.2013.01.010

Guercini, S., & Runfola, A. (n.d.). Disruptive Interaction. Emerging Issues and Research Propositions, 1–12.

Guttentag, D. (2013). Airbnb: disruptive innovation and the rise of an informal tourism accommodation sector. *Current Issues in Tourism*, *3500*(April), 1–26. http://doi.org/10.1080/13683500.2013.827159

Hagiu, A. (2006). Multi-Sided Platforms: From Microfoundations to Design and Expansion Strategies. *Business*, 1–25. http://doi.org/10.2139/ssrn.955584

Hagiu, A. (2014). Strategic Decisions for Multisided Platforms. *MIT Sloan Management Review*, *55*(2), 71–80.

Hagiu, A., & Wright, J. (2013). Structuring your business as a marketplace may seem attractive , but it ' s often a recipe for failure . by Andrei Hagiu and Julian Wright. *Harvard Business Review*, 103–108.

Hagiu, A., & Wright, J. (2015). Multi-sided platforms. *International Journal of Industrial Organization*, *43*, 162–174.

Hall, W. (2008). Information Systems Research. *Information Systems Research*, (Article in Advance).

Haller, S. (2010). The Things in the Internet of Things. *Symposium A Quarterly Journal In Modern Foreign Literatures*, 97–129. http://doi.org/10.1007/978-3-642-19157-2

Harles, J. E. A. N., Ean, R. O. J., Rochet, J., & Tirole, J. (2001). PLATFORM COMPETITION Platform Competition in Two-Sided Markets, 5–6.

Harris, I., Wang, Y., & Wang, H. (2015). ICT in multimodal transport and technological trends: Unleashing potential for the future. *International Journal of Production Economics*, *159*, 88–103. http://doi.org/10.1016/j.ijpe.2014.09.005

Hatchuel, A., Masson, P. Le, Weil, B., Paristech, M., Michel, B. Saint, Nationale, A.-A., … Segrestin, B. (2010). P LATFORMS FOR THE DESIGN OF PLATFORMS : 1- - - Introduction : platforms for platform design.

Henderson, R. M., & Clark, K. B. (1990). Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. *Administrative Science Quarterly*, *35*(1), 9–30. http://doi.org/Article

Hoelck, K., & Ballon, P. (2015). Competitive dynamics in the ICT sector Strategic decisions in platform ecosystems. *Communications & Strategies*, 21.

Hogan, M. (2015). Upstream Effects of the Streaming Revolution: A Look into the Law and Economics of a Spotify-Dominated Music Industry. *Colorado Technology Law Journal*, *14*, 131. Retrieved from http://heinonline.org/HOL/Page?handle=hein.journals/jtelhtel14&div=13&start_page=131&collection=journals&set_as_cursor=26&men_tab=srchresults

Kenagy, J. W., & Christensen, C. M. (2002). Disruptive innovation: a new diagnosis for health care's "financial flu". *Healthcare Financial Management : Journal of the Healthcare Financial Management Association*.

Lu, J., Wang, L., & Hayes, L. a. (2012). How Do Technology Readiness, Platform Functionality and Trust Influence C2C User Satisfaction? *Journal of Electronic Commerce Research*, *13*(1), 50–69. Retrieved from http://search.proquest.com/docview/1013810818?accountid=14495\nhttp://diana.uca.es:4550/resserv?genre=article&issn=15266133&title=Journal+of+Electronic+Commerce+Research&volume=13&issue=1&date=2012-02-01&atitle=HOW+DO+TECHNOLOGY+READINESS,+PLATFORM+FUNCTI

Ma, T., & Zhang, C. (2011). On the disruptive potentials in internet of things. *Proceedings of the International Conference on Parallel and Distributed Systems - ICPADS*, 857–859. http://doi.org/10.1109/ICPADS.2011.87

Mäkinen, S. J., Seppänen, M., & Ortt, J. R. (2014). Introduction to the special issue: Platforms, contingencies and new product development. *Journal of Product Innovation Management*, *31*(3), 412–416. http://doi.org/10.1111/jpim.12104

Markides, C. (2006). Disruptive Innovation : In Need of Better Theory † Business-Model Innovation, (1997), 19–25. http://doi.org/10.1111/j.1540-5885.2005.00177.x

Markus, M. L., & Loebbecke, C. (2013). C OMMODITIZED D IGITAL P ROCESSES AND B USINESS C OMMUNITY P LATFORMS : N EW O PPORTUNITIES AND C HALLENGES FOR D IGITAL B USINESS S TRATEGIES 1, *37*(2), 649–654.

Mazhelis, O., Luoma, E., & Warma, H. (2012). Defining an internet-of-things ecosystem. In *Internet of Things, Smart Spaces, and Next Generation Networking* (pp. 1–14). Springer.

Mazhelis, O., & Tyrvainen, P. (2014). A framework for evaluating Internet-of-Things platforms: Application provider viewpoint. *Internet of Things (WF-IoT), 2014 IEEE World Forum on*, (February 2011), 147–152. http://doi.org/10.1109/WF-IoT.2014.6803137

Mikusz, M., Jud, C., & Schäfer, T. (2015). Business Model Patterns for the Connected Car and the Example of Data Orchestrator. *Icsob*, *114*(April 2016), 261–266. http://doi.org/10.1007/978-3-642-30746-1

Milito, R. (2014). Fog in Support of Emerging IoT Applications, (November).

Mineraud, J., Mazhelis, O., Su, X., & Tarkoma, S. (2015). A gap analysis of Internet-of-Things platforms, 1–7. http://doi.org/10.1016/j.comcom.2016.03.015

Muzellec, L., Ronteau, S., & Lambkin, M. (2012). Two-sided Internet platforms: A business model lifecycle perspective. *Industrial Marketing Management*, *45*, 139–150. http://doi.org/10.1016/j.indmarman.2015.02.012

Parker, G. G., & Van Alstyne, M. W. (2005). Two-sided network effects: A theory of information product design. *Management Science*, *51*(10), 1494–1504. http://doi.org/10.1287/mnsc.l050.0400

Parker, G. G., & Van Alstyne, M. W. (2012). A digital postal platform: Definitions and a roadmap. *International Post Corporation/MIT Sloan School of Management*, (January), 30. Retrieved from http://www.ipc.be/~/media/Documents/PUBLIC/Markets/MIT_White-paper_Digital_Postal_Platform.pdf

Rochet, J. (2016). Two-Sided Markets, *1*(4), 990–1029.

Rodrigues, M. A. D. S., Chimenti, P., Nogueira, A. R. R., Hupsel, L. F., & Repsold, A. (2014). From print to screen: changes and challenges facing the Brazilian publishing industry. *Revista de Administração*, *49*(3), 491–505. http://doi.org/10.5700/rausp1163

Sandrini, G. (2015). What are the perspectives for technology platforms in the field of neuroscience ?, *2020*(2), 8971.

Sapsed, J., Grantham, A., & DeFillippi, R. (2007). A bridge over troubled waters: Bridging organisations and entrepreneurial opportunities in emerging sectors. *Research Policy*, *36*(9), 1314–1334. http://doi.org/10.1016/j.respol.2007.05.003

Scadura, T. A., & Williams, E. A. (2000). Research Methodology in Management: Current Practices, Trends and Implications for Future Research. *Academy of Management Journal*, *43*(6), 1248–1264. http://doi.org/10.2307/1556348

Soleimani, F., & Zenios, S. (2011). Disrupting incrementalism in health care innovation. *Annals of Surgery*, *254*(2), 203–208. http://doi.org/10.1097/SLA.0b013e3182251538

Sterling, B. (2005). *Shaping Things (Mediaworks Pamphlets)*. The MIT Press. Retrieved from http://www.amazon.com/exec/obidos/redirect?tag=citeulike07-20&path=ASIN/0262693267

Tee, R., & Gawer, A. (2009). Industry architecture as a determinant of successful platform strategies: a case study of the i-mode mobile Internet service. *European Management Review*, *6*(4), 217–232. http://doi.org/10.1057/emr.2009.22

Thomas, L. D. W., Autio, E., & Gann, D. M. (2014). Architectural Leverage: Putting Platforms in Context. *Academy of Management Perspectives*, *28*(2), 198–219. http://doi.org/10.5465/amp.2011.0105

Uckelmann, D., Harrison, M., & Michahelles, F. (2011). Architecting the Internet of Things. *Architecting the Internet of Things*, (JANUARY), 1–353. http://doi.org/10.1007/978-3-642-19157-2

Walsh, S. T. (2004). Roadmapping a disruptive technology: A case study The emerging microsystems and top-down nanosystems industry. *Technological Forecasting and Social Change*, *71*(1-2), 161–185. http://doi.org/10.1016/j.techfore.2003.10.003

Westerlund, M., Leminen, S., & Rajahonka, M. (2014). Designing Business Models for the Internet of Things. *Technology Innovation Management Review*, *4*(7), 5–14. http://doi.org/10.1007/978-3-642-19157-2

Yin, B. R. K. (1994). Case Study Research. Design and Methods, 1–5. http://doi.org/10.1080/09500790.2011.582317

Zervas, G., Proserpio, D., & Byers, J. W. (2013). The Rise of the Sharing Economy: Estimating the Impact of Airbnb on the Hotel Industry. *Boston University School of Management Research Paper Series*, *16*, 1–36. http://doi.org/10.2139/ssrn.2366898

Zlyvko, O. (2013). Russian experience of the application of the technology platform concept as a mechanism for a national economy. *Czech Journal of Social Sciences, Business and Economics*, *2*(2), 49–54.

Appendix A

This part of the paper is delivered separately.

Appendix B

This part of the paper is delivered separately.

Appendix C

The invite sent via email to companies asking them to be part of the study:

"

Dear Mr. / Mrs.,

Would your company be willing to be briefly interviewed by me about "Disruptive innovation, platform thinking, and internet of things"?

My name is Cristian Pîrvan, I am a student currently enrolled in ICT in Business master program offered by Leiden University (http://www.leidenuniv.nl/ , The Netherlands). With my master thesis, I explore methods to understand the mechanisms behind platform-enabled disruptive innovations.

I believe that your company can provide useful insight to my work. The interview can take place at a location convenient to you (Skype is also possible) and would last not more than one hour. I will share the results of our study with you when we have them.

In case your company decides to participate, my contact email is: c.pirvan@umail.leidenuniv.nl.

We will of course treat the information you share with us with care and promise to keep you anonymous.

Thank you for your time. I am looking forward to your reply.

Kind regards,

Cristian

"