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Abstract: Can a platform leader be challenged and loose its architectural control over its innovation ecosystem? The question seems absurd since theoretical works on modularity and multi-sided markets depict platform competitive landscapes as controlled by a hegemonic platform leader. However, platform history chronicles several cases of leadership shifts for the benefit of firms formerly providing complementary innovations. We coined these situations "platform overthrows". To bridge the gap between classical optimization models and empirical evidences of platform overthrow, we rely on a design-theory-based model (Legrand et al. 2017) of platform dynamics to generate testable hypothesis. We then test them with a sample of 22 empirical cases of attempts of platform overthrow. Our results indicate that platform overthrows are always built by a challenger that introduces a new functional range in the ecosystem. However, the efforts of the challenger can be ruined if the technology of the platform leader is easily adaptable to the new functional range. Otherwise, the challenger can overthrow its platform leader if it succeeds in designing a technology that can address both the former and the new functions. We conclude by highlighting how studying both technological and functional evolutions can provide a thorough understanding of platform ecosystem dynamics.

1. Introduction

Competition and its impact on innovation ecosystem evolutions have been receiving increasing attention, and (Gomes et al. 2016) signals that the question of "how a firm leads an ecosystem and […] it's renewal when facing a competition based on a radical innovation" remains an open question.

In this paper we extend current theory on innovation ecosystem competition by empirically testing a model of industry platform dynamic. (Annabelle Gawer and Cusumano 2014) define an industry platform as "products, services, or technologies developed by one or more firms, and which serve as foundations upon which a large number of firms can build further complementary innovations". Industry platforms are thus specific innovation ecosystems in which platform leaders –one or several firms- orchestrate innovation through a specific technical core (Autio and Thomas 2014) .

Industry platform is a fruitful academic setting to study innovation ecosystem evolution as the current models on which the field is built fail to account empirical platform dynamics. Industry platform literature draws from two main concepts – modularity and multisided-market – to explain how platform leaders build their successes. First companies such as Intel, Palm or DoCoMo rely on modular systems for their products (Baldwin and Clark 2006). Modularity enables other firms – the complementors – to innovate by providing best-in-class modules, the platform leader being responsible for the overall structure of the product and the modules' compatibility. Second platforms leaders are able to successfully conduct multi-sided market strategies (Rochet and Tirole 2003) towards their different groups of users. In a platform context, heterogeneous groups of users are subjected to indirect network effects: they mutually benefit from the size and characteristics of the other side. Therefore, platform leaders must harness the resulting network effects to ensure a high growing number of users and reach a critical mass that protect the platform leader from competition. Therefore, modularity and network effect models drive a trend in the literature that describes competitive platform landscapes as dominated by installed platform leaders for which small players can never be a threat.

However, these theoretical approaches fail to provide consistent explanation for some empirical facts. Based on well-known examples (see for example the early history between IBM and Intel), the industry platform literature recognized that a complementor can innovate in a platform-competing way and threaten the platform leader position (Anabelle Gawer 2014). In this paper, we therefore tackle this gap by quantitatively testing a model that account for shifts of leadership in industry platform ecosystem.

The paper is therefore structured as follow. First, in the literature review, we indicate why the historic models are irrelevant to account for the dynamics occurring when there is an attempt of platform overthrow. We conclude that these models are static models that convey an underlying assumption of stability in the functional range that the platform performs. We then depict a model, previously published by the authors that encompass functional extension and provides relevant analysis of platform overthrow situations. We build from this model hypothesis that we test empirically on historic examples. Second, we described the methodology we follow to build a sample to test our hypotheses. Third, we present the results of our tests. Fourth in the discussion we highlight three striking facts that constitute our contributions to the field: 1) Platform overthrow is common phenomenon across the different platform sectors, 2) Functional extension is a necessary condition to undertake a platform overthrow attempt and 3) the success of such attempts is link with the ability to adapt the technology to address the newly introduced function, which is coined in the literature as technological genericity. We conclude with the next relevant avenue for research and our contribution to practice.

2. Literature review: The overthrow of a platform leader as an empirical fact revealing the underlying hypothesis of the classical platform models

Platforms and platform leaders have become major subjects in the academics fields for the past few years. In this section, we build on these constant academic progresses to highlight the issue of platform dynamic when submitted to competition in a Three-folded approach. First we point out that the literature reports on leadership shifts in platform ecosystems while the classical models – modularity and multi-sided market – are not accounting for them. We draw from the literature that the main weakness of these models relies on their underlying assumption of a stable functional range that the platform provides. Second we call upon the design theory literature to explain why model developed by the authors can encompass functional extension and provide insights on platform overthrow. Third, we deduce from the model relevant and quantitatively testable hypothesis.

2.1 Understanding platform overthrow as a way to bridge the gap between platform models and empirical evidence

Early academic work on platform industry was initiated in the end of the 90's to explain the success of several firms in software sectors that achieved fast market domination (Steinberg 2017). Empirical evidence from the technological management literature that described how companies such as Intel, Palm or DoCoMo, coined as platform leaders, relied heavily on complementary innovations that ensure their market successes (Anabelle Gawer and Cusumano 2002).
Two main bodies of theoretical works, from both strategic management and industrial organization economics literature have modeled underlying mechanisms that a platform leader uses to foster efficient complementary innovation. First, the modularity literature explains how platform leaders foster complementary innovations (Baldwin and Clark 2006). Thanks to modular systems some parts could be designed by "complementors" that are in charge of providing best-in-class modules, while the platform leader is responsible for the coherence of the overall structure and the modules' compatibility. Second the multisided-market models provided the theoretical prism to understand how to achieve fast market domination with complementary innovation (Rochet and Tirole 2003). The multisided market approach assumes the existence of at least two groups of heterogeneous platform users that are subjected to indirect network effects which means that different sides of a platform can mutually benefit from the size and characteristics of the other side. The more customers from one side join the platform the more the other side is interesting in joining, leading to a virtuous circle. Therefore a platform leader should develop complementary innovation so that ensure that both side join and stay on board. Thus by combining modularity and multi-sided network effects the academic literature provides good insights on the dynamics at stake for the rise of a successful platform leader.
These straightforward models of platform dynamics are built on an underlying assumption that a platform leader, once established, remains in control of a thriving innovative ecosystem. However, these assumptions have been undermined by recent studies on platform ecosystem evolutions. Thus, based on empirical observations, several scholars point out that industry platforms are not stable structure overtime and different stages of industry platform (Anabelle Gawer 2014; Thomas, Autio, and Gann 2015). They describe that a platform ecosystem can be damaged to a point where the platform leader can no longer orchestrate innovation. As if this prospect was not worrisome enough for platform leaders, the literature accumulates examples where platform leaders lose their architectural control for the profit of a complementor - see for example IBM losing its architectural control on the PC platform for the profit of Intel (Anabelle Gawer and Cusumano 2002), Nokia facing the rise of Microsoft OS and losing control over the Symbian platform (Kenney and Pon 2011) and Yahoo! becoming Google's complementor (Rindova et al. 2012). We coin in this article these situations as platform overthrow.
Nurtured by these empirical examples, the literature gradually identified that the existing models of platform dynamics were unable to account for platform overthrow and that this subject constitute a relevant gap for research. In the critics concerning these models that arise in the literature, two trends can be identified: one on functional extension and the second on technology evolution. First, the existing models cannot account for feedbacks induced by functional extension which is the result of the leader's efforts to foster innovation. Theses authors highlight that a poorly managed functional extension can weaken a platform leader. If the leader misses some important functions, it may face radical-innovation-based competition (Gomes et al. 2016) and be submitted to platform leaders dilemma (Cusumano 2011; Annabelle Gawer and Cusumano 2014)**.** Second, although the existing models look for neglect technological changes that a platform leader conduct on its technical core in order to remain the innovation orchestrator which have been recognized to understand important aspects of platform dynamics such as organization (Anabelle Gawer 2015), architectural control of the ecosystem (Autio and Thomas 2014) and regulation of ecosystem (K. Boudreau and Hagiu 2009). These two folded critics – on functional extension and core technical evolution – has been noted in recent literature review and (McIntyre and Srinivasan 2017) note that "*There is relatively little understanding of platform dynamics and their evolution, with platforms being treated as systems that remain relatively stable overtime […] As a result, additional research is needed that focuses on how a platform firms manage and leverage their portfolio of complements during regimes of frequent technological change*". Therefore understanding how a complementor can overthrow a platform leader could lead to bridge the remaining gap in the description of platform dynamics.
As our literature review reveals, understanding platform overthrow is both a legitimate and interesting question for research. In particular, it can allow the field to bridge the gap between model based on an underlying hypothesis of a stable set of functions while empirical evidence suggest that functional extension play a role in platform completion as well as the capability of the platform leader to adapt its technical core. Therefore we look in the literature for models that can help us answer the following research question: what are the relevant strategies for a complementor to take the architectural control of an innovation ecosystem at the expense of its former platform leader?

2.2 The design theory literature as a promising academic setting to provide a valuable model of platform overthrow

To better understand platform dynamics, we previously saw that new models were needed with the following features. First, these new models should be able to take into account new functions and the capability of the technological core to evolve. In line with the work on modularity (Baldwin and Clark 2006) which drew from engineering design literature to build relevant platform models, we claim that design theories (Hatchuel and Weil 2003; Shai and Reich 2004) are good settings to develop model that could be able to account for platform overthrows. The axiomatic design theory (Suh 1984) seems particularly appropriate as it studies the links between functions and technological evolution. The authors, in a precedent study, developed a model for platform overthrow using axiomatic design theory (Legrand et al. 2017). They also proved the consistency of their model with former platform models that used Design Structure Matrix (Baldwin and Woodard 2009; Eppinger 1991). The aim of this paper is not to linger on the model but to build from it testable hypothesis in platform context which is what constitute the next section.

2.3 Hypothesis formulation

The work conducted on platform overthrow is motivated by the observation that the classical models describing platform dynamics are built on the underlying assumption that the main functions provided by the platform remain stable overtime. More precisely, modularity models and multi-sided market models assume that a platform leader can improve existing functions – or have them improved by complementors – but cannot foster functions that address new value proposition for the customer. On the contrary, our model indicates that functional extension is a necessary condition to conduct a platform overthrow. Therefore, to confirm the close links between platform ecosystem dynamics and functional extension we formulate our first working hypothesis:

$H_1$1: Every attempt of **platform overthrow** is built on a **functional extension** originating from the challenger.

This first hypothesis gives a necessary condition to undertake an attempt of platform overthrow. Nevertheless, the model provides also insights on the outcome of such attempts. First the model clarified what can be called a success for the leader and for the challenger in context of platform overthrow. From an incumbent platform leader point of view, success is achieved when it can remain in architectural control of the ecosystem therefore when the challenger has to leave the market or become a complementor of the incumbent platform leader. From a challenger point of view, success is achieved if it takes control of the totality or some parts of the architectural control on the platform. The model therefore encompasses the asymmetry between incumbent and challenger. The model predicts that the success of one player is linked with its capacity to propose a generic technology. The genericity of a technology is a notion that comes from the general purpose technology literature (Bresnahan 1995), qualifying the ability of a technology to be adapted to address new functions. A technology is generic if it can, while minimizing the design effort, address an enhanced functional range (Kokshagina et al. 2012). The hypothesis we formulate from the model is the following:

$H_2$1: To achieve success in case of a platform overthrow, one must control a **generic technology**.

This second hypothesis calls for two remarks. First, the hypothesis still takes into account the asymmetric situation between the two competitors. The challenger technology is generic if it can address the new functions and at least some of the former functions (but not necessarily all of them). The platform leader technology is generic if it can address the functional extension provided by the challenger. In that case, the model predicts that the challenger is unable to propose a generic technology since it would mean to build the entire platform already possesses by the incumbent. Second, this hypothesis is in line with the work on envelopment strategies (Eisenmann, Parker, and Van Alstyne 2011). These authors describe a possible strategy for a platform leader to counter an attack from a new entrant. To do so, the platform leader should include for free in its current offer the competitor functions. This strategic move decreases the switching costs for the consumers in particular when the entrant and incumbent user bases overlap. Thus the incumbent can capture the consumers of its competitors and therefore avoid platform overthrow. Our hypothesis are aligned with this contribution since the envelopment strategy assumes that the competitors provide a functional extension (Hypothesis 1) that has to be included in the platform leader offer through its existing technology (Hypothesis 2).

These hypothesises could lead us to describe the underlying mechanisms occurring in platform overthrow context. If H2 is confirmed, we could formulate relevant strategies for both the incumbent platform leader and the platform challenger. However we should compare our explanatory variables – functional extension and genericity - with the straightforward explanations of platform weakening in the literature. Thus several scholar already studied platform weakening mechanisms such as a competition with an already established platform (Cennamo and Santalo 2013), a better pricing strategy provided by the new entrant to ensure a quick critical mass (Evans and Schmalensee 2010) and a takeover by the challenger (Eisenmann, Parker, and Van Alstyne 2011). Therefore we formulate a final hypothesis:

$H_3$1 : The explanatory variables of **platform leader competition, pricing strategy and takeover** better explain the outcome of platform overthrow than the two explanatory variable **functional extension and genericity**

3) Experimental method: Quantitatively test the hypothesis on a highly qualitative sample

To evaluate our hypothesis concerning platform strategy, we aim at using a quantitative methodology. However, we are aware that it might be too bold of a choice since the complexity of strategic actions taken by platform leaders lead scholars to focus on cases studies (de Reuver, Sørensen, and Basole 2018). Quantitative methods have been used to study platform ecosystems (K. J. Boudreau 2012; Ceccagnoli et al. 2012), nevertheless they always focus on one particular platform ecosystem. Therefore there is, to the best of our knowledge, no quantitative study assessing the relevance of a given strategy across several platforms sectors because of the difficulty to provide a general framework that makes sense for all platform ecosystems. We hope that platform overthrow constitute a framework that enables us to conduct a relevant analysis across platform sectors. However, due to the difficulty to gather a high number of cases, we strengthen the humble tests we conduct with a highly qualitative sample and analysis of cases. In the following of the section, we present the sample collection method and the analysis conducted. The main idea of this experimentation is to review previous cases related to platform overthrow and to code them with the functional extension and genericity variables.

3.1 Gathering an heterogeneous and qualitative sample of platform overthrow attempts

To quantitatively test our hypothesis, we build a sample composed of situations in which a challenger attempts to overthrow a platform. To do so, we analyze long term history of well-known platforms thanks to academic description of those cases. Relying on academic works studying long term platform evolution as the primary source for our data ensures the quality of our sample in three interrelated ways that are consistent with our research question. First, it enables us to include in the sample cases in which the challenger failed to overthrow the platform. We therefore avoid the bias of focusing only on emblematic cases where platform overthrow occurred. Second, the requirements of academic work allow for fruitful cases descriptions. This point is crucial in our work since we look for variables - functional extension and genericity extension – that require to report on both technical and value proposition aspects. Third, by analysing sources explicitly related to platform body of literature, we validate that the cases included in our sample are platform related and not belonging to different competition logic.
In coherence with our methodology setting, our primary sources consist in two main books related to platform long term history (Anabelle Gawer and Cusumano 2002; Evans, Hagiu, and Schmalensee 2006) and several academic papers (Den Hartigh et al. 2016; West and Wood 2013; Ansari, Garud, and Kumaraswamy 2016) that specifically aim at describing long term history of a platform ecosystem. To spot in those documents cases of attempt of platform overthrow we look for unambiguous statement from either the challenger or the platform leader that a specific strategic move falls within an attempt of platform overthrow. Applying this methodology we build a sample of 22 cases of platform overthrow attempts. Table 1 elucidates for each source the number of cases found and one example of a case with the names of the platform, and the citation that make them belong to the sample.

---------- Insert Table 1 here ----------

3.2 Coding the cases to allow quantitative analysis

To undertake the analysis of our sample according to the hypothesis we build, we undertake a textual coding of our case descriptions. In coherence with our model, we extracted quotation in case description that related to the variable at stake. For the functional extension variable – labelled Fr – we look for quotations that compare the incumbent platform and the challenger functions. For the incumbent genericity variable –labelled G_{inc} - we looked for quotations that indicate that the platform leader was able to adapt its technology to the new functions easily. For the challenger genericity variable –labelled G_{cha} - we look for quotations that indicate the challenger was able to provide a technology that encompasses the previous function of the platform leader. For the success variable – labelled S_{cha} for the success of the challenger - we look for quotation that could indicate whose firm succeeded. Then according to these citations we attribute for each variable the Boolean value 0 or 1 accordingly. For illustrative purpose, the table below details examples of our analysis.

---------- Insert Table 2 here ----------

4) Results

4.1 Quantitative results (Hypothesis 1 and Hypothesis 2)

As described above, we characterized each cases of attempt of platform overthrow with three variables: success of the challenger S_{cha} (which is the complementary variable of the platform leader success S_{inc}), functional extension provided by the challenger Fr and technical genericity coming from either the challenger G_{cha} or the incumbent G_{inc} (these two variables being also complementary).

$H_1$1 hypothesizes that the challenger undertakes a platform overthrow by providing a functional extension. We test the hypothesis $H_1$0 that the variable functional extension follows a binomial law with a one-sided 1% trust interval. In our sample, 22 cases of attempt out of 24 were built with a functional extension while the probability for Fr following a binomial law with p=0.5 to be above 22 is 0,999. Thus we reject $H_1$0 and formulate a dependency between the variable Fr and the belonging to our sample. We therefore conclude the following for H_1: An attempt of platform overthrow cannot be undertaken by a challenger without proposing a functional extension compared to the previous platform.

$H_2$1 hypothesizes that the winner of a situation of platform overthrow – may it be the challenger or the platform leader – is the one that extend the genericity of its technology. We test the hypothesis $H_2$0 which hypothesizes a uniform distribution among the four different sectors: Success of incumbent with genericity (S_{inc} = 1 and G_{cha} = 0), success of incumbent without genericity (S_{inc} = 1 and G_{cha} = 1), success of challenger with genericity (S_{inc} = 0 and G_{cha} = 1) and success of the challenger without genericity (S_{inc} = 0 and G_{cha} = 0). We test $H_2$0 with a χ^2 test for a two-sided 0,5% confidence interval. We obtain a total distance of 20.0 which is superior to the table distance of 7.8. Thus we rejected $H_2$0 and formulate a non-uniform distribution of the success in a platform overthrow context and the genericity of the winner's technology. Therefore, with respect to H_2, we conclude as follow: In a situation of platform overthrow the success goes to the player whose technology is generic. We insist that genericity for the leader and for an incumbent is different but so does is the success as a challenger will be consider a success if it just remains on the market.

Table 1. Sources contribution description

Source reference	Number of cases from the source	Example of one case from the source	
		Incumbent versus Challenger	Platform overthrow attempt quotations
(Anabelle Gawer and Cusumano 2002)	9	Microsoft vs. Netscape	1) " *[Netscape Navigator] posed a potential threat to both [the] software platform and application business [of Microsoft]*" (p.144) 2) "*Customers can launch software applications from Web servers that interact with Internet browsers, rather than with Windows, making the browser a competing platform*" (p.93)
(Evans, Hagiu, and Schmalensee 2006)	8	Microsoft vs. IBM	*"IBM released OS/2 2.0 in 1992 with the slogan, "a better DOS than DOS, and a better Windows than Windows""* (p.94)
(Ansari, Garud, and Kumaraswamy 2016)	1	Nielsen vs. TiVo	"*TiVo's strategy was to create a platform that would result in a significant departure from the traditional television-broadcasting model and the negotiated relationships and agreements that this model implied*" (p.8)
(Den Hartigh et al. 2016)	1	Apple vs. IBM	1) "*IBM noticed that Apple with VisiCalc could compete with IBM's more expensive mainframe systems, and responded promptly*" (p.5) 2) "*From that moment [Apple II released] onwards, various rival platforms would fight for dominance in the personal computer industry*" (p.4)
(West and Wood 2013)	3	Microsoft vs. Symbian Ltd	1) "*A key goal shared by Symbian and its owners was preventing Microsoft from extracting proprietary rents from mobile devices as it had in PCs, where it commoditized the systems vendors*". (p.31) 2) "*A few months later, Microsoft's CEO Bill Gates termed [Symbian] "serious competition"* " (p.32)

Table 2. Two examples of case analysis

Incumbent vs. Challenger	Fr	Quotation Fr	$G_{inc} = \overline{Gcha}$	Quotation $G_{inc} = \overline{Gcha}$	S_{cha}	Quotation S_{cha}
IBM vs. Intel (Anabelle Gawer and Cusumano 2002)	1	1) "*We picked [Intel's PCI] because it solved a range of problems: It solved a graphics problem, it solved plug and play problems, it solved interrupt problems, it solved performance issues*"	0	1) "*This was coincident with IBM proving either lack of interest or inaptitude in moving the PC platform forward*" (p.26) 2) "*The development of these chip sets [of IBM] or computer platform was getting much more complex. So, it was getting increasingly difficult for the larger OEMs to keep up*" (p29) 3) "*The PCI bus [of Intel] was an internal interface whose definition potentially affected all the companies that design and manufactured other parts of the computer attached to the bus*" (p.29) 4) "*You've got 500 vendors out there in the industry that are providing add-in board for various functions that plug into PCI*" (p.31)	1	1) "*The initiative was a resounding success*" 2) "*Thanks to PCI, Intel grabbed the position of platform leader*"
Palm vs. Handspring (Evans, Hagiu, and Schmalensee 2006)	1	1) "*This expansion slot allowed owners of the Handspring Visor Deluxe to attach other hardware modules to make their PDA a pager, mobile phone or voice recorder*" (p.166) 2) "*The colour unit […] was another feature of the […] Handspring models*" (p.167)	0	1) "A *major disadvantage of the original Palm hardware architecture (especially in contrast to SpringBoard) was the lack of an expansion slot or standard connector that made it easy for third parties to add on modules*." (p.208) 2) "Unlike *Palm, […], Handspring engineers designed the hardware […] in a bold move to make modules or peripherals as easy as possible to connect. The expansion modules literally snapped into the expansion slot on the back of the Visor PDA. Palm device lacked such a simple mechanism for expansion when Handspring introduced this innovation*." (p.206)	1	1) " *Handspring had taken the lead in defining price points for PDAs as well as hardware design*" (p.208) 2) "*Although Handspring was helping to build broader acceptance of Palm OS as a standard platform, the company seemed to be doing more than Palm to drive forward that PDA architecture and functionality*"

4.2 Qualitative results (Hypothesis 3)

Now that we have shown a relationship between to model-driven variables and the success of a platform overthrow strategy, we analyse these phenomena in more depth. In particular, we underline that those two variable – technological genericity and functional extension – explain better the outcome of an attempt of platform overthrow than the classical descriptors of platform competition namely multi-sided market pricing strategy and take over. To correctly test H3, we therefore should have used a logistic regression; however the number of cases is not enough to provide testable results.
Therefore we rely on an in-depth analysis of two extreme cases concerning pricing and take-over. For the pricing analysis, we rely on cases brought to us by the book of (Evans, Hagiu, and Schmalensee 2006) which belong to the economic academic field. Several clues in their work tend to prove that establishing a pricing strategy is not used at all to undertake platform overthrow. Quantitatively, only in only one out of seven cases in our sample do the authors indicate that a new pricing structure is used by a successful challenger which rises their attention as the authors "*It is natural to ask how software platforms' pricing strategies evolve over time. Based on our case studies, the surprising answer is, to a first approximation, they don't. Both what is priced and the basic pricing structures tend to remain constant over time. The only major shift in pricing strategy that we have observed occurred in 1977, when Atari began selling its new VCS game console below manufacturing costs*". Therefore, competition for platform leadership seems not to trigger several pricing structures in the way the sides of one platform are addressed. This is a "*surprising*" fact for the authors as they also note that the pricing structure differs between several platform industries and therefore one new comer could be tempted to disrupt the industry with a new pricing structure.
For the take-over variable, our argument rely both on empirical and theoretical observation. When analysing the sample we collected, we realize that Cisco is the company that is known for regularly take over potential rivals. However, this approach of Cisco is described as being completed with a hard work to adapt their technology to the newly acquired company. Cisco regularly change its core, we would say extend its technologic genericity, while taking over other companies. Therefore, we think that the variable "take over" is encompassed by the "genericity extension" variable. Our second argument is theoretical and grounded in the model provided by (Legrand et al. 2017) and our hypothesis H_1 and H_2: if a company had acquired a platform challenger, this challenger had proposed a functional extension that is threatening for the platform leader (Hypothesis 1). Once acquired, if the platform fails to integrate the functional extension in its technology (Hypothesis 2), what prevents a new challenger to rise? Therefore both theoretical argument and empirical argument indicates that the pricing strategies and takes over are not the best explanatory variables to account for platform overthrow situations.

5) Discussion

5.1 Main contribution

Our main contribution to the platform literature is twofold. First, we legitimate the notion of platform overthrow through establishing a consistent sampling a those cases. The platform overthrow analytical setting enables us to conduct the first multi-platforms quantitative study. Second we strengthen the notion of platform overthrow by testing general laws accounting for the dynamics at stake in such cases. We first demonstrate that a functional extension is a necessary condition to undertake a leadership change in a platform ecosystem. Second we highlight the role of technical evolution in the outcome of a platform overthrow situation. In particular, we established that to foster a successful outcome both challenger and established platform leader should be able to adapt their technology so that it addresses the newly introduced function. This capacity being called in the literature genericity, we summarize our contribution by stating that to succeed in the case of platform overthrow one – may it be the platform leader of the challenger – must propose a generic technology. More precisely, we show that if the platform leader technology is generic it maintain its leadership and if it is not, then the more the challenger technology is generic, the more architectural control it will gain at the expanse of the platform leader.
The high level of analysis that we have been able to conduct in this study is largely due to previous works from the platform literature and remain consistent with them. First, our results confirm and generalize the exemplary work on platform envelopment strategy (Eisenmann, Parker, and Van Alstyne 2011). Platform envelopment can be analyzed as a particular strategy a platform leader can implement to counter an attempt of platform overthrow. Second the literature has for long suspected the existence of specific strategies (Suarez and Kirtley 2012) aiming at weakening the platform leader position (Anabelle Gawer 2014). Our work provides a setting that can help conducting systematic analysis of those situations. Finally, the literature has for long acknowledge that platform leaders implement sophisticated strategies to strengthen their architectural control on their ecosystem (Gawer and Henderson 2007; Perrons 2009). Our

work underlines the importance for the platform leader to anticipate functional extensions that could occur in its ecosystem.
The results from our research, that highlights functional extension and genericity as key mechanisms, structure notions that are already present in the literature. Functional extension has for long be scrutinized by the field, in particular to find the dimensions that can stimulate it such as closeness versus openness (K. Boudreau 2010), pricing structures (Hagiu 2009) or the number of complementors (K. J. Boudreau 2012). Technical evolution and genericity have often be referred to – though with other terms – in recent researches that highlight their importance to understand platform dynamics (McIntyre and Srinivasan 2017; Anabelle Gawer 2015).

5.2 Limitations

As highlighted throughout this paper, our research has strong limitation. The first and obvious one is linked with the small number of cases we have been able to gather so far because of our demanding sampling methodology. This limitation weakens the quantitative analysis that we conducted. While this limitation may have seriously misleading effects on the second hypothesis from a statistical point of view, basing our hypothesis on a model strengthens our analysis and seems to indicate global trends that support our findings. We are currently working to enhance our sample with other highly qualitative sources describing platform history. A second limitation is linked with the third hypothesis which needs logistic regressions to be properly tested. Once again, we hope that the enhancement of our sample will eventually enable us to conduct such analysis. A third limitation is grounded in the methodological approach. As we used secondary data to build our sample, we could be submitted to misinterpretations of platform histories. We hope that our approach can be confronted to several practitioners or platform specialists so as to triangulate our data and strengthen our analysis.

5.3 Further research

In line with the literature, we call for more systematic analysis of platform dynamics and claim that merging market-oriented and technological approaches opens avenues for further researches. More precisely, we encourage scholars to investigate the functional dynamics of a platform ecosystem and their underlying technical evolutions instead of concentrating on pricing strategies. These works has been undertaken at a firm level, we call for studies that conduct such analyses at an ecosystem level. These works could aim at developing new types of regulations based on dynamics model of competitive landscapes. For examples, scholars could investigate under which conditions new functions emerge and how it impacts value capture in a given ecosystem. Furthermore, managing functional extensions at an ecosystem level requires organization, skills and resources that still have to be characterized. We also encourage scholars, in particular ones working with the innovation ecosystem construct to cross fertilize with model oriented body of research such as design theories in order to build contributions for further research. Therefore, we hope our research will contribute to foster fruitful exchanges between innovation ecosystem and the technology management literatures such as those initiated by (Kokshagina et al. 2012) with the notion of generic technology.

6) Conclusions and managerial implication

The results of our research include several new findings and confirm certain results in the literature. The platform overthrow prism is relevant to analyse platform dynamics and compare them across industrial sectors. Functional extension and the evolution of the technical core are two keys features to understand quick leadership shifts in platform ecosystems. These two variables account for the cases related in the literature.

The platform overthrow framework enables manager to conduct new analysis on their competitive ecosystem. First, our research provides simple criteria to guide practitioners in their competitive benchmarks across platform ecosystem. A complementor could be a real threat only if it performs new functions with a generic technology. Second our work indicates two crucial ways to enrich a platform strategy: thriving for functional extension and technological genericity. Therefore we hope that these features will help managers to assess the performance of their current technology and indicate ways to improve them.

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