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HOW THE VALUE OF RESOURCES VARIES  
ACROSS MARKETS**

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**FUNDACIÓN DE LAS CAJAS DE AHORROS  
DOCUMENTO DE TRABAJO  
Nº 654/2011**

De conformidad con la base quinta de la convocatoria del Programa de Estímulo a la Investigación, este trabajo ha sido sometido a evaluación externa anónima de especialistas cualificados a fin de contrastar su nivel técnico.

ISSN: 1988-8767

La serie **DOCUMENTOS DE TRABAJO** incluye avances y resultados de investigaciones dentro de los programas de la Fundación de las Cajas de Ahorros.  
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# INCUMBENTS AND INSTITUTIONS: HOW THE VALUE OF RESOURCES VARIES ACROSS MARKETS

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## Abstract

Recent history is full of incumbent failures when confronting a radical technological change. In this article, we investigate the influence of complementary resources on incumbents' success in a context of radical technological disruption. We study how the value of these complementary resources can vary across markets with different level of institutional development. We test our hypotheses in the context of the world mobile telecommunications industry (46 countries and 157 mobile service providers). Our findings show that these resources are more valuable for incumbents in markets with low formal institutional development because complementary assets allow incumbents to maintain the previous social relationships to counteract the institutional disadvantages, such as asymmetric information, uncertainty and lack of protection of property rights.

*Key words:* Complementary Resources; Technological Change; Incumbents' Advantages; Institutions; Performance; Telecommunications

*JEL classification:* L10, L14, L25.

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**Acknowledgements:** Financial support from the Spanish Ministry of Education and Science, FEDER (projects ECO2008-04129), the Regional Government of Aragón (S09) and the “Programa Nacional de Becas de Formación de Profesorado Universitario”.

## 1. INTRODUCTION

Recent history is full of incumbent failures when confronting a radical technological change. This is because a radical technological innovation often entails uncertainty, entry of new competitors and changes in the market structure (Benner, 2007; Tushman and Andersen, 1986). It frequently results in the failure of incumbent firms to survive in the new technological setting, being displaced by newcomers (Utterback, 1994) through a process that Schumpeter called “creative destruction”. Traditionally, literature has paid extra attention to the numerous disadvantages that incumbents face up to when this change takes place, such as lack of incentives and capabilities to develop the new technology which tends to cannibalize their current profits (Arend, 1999; Laive, 2006). Uncertainty about the future success of the technology, organizational inertia, and prior strategic commitments are examples of causes that have been argued to decrease incentives and capabilities to make efficient investments in the new technological field (Hill and Rothaermel, 2003).

However, in the last two decades an important amount of literature has highlighted the existence of exceptions to the “chronic” failure of incumbents (Helfat and Lieberman, 2002; Hill and Rothaermel, 2003; Lavie, 2006; Kim and Min, 2010). For example, Hill and Rothaermel (2003) analyze the moderators in the relationship incumbents-performance in a context of radical innovation. They conclude that factors such as the investment in basic research, the legitimization and institutionalization of autonomous action within the incumbent organization or strong downstream assets, among others, may justify the incumbent survival. Lavie (2006) integrates dynamic capabilities literature and research on technological discontinuity to maintain that incumbents may succeed through capability reconfiguration mechanisms. Under these circumstances, incumbents may have the possibility not only to survive but also to obtain abnormal returns in a context of technological disruption.

The role of complementary assets – those that can maintain their value after a technological change – such as brand value, reputation or relationships with buyers (Helfat and Lieberman, 2002), has been considered as one of the key elements that incumbents should hold in order to maintain their competitive advantage and not to be displaced (Teece, 1986; Mitchell, 1989, 1991; Tripsas, 1997; Rothaermel, 2001). These resources support incumbents in the new stage of competition as they are difficult to imitate by new competitors (Helfat and Lieberman, 2002) and potentially useful in the new technological field (Mitchell, 1991).

In this paper, we empirically address the role of complementary resources for the incumbent success in a context of radical technological innovation. However, we consider that the value of these resources is contingent to the institutional context. Our main premise is that it cannot be assumed that the value of the complementary resources holds irrespective of the conditions under which the firm competes. In particular, we bring the institutional dimension into the analysis of the value of complementary resources when a technological innovation occurs.

Most of the empirical management literature has tended to pay limited attention to the institutional context in which firms operate, considering institutions as “background” conditions (Peng, Wang and Jiang, 2008). Even, more specific technological management literature has neglected the influence of the institutional landscape on the competitive position of incumbents to develop and succeed after technological changes (Lavie, 2006). From a macro-institutional viewpoint, the influence of the level of institutional development on the success or failure of incumbents has been obviated, mainly because most studies have been focused on only one country, especially the United States (Banbury and Mitchell, 1995; Kim and Min, 2010; Mitchell, 1991).

This paper aims to extend previous research on technological discontinuities (Hill and Rothaermel, 2003; Jones, 2003; Lavie, 2006) and the literature on institutional theory (Meyer, Estrin, Bhaumik and Peng, 2009; Peng, Sun, Pinkham and Chen, 2009; Berry, Guillén and Zhou, 2010). We empirically test a model capturing incumbents’ profitability over time after a radical technological change based on the existence of complementary assets. We observe that the value of complementary resources for an incumbent when confronting a technological change is contingent to the institutional context. In particular, our main findings show that these resources are more valuable for incumbents in markets with low *formal* institutional development.

The contribution of this article is threefold. Firstly, we offer additional empirical evidence supporting incumbents’ survival in technological turbulent environments. Secondly, we internationalize management literature by presenting evidence on a wide sample of countries covering the five continents. Lastly, we respond to the claim that management research must incorporate more formally the role of context (Bamberger 2008). In doing so, we consider *institution-based view as a third leading perspective in strategic management* (Peng et al., 2009), beyond the traditional binomial industry-based and resource-based views.

We empirically test our hypotheses within the world mobile communications industry using a longitudinal panel spanning the period 1998 to 2009. The data refers

to the competitive performance of 54 incumbents of the fixed-telephony technology that competes in wireless technology against 103 newcomers with a total of 3,923 observations. Thus, the technological change is related to the transition between fixed-telephony and mobile communications. The data refers to 20 European markets (between the years 1998 and 2009) and 26 countries in Asia, Oceania, Africa and America (from 2005 to 2009). This wide scope allows us to identify remarkable institutional differences and determine how institutions moderate the value of firm complementary resources.

The rest of the paper is organized as follows. In Section 2, we offer a brief literature review on technological change and institutional theory. Section 3 develops the hypotheses of incumbent's profitability, focusing on the moderating impact of the institutional context on the value of complementary resources. Section 4 describes the data base and the variables, whereas Section 5 provides evidence of the performance of incumbents across different institutional environments. We close the paper by discussing its main findings and its managerial and policy implications.

## **2. LITERATURE REVIEW**

### **2.1. Competitive Advantage, Incumbents and Technological Change**

*A radical technological innovation involves methods and materials that are novel to incumbents* (Hill and Rothaermel, 2003: 258). Under these circumstances, they have to decide on their participation in the next stage of the industry (Helfat and Lieberman, 2002). Since they suffer from some incentives, capabilities and adaptation problems in the new technological environment, the literature has highlighted the existence of a process of "creative destruction" through which incumbents are displaced from the market (Schumpeter, 1942). In that sense, they have been accused of a "myopic" perspective in facing technological innovation.

Hill and Rothaermel (2003) provide an overview of the main economic, organizational and strategic reasons that justify the lack or slow response of incumbents to the development or implementation of a new technology that threatens to cannibalize their performance and, in some cases, displace them from the market. Firstly, the existence of *economic uncertainty* about success and future rents of an innovation decreases the incentives of incumbents to invest in the new technology until there were certain rents. Arend (1999) insists on the idea that this behavior in which incumbents decide to wait until the technology has been developed by newcomers is

rational since they keep their attention on short-term efficiencies, mainly derived from shareholders or stock market pressures. Benner (2010) observes that securities analysts are reluctant to strategies of incumbents which aim to extend technological innovations, whereas they have a more positive attitude towards strategies that support existing technologies. Due to this fact, external pressures contribute to slowing down the incumbents' reaction. It frequently causes a loss of pioneer advantages and, even, the opportunity to compete in the new era (Banbury and Mitchell, 1995; Lieberman, 1989).

Recent literature has also highlighted the existence of *organizational inertia* that reduces the capability of incumbents to successfully adapt to the new technological environment (Lieberman and Montgomery, 1988). Organizations have developed routines, formal procedures and bureaucracy requirements that allow them to improve information systems in steady environments (Tripsas, 1997) and face the limited rationality (Hill and Rothaermel, 2003). But when a radical technology innovation occurs, the environment becomes unstable and adaptation process to new circumstances is required. The organizational inflexibility, as a result of the excess of formalization of the previous period, makes adapting difficult. Additionally, there are adaptation difficulties and investments that newcomers do not have to face, which can give them time and cost advantages.

The existence of *strategic commitments* with other firms, suppliers and customers has been argued to be another source of inflexibility of incumbents (Ghemawat, 1991). Incumbents have developed structures and allocated resources to satisfy the needs of their current users. But the demand necessities might shift faster than incumbent's perception. Newcomers may develop faster the new technology that meets their needs and benefit from this myopic attitude of incumbents (Hill and Rothaermel, 2003; Hannan and Freeman, 1984). Moreover, it has been argued that a radical change means an impact on the value creation activities of incumbents and determines the loss of value of most of them (Hill and Rothaermel, 2003).

These arguments have been counteracted in the literature since they neglect some technological and investment capabilities and resources that incumbents have been able to generate (Lavie, 2006). In that sense, it has been argued that although there would be uncertainty about the success of the new technology, incumbents have been able to develop basic R&D routines that allow them to better identify new opportunities and make accurate investments. In other words, incumbents have been able to accumulate absorptive capacity that helps them to take accurate decisions in case of a radical technological change (Hill and Rothaermel, 2003). Moreover, if in the industry

where the firm operates there were some isolating mechanisms of pioneers' advantages – such as network effects, switching costs, proprietary rights protection, etc. –, it is predictable that the incumbent will be especially interested not only in adopting the new technology, but also in developing it before the entry of newcomers into the market. Precisely, the existence of pioneers' advantages has been highlighted as one of the isolating mechanisms of incumbents' advantages (Jones, 2003). Thus, not necessarily the uncertainty surrounding technological change implies the lock-out of incumbents from the market and their lack of incentives to invest in the new technological subfield.

Those arguments that defend the inflexibility of incumbents to quickly react to a radical technological change are based on a static viewpoint of firm capabilities, which obviates the existence of dynamic capabilities that allow firms to adapt to changes. Lavie (2006) shows the existence of different mechanisms of capability reconfiguration (i.e. substitution, evolution and transformation) that allow incumbents to respond to a technological innovation. Moreover, the reaction capability also depends on the corporate culture about the legitimization and institutionalization of autonomous action. Middle-managers are less conservative and influenced by power struggles than top-managers. As a result, organizations which support their initiatives have a higher reaction capability (Hill and Rothaermel, 2003).

Finally, the incumbent also benefits from the relationships that have been established in the past. After a technological change, some value chain activities can maintain their value when *it does not entail selling to new consumers, altering the uses of products, or selling the products in different ways* (Hill and Rothaermel, 2003: 269). It means that the incumbent continues interacting with the same *system of producers and markets serving the ultimate users of the products and services to which a given innovation contributes* (Rosenbloom and Christensen, 1994: 657). In this case, several complementary assets such as marketing, sales and logistic services, market knowledge, brand or reputation can maintain their value since the user bases of the new technological field do not change (Helfat and Lieberman, 2002; Mitchell, 1991). The importance of these complementary assets to allow incumbents' advantages has been highlighted in Tripsas (1997). This study argues that the key factor of survival for incumbents is the possession of complementary assets that maintain their value after a technological change and are not imitable by new entrants. Although incumbents hold investment and technological capabilities, the possession of these complementary assets is also essential to success in the new technological stage.



## 2.2. The Institutional Context

Institutions have been broadly defined as *the rules of the game in a society or, more formally, as the humanly devised constraints that shape human interaction* (North, 1990: 2) or as *cognitive, normative and regulative structures and activities that provide stability and meaning to social behavior* (Scott, 1995: 33). Although the former belongs to the economic perspective and the latter to the sociological viewpoint, both of them may be considered as complementary (Peng and Heath, 1996; Scott, 1995). The interaction between institutions, organizations and strategic choices has recently become a research issue in management literature (Peng et al., 2008), since the behavior and performance of an organization should be understood in the institutional framework where it operates (Peng et al., 2005; Peng, 2002; Singh, 2007). In that sense, strategic choices have been considered as the outcome of the interaction between institutions and organizations (Peng 2003, 2006; Peng et al., 2008).

Surprisingly, institutions have usually been relegated to a “background” question, as a simple control variable in international studies. But the importance of institutions, mainly in international comparisons, has been stressed in the last two decades since they are able to condition the relationship between strategy and performance. Recent research has considered the institution-based view *as a third leg for a strategy tripod* (Peng et al., 2009), to complement the other two leading perspectives in strategic management – the industry and resource-based views. For this reason, we have observed an enormous progress in the study of institutions (Chan, Isobe and Makino, 2008; Meyer, Estrin, Bhaumik and Peng, 2009; Peng et al., 2009; Williamson, 2000). Several authors have tried to integrate the traditional theories of strategy with the new institutional-based perspective in fields such as the study of product diversification (Khanna and Palepu, 2000), international diversification (Cuervo-Cazurra and Genc, 2008), market entry strategies (Brouthers, Brouthers and Werner, 2008; Meyer et al., 2009) or country-effects over performance (Chan et al., 2008; Makino, Isobe and Chan, 2004). All these studies show their interest in integrating the influence of the institutional context in the outcomes of firm strategy. However, a further empirical development of institutional explanations with firm performance is needed (Singh, 2007).

It has been argued that institutions reduce the uncertainty surrounding economic transactions since they condition the behavior and limits of what is considered legitimate (Peng et al., 2009) or, in other words, *what is desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs and definitions* (Suchman, 1995: 574). Institutions reduce the information asymmetries

among the contracting parts and their possible opportunistic behavior in the future and have an important role in supporting the effective functioning of the market, reducing risk and costs (Arrow, 1971; Casson, 1997; North, 1990; Meyer et al., 2009).

Institutions have been divided in *formal*, such as laws, regulations, discipline of economic and political markets and contracts, and *informal*, such as country culture, codes, norms, trust-based relationships, religion or traditions (Dunning and Lundan, 2008; North, 1990)<sup>1</sup>. The degree of institutional development in a country has been usually measured as the degree of development of *formal* institutions which support economic exchanges. Strong *formal* institutions are those that *support the voluntary exchange underpinning an effective market mechanism*, while weak ones refer to institutions that *fail to ensure effective markets or even undermine markets* (Meyer et al., 2009: 63). It has been argued that depending on the development of *formal* institutions, *informal* ones are more important in supporting economic exchanges. When *formal* institutions are weak, *informal* institutions have a greater influence on driving firm strategies and performance (Peng and Heath, 1996; Peng et al., 2008). In that sense, the informal ties that the firm has been able to build with the organizations of their environment, such as suppliers, consumers, investors or employees, will play an important role in reducing uncertainty and limit opportunistic behaviors, by replacing non-existent or inefficient formal mechanisms.

### 3. HYPOTHESES

#### 3.1. Incumbency, Complementary assets and Performance

A radical technological innovation can affect the value of the incumbents' assets by making them obsolete and destroying the source of competitive advantage which they had been enjoying (Tripsas, 1997). However, most recent studies have highlighted the existence of some kind of assets that maintain their value and increase the possibilities of incumbents to survive in the new technological stage (Dierick and Cool, 1989; Mitchell, 1991; Tripsas, 1997). Helfat and Lieberman (2002) explain that established firms tend to enter into new industries – including new product or technological generations – that require resources with a high degree of similarity to the older ones and which give competitive advantages to firms.

These resources have been named *complementary assets* and can be considered as those *resources that are required to capture the benefits associated with a strategy, a technology or an innovation* (Christmann, 2000: 664). Hill and Rothaermel (2001)

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<sup>1</sup> Informal institutions have been traditionally linked to social capital (Farrell and Knight, 2003).

consider them as the resources that support the downstream activities and maintain their value after a technological change.

Literature has highlighted three basic conditions that complementary assets have to satisfy in order to be considered as sources of incumbents' advantages. An incumbent possesses a competitive advantage over their rivals when its resources are non-tradable, non-imitable and non-substitutable (Dierickx and Cool, 1989). First, these assets should have been accumulated over time by making the appropriate strategic choices in a successive process of learning and training. It impedes the acquisition of this kind of assets by newcomers. Secondly, they should be non-imitable, which happens when the stock accumulation depends on the time that a firm has been operating in the market or the existence of a previous stock of assets. It means that new entrants cannot imitate the level of valuable resources of incumbents and, jointly with non-tradability, it assures the non-appropriability of these resources. And thirdly, it is necessary that these assets cannot be replaced by other different resource stock, since the assets should have an essential character in supporting the commercialization of the product or service.

Not every complementary asset satisfies these three conditions. Literature has established a traditional classification which distinguishes between generic and specialized complementary assets (Teece, 1986).<sup>2</sup> Generic assets refer to those that do not need to be adjusted to the innovation, since they can be acquired in the market or built internally. This kind of assets is not able to confer incumbents' advantages because they can easily be imitable by competitors. In contrast, specialized assets are critical to the commercialization of the innovation. Rothaermel and Hill (2005) summarize the characteristics of these assets as path dependent, idiosyncratic, valuable and difficult to imitate. It implies that specialized assets satisfy the three basic conditions to be considered as source of incumbents' advantages.

Additionally, in context of radical technological change, these specialized complementary assets should meet a fourth condition. It is necessary that they support an innovation which does not imply the change in the user bases (Hill and Rothaermel, 2003; Rosenbloom and Christensen, 1994). It means that *core products change significantly but users for the new products remain largely the same from one set of products to the next* (Mitchell, 1991: 85).

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<sup>2</sup> Although Teece (1986) distinguishes between specialized and cospecialized assets, we consider in this article "specialized" referred to both of them since the distinction is not important to this analysis. This criteria has been used in other articles (Helfat and Lieberman, 2002; Rothaermel and Hill, 2005; Tripsas, 1997).

Several complementary assets have been argued to comply with the four conditions to be a source of incumbents' advantages since they are specialized, non-tradable, non-imitable, non-substitutable and based on the existence of a previous user base which do not change: i.e. brand capital, reputation, sales and service systems, market-specific knowledge and incremental R&D capabilities (Helfat and Lieberman, 2002; Peteraf, 1993; Mitchell, 1991; Thomas, 1995).

According to the previous arguments, the possession by incumbents of specialized complementary assets gives them a higher probability of taking advantage of newcomers. Thus, the first hypothesis of our study is stated as follows:

***H1. Complementary assets are positively related to incumbents' performance***

### **3.2. The moderator role of the institutional context**

So far, we have argued that the possession of complementary resources may strengthen the value of other assets, thus increasing company performance. However, the value of these complementary assets is not independent of the context where the firm competes. For example, the institutional perspective suggests that the existence of previous relationships between incumbent and other organizations, such as suppliers, users or authorities (DiMaggio and Powell, 1983) confers incumbents an advantageous position that reinforces the value of complementary assets. As a consequence, the firm gains legitimation to operate in these markets (Granovetter, 1985; Peng et al., 2005; Powell and DiMaggio, 1991).

These informal ties will be especially important when the *rules of the game* are not too clear. This is the case when *formal* institutions are underdeveloped (Peng et al., 2005). The preeminence of *informal* institutions has been observed in emerging economies, where the *formal* market-institutions which support economic exchanges are less developed as a result of being in an economic transition period (Peng and Heath, 1996; Peng et al., 2009; Peng, 2002).

A weak institutional context is characterized by several market failures which imply that firms are subject to contractual and political hazards (Henisz, 2000). There is a lack or insufficient development of intermediation institutions, such as financial analysts, investment bankers, auditors, solicitors, brokers, and consultants. These intermediaries increase information exchanges between contractual parties, resolving problems of asymmetric information and reducing costs associated to product, labor and capital markets (Arrow, 1971; Casson, 1997; Chan et al., 2008; Khanna and

Palepu, 2000; Meyer et al., 2009; North, 1990). Thus, the lack of intermediaries increases transaction costs, meaning a lower predictability about the future behavior of the other contracting part. Under these conditions, the risk of opportunistic behavior increases and it is necessary to spend resources to boost the available information (Tong, Reuer, and Peng, 2008), which increases the costs of drafting and enforcing contracts (Ketchen, Boyd and Bergh, 2010; Peng, 2002; Peng et al., 2008). Political hazard exists because a weak institutional environment is characterized by imperfect judicial systems, unpredictable regulation, and bureaucracy constraints, such as importation controls, restrictive licenses and high taxation. It means a low protection of property rights and formal difficulties to develop economic exchanges, which could disincentive firms to innovate and invest in new activities (Cuervo-Cazurra and Genc, 2008; Ghemawat and Khanna, 1998; Chan et al., 2008).

According to these arguments, we suggest that the value of complementary assets will be contingent to the institutional environment. Incumbents will be in a better position in those markets with low *formal* institutional development because the network of informal relationships counteracts the disadvantages of operating in a context of high contractual and political hazard. The lack of clear *rules of the game* can be replaced by the information that organizations directly acquire from the network of relationships that incumbents have previously developed. The maintenance of logistic, sales or service systems facilitates the interaction with suppliers or consumers, which jointly with the accumulated market knowledge, decreases information asymmetries and puts incumbents in a better competitive position (Delios and Beamish, 1999; Meyer et al., 2009).

When *formal* institutions are developed, the importance of complementary assets for counteracting market failures decreases. External mechanisms are used in order to increase information availability, enforce contracts and property rights protection and simplify bureaucracy, such as market intermediaries, efficient judiciary systems, and regulatory quality (Cuervo-Cazurra and Genc, 2008; Peng et al., 2005; Chan et al., 2008). Contracting with unknown parties is less risky and, thus, newcomers are less damaged by the institutional environment.

Summarizing, we posit that specialized complementary assets influence incumbents' performance more strongly when *formal* institutions are less developed. In such context, complementary assets not only support incumbents' advantages, but also serve to face institutional constraints to economic exchanges. As a consequence, our second hypothesis is formulated as follows:

***H2. The lower the level of formal institutional development, the higher the influence of the stock of complementary assets on performance.***

#### **4. DATA AND VARIABLES**

##### **4.1. The worldwide telecommunications industry**

Telecommunications industry can be considered as a paradigmatic case of radical technological change as it has experienced the shift from fixed to wireless technology. Fixed telephone services are based on a technology that uses a solid medium, such as metal wire or optical fibre, to allow voice transmissions. Fixed technology had been used up until the last years of the 20<sup>th</sup> century as the main instrument for human communication. Given its consideration as a natural monopoly, fixed line services have been usually provided by one state-owned firm (Amstrong, 1997; Banerjee and Ros, 2004).<sup>3</sup> In most of countries there has been a privatization process in the last three decades. Due to being a state monopolist for a long period of time, we expect these companies to accumulate valuable assets such as reputation, brand value or users' relationships (Dierickx and Cool, 1989).

A new technology based on radio waves was developed in the second half of the 20<sup>th</sup> century (Gruber, 2005). This technological innovation included the use of new methods, materials and knowledge to allow voice transmission. Thus, it can be considered a radical technological disruption (Hill and Rothaermel, 2003). Although some wireless voice transmissions had previously taken place with non-commercial and military uses, it was in the late 80's that analogue mobile phones started to be commercialized (Banerjee and Ros, 2004).

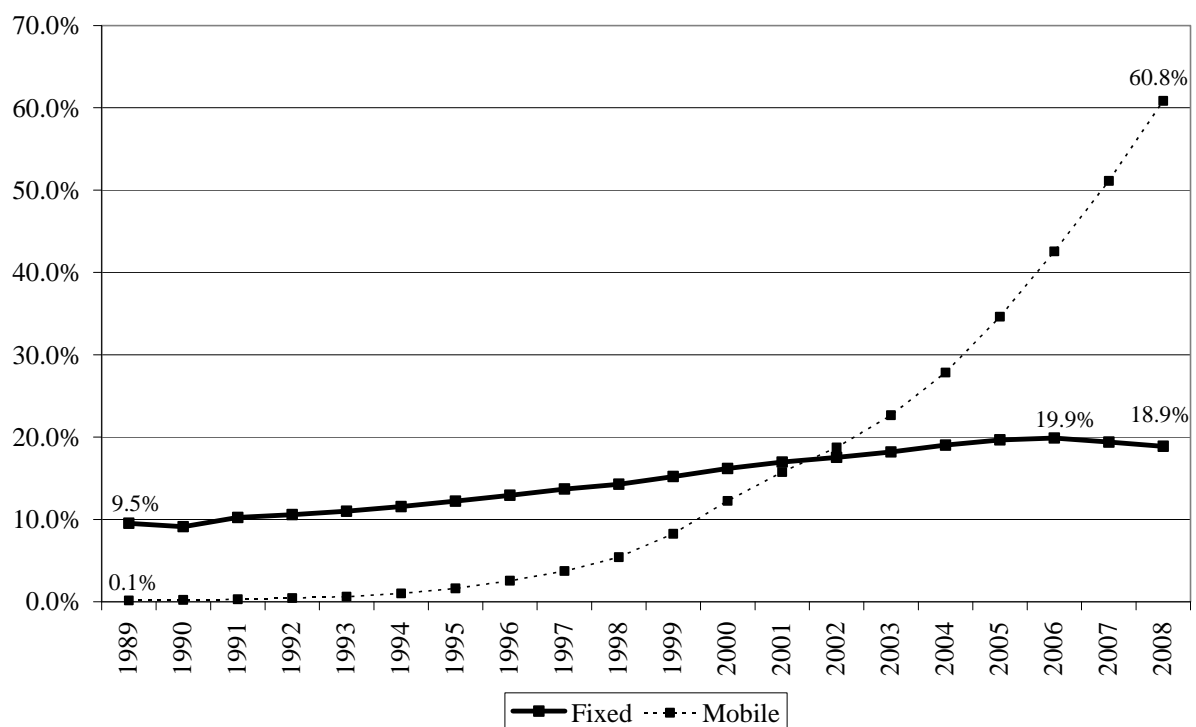
It was in the early 90's with the appearance of digital mobile systems – Second-generation or 2G systems – when the real take-off of mobile communications took place. In this decade, wireless communications started to substitute fixed lines communications in many countries, especially in those that had technological problems in fixed-line technology (Banerjee and Ros, 2004). It can be observed that penetration rates of fixed telephony during the last years of the 20<sup>th</sup> century and the first decade of 21<sup>st</sup> century have not substantially increased around the world in comparison with mobile communications (Figure 1), whose diffusion rate has been proved to dramatically increase during the last decade. As a result of this evolution, the absolute

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<sup>3</sup> In several countries, such as Argentina or United States, the huge territorial extension justified the existence of two or more firms that developed the fixed landline services.

number of mobile users was higher than the fixed main lines for the first time in 2002 (ITU, 2003). Gans, King and Wright (2005) provide an accurate overview of the works that study this substitutive effect. This literature shows that individual's spending on fixed-line telephony decreases when the user also has a mobile phone (Horvath and Maldom, 2002). Cadima and Barros (2000) observe a reduction in fixed-line services demand when there is access to mobile services. Interestingly, the improvement in mobile services has been translated into higher competition, lower prices and higher functionality, which have increased the attractiveness of mobile technology to satisfy communications needs (Gruber, 2001; Gruber and Verboven, 2001; Gans et al., 2005; Rodini, Ward and Woroch, 2003). This substitution effect can also be appreciated in Figure 1 since the penetration rate of fixed technology reached a maximum in 2006 (19.9%) and dropped off to 18.9% in 2008. Due to this fact, telecommunications industry constitutes a useful setting to test our theoretical predictions.

**Figure 1. World fixed and mobile telephony penetration rate (1989-2008)**



Source: The World Bank Group (2010). World Development Indicators.

In this context of radical technological change, incumbents from fixed-line telephony started to operate in wireless telecommunications in most of countries, jointly with newcomers that entered into the market. Given the existence of incumbents and newcomers in mobile communications around the world, this research setting is showed as accurate to measure divergences in the performance between these

agents. Additionally, as having information on the five continents, it is expected to appreciate enough variability on the institutional context in which the operators compete.

## 4.2. Sample and variables

Our database includes the whole population of mobile communications providers that operated in 46 markets between the last quarter of 1998 and the third quarter of 2009.<sup>4</sup> The availability of this wide scope of countries is needed for our institutional comparison purposes. Our data comes from multiple sources, but the main one is the Merrill Lynch Global Wireless Matrix. This publication provides quarterly information on several of the variables of interest such as the name of the firms, the number of subscribers, the number of firms per market and their performance. We have also collected information about incumbency and date of entry, mainly from industry reports and the corporate information of the firms. Institutional data has been obtained from the Heritage Foundation. The sample includes a total of 54 incumbents and 103 newcomers that amounts 3,923 observations.

### *Dependent variable*

$PERFORMANCE_{ikt}$ . Profitability of firm  $i$  in market  $k$  in period  $t$  is measured through EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) divided by the total revenues of the firm.

### *Independent variables*

$INCUMBENCY_{ik}$ . Incumbency is defined as a dummy variable that takes value 1 when the firm  $i$  has been operating as state-owned fixed operator in market  $k$  previously to the introduction of mobile technology and 0 otherwise.

$COMPLEMENTARY ASSETS_{ikt}$ . Our theoretical development suggests that specialized complementary assets confer incumbents' advantages when they are non-tradable, non-imitable, non-substitutable (Dierickx and Cool, 1989; Teece, 1986) and especially important to support the commercialization of the new product innovation in a similar user market (Mitchell, 1991; Rosenbloom and Christensen, 1994; Tripsas,

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<sup>4</sup> The countries considered in our research are Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the United Kingdom (from 1998 to 2009) and, due to availability of data Argentina, Australia, Bangladesh, Brazil, Canada, Chile, Colombia, Egypt, Hong Kong, India, Indonesia, Japan, Korea, Mexico, Morocco, New Zealand, Pakistan, Peru, Philippines, Singapore, South Africa, Taiwan, Thailand, Turkey, United States and Venezuela (from 2005 to 2009).



1997). The measurement of complementary resources in previous literature has been varied from a dummy (1/0) that shows its possession or creation by the firm (Ceccagnoli, 2009; Mitchell, 1989; Tripsas, 1997) to a continuous variable that shows industry experience as a proxy of complementary assets accumulation (Mitchell, 1989).

Reputation is one of the most important complementary assets that can lead incumbents to maintain their advantage in the new technological setting (Helfat and Lieberman, 2002; Mitchell, 1991; Peteraf, 1993). Reputation is the result of previous stock accumulation marked by causal ambiguity and time dependency (Dierickx and Cool, 1989), which assures the non-tradability and non-imitability conditions. It is mainly based on previous relationships between the firm and their stakeholders. The causal ambiguity and the impact of reputation on performance have been considered as one of the most important resources for a firm to succeed (Flanagan & O'Shaughnessy, 2005).

We have previously analyzed the substitution effect between mobile and fixed-line communications. In this context, we posit the complementarity between the fixed-line installed base for the incumbent and its mobile installed base. In the telecommunications industry, the installed base of a company is considered a strategic asset (Shankar and Bayus, 2003) because of the existence of network effects (Birke and Swann, 2006; Doganoglu and Grzybowski, 2007). This means that *the utility that a user derives from consumption of the good increases with the number of other agents consuming the good* (Katz and Shapiro, 1985: 424). Users form expectations about which firm will be dominant in the future, since they prefer choosing a firm that will persist over time with an increasing installed base. For this reason, firms try to launch signals that create users' expectations about their future dominant nature. Reputation has been identified as one of these signals because *in markets where network effects are present, a firm can benefit from having a reputation for selling "successful" products; (...) even more than in other markets, firms with established reputations, well-known brand names, and ready visible access to capital have competitive advantages* (Katz and Shapiro, 1994: 104,107).

We use this interplay between the installed base and the idea of reputation as a proxy of complementary assets in telecommunications. In this industry, incumbents have been usually operating as state monopolist before the introduction of mobile technology. For this reason, the fixed telephony penetration rate represents the number of users in each market that have directly interacted with the incumbent. Thus, it can be argued that the value of reputation for each incumbent will be proportional to the amount of people who know the firm. We closely follow Jones (2003) where the

measure of complementary assets takes into account the average physical line sales of a firm in the U.S. market during the prior three years to the entry of the incumbent in the new technological field. We propose as a measure of complementary assets the average fixed telephony penetration rate of the 3-years immediately prior to the entry of the incumbent in digital mobile technology.

*DEVELOPMENT OF FORMAL INSTITUTIONS* ( $DFI_{kt}$ ). In order to measure the institutional context in market  $k$  in period  $t$ , we built an index based on the yearly Economic Freedom Index provided by The Heritage Foundation. This index has been previously used in the literature with similar purposes (Goerzen and Beamish, 2003; Meyer et al., 2009). The Economic Freedom Index (EFI, thereafter) measures the degree in which all liberties and rights of production, distribution, or consumption of goods and services are guaranteed in each country. In this sense, a higher value of the index means that *formal* institutions (law, regulations...) provide better support to economic exchanges. The full Index is based on 10 items. However, this study only considers those that, according to Meyer et al. (2009), better show the efficiency in markets: trade freedom, business freedom, investment freedom, financial freedom and property rights protection. This Index has been shown to be correlated to other indexes that measure the institutional development of countries, such as the Institutional Development Index calculated by Chan, Isobe and Makino (2008), the Corruption Perceptions Index published by the Transparency International society or the Worldwide Governance Indicators of the World Bank (Kaufmann, Kraay and Mastruzzi, 2010).

#### *Control variables*

We control for the population in market  $k$  in period  $t$  ( $POPULATION_{kt}$ ), which is expected to have a positive relationship with performance, since the potential market will be higher. We also control for country-specific rivalry by taking into account the number of firms operating in market  $k$  in period  $t$  ( $FIRMS_{kt}$ ). This variable is expected to negatively affect firm performance. A third control variable is the time (in months) that the firm  $i$  has been operating in market  $k$  in period  $t$  ( $TIME_{ikt}$ ). Additionally, we control for time in the market because the literature has suggested that after a radical technological change performance could depend on the existence of first mover advantages (Jones, 2003). Thus, a positive relationship between time in the market and performance is expected. The model includes dummies controlling for the effect of a national merger among the firms that appear in the sample during the period under study ( $MERGER_{ikt}$ ). We also control for the possibility that company  $i$  is incumbent in other markets different from  $k$  in period  $t$  ( $FOREIGN\ INCUMBENCY_{ikt}$ ). Finally, the

model considers regional and year dummies to control for geographic and time-specific influences respectively.

### **4.3. Descriptive Statistics**

Descriptive statistics and correlations are shown in Table 1 both referred to 3,923 observations. As can be seen in Table 1, the average firm has an average EBITDA ratio of 0.29, is not an incumbent and has been operating in a country with 63.64 million inhabitants over almost 10 years (117 months). The average number of firms per market is 4. When we analyze the correlation matrix, we interestingly observe that EBITDA is positively correlated with being incumbent, complementary assets (hypothesis 1) and time in the market. The correlation of EBITDA is also positive with population and the existence of a merger. Nevertheless, the correlation becomes negative between EBITDA and institutional development, the number of firms that operate in the market or when a foreign incumbent holds the ownership of the national operator. The correlation among the independent variables is moderate. The only exception is the relationship between incumbency and complementary assets, since only incumbents possess this kind of resources.

TABLE 1. DESCRIPTIVE STATISTICS (N=3,923)

Variable	Mean	Std. Dev.	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. PERFORMANCE	0.29	0.31	-9.17	0.91	-														
2. INCUMBENCY	0.36	0.48	0	1	0.22*	-													
3. COMPLEMENTARY ASSETS	12.94	20.33	0	68.22	0.17*	0.84*	-												
4. DFI	71.37	13.49	24.29	92.14	-0.05*	0.03*	0.23*	-											
5. POPULATION	63.64	137.66	3.86	1155.3	0.02	-0.09*	-0.08*	-0.33*	-										
6. FIRMS	3.84	1.03	2	7	-0.09*	-0.13*	-0.04*	0.02	0.18*	-									
7. FOREIGN INCUMBENCY	0.29	0.46	0	1	-0.09*	-0.16*	-0.24*	0.03	-0.04*	-0.01	-								
8. MERGER	0.05	0.22	0	1	0.02	0.14*	0.12*	0.01	-0.03*	-0.05*	0.13*	-							
9. TIME	117.12	44.99	1	273	0.36*	0.33*	0.30*	0.11*	-0.01	-0.02	-0.08*	0.14*	-						
10. AFRICA	0.03	0.17	0	1	0.09*	0.05*	-0.09*	-0.23*	-0.01	-0.19*	-0.05*	-0.04*	0.05*	-					
11. ASIA	0.18	0.38	0	1	0.06*	-0.10*	-0.12*	-0.27*	0.29*	0.36*	-0.16*	-0.07*	0.16*	-0.08*	-				
12. EUROPE	0.60	0.49	0	1	-0.07*	-0.02	0.08*	0.41*	-0.31*	-0.31*	0.08*	0.00	-0.11*	-0.21*	-0.56*	-			
13. LATIN AMERICA	0.12	0.33	0	1	-0.04*	0.02	-0.15*	-0.41*	0.03*	-0.00	0.18*	0.15*	-0.11*	-0.06*	-0.17*	-0.45*	-		
14. NORTH AMERICA	0.05	0.21	0	1	0.05*	0.11*	0.25*	0.20*	0.21*	0.30*	-0.09*	-0.05*	-0.01	-0.04*	-0.10*	-0.27*	-0.08*	-	
15. PACIFIC	0.29	0.17	0	1	-0.00	0.05*	0.09*	0.17*	-0.06*	-0.08*	-0.05*	-0.03	0.13*	-0.03	-0.08*	-0.21*	-0.06*	-0.04	-

\* Significant at  $p < 0.05$  or less.

## 5. RESULTS

The model we estimate is the following:

$$PERFORMANCE_{ikt} = \beta_0 + \beta_1 COMPLEMENTARY ASSETS_{ikt} + \beta_2 DFI_{kt} + \beta_3 COMPLEMENTARY ASSETS_{ikt} \times DFI_{kt} + \beta_4 CONTROL VARIABLES + \varepsilon_{ikt}$$

Table 2 shows random effect estimates<sup>5</sup> of our model on the relationship between incumbents' performance and the value of complementary resources across different institutional environments. All the equations present heteroskedasticity and autocorrelation consistent (HAC) estimates. To test our hypotheses, we estimated five models. Model 1 only considers the influence of control variables over performance. In Model 2 we include incumbency as independent variable (in order to confirm the positive influence of being incumbent over performance) whereas Model 3 analyzes the influence of complementary assets (Hypothesis 1). Model 4 includes the institutional context while Model 5 is the full model with the interaction between complementary assets and the institutional context (Hypothesis 2). The F-Tests show that the latter is the model that better fits our data.

Model 2 shows that the variable *incumbency* presents a positive and highly significant coefficient. Model 3 shows that the possession of *complementary assets* by incumbents positively influences performance. Their positive and significant effect is maintained in the full Model, thus supporting Hypothesis 1: the accumulation of complementary assets by incumbents leads to an increase in firm performance.

The DFI variable (institutional context) does not have a significant impact, which means that the level of development of formal institutions does not have a direct impact on firm performance. However, the interaction between complementary assets and the institutional context have a negative and significant impact. It means that the lower the development of formal institutions is, the higher the impact of possessing complementary assets to achieve a higher performance, which offers support to our Hypothesis 2.

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<sup>5</sup> The Hausman test has shown that there are systematic individual effects. By running a fixed-effects regression, time-invariant variables are dropped. Several of these variables, such as incumbency or the stock of complementary assets, are the basis of our first hypothesis. Literature argues that, in those cases in which the non-variation of the variable is theoretically justified, the random effects model can be an appropriate alternative (Certo and Semadini, 2006).

Overall, time in the market has a positive and significant effect on performance, while number of firms also has a significant effect on firm performance, but negative. Population and the existence of a merger in a particular market do not have any significant influence on performance in the full model. Interestingly, regional variables show mixed results. If we consider that the European region is the case base, it can be observed that an average operator in North America, Africa or Asia reaches a higher performance, which means that we can find regions that are more profitable than others.

**TABLE 2. COMPLEMENTARY ASSETS, INSTITUTIONS AND PERFORMANCE**

<i>Dependent variable:</i>					
<b>PERFORMANCE</b>	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>
<i>INCUMBENCY</i>		0.0794*** (3.15)			
<i>COMPLEMENTARY ASSETS</i>			0.0016** (2.32)	0.0016** (2.41)	0.0171** (2.36)
<i>DFI</i>				-0.0015 (-0.98)	0.0001 (0.07)
<i>COMPLEMENTARY ASSETS x DFI</i>					-0.0002** (-2.26)
<i>TIME</i>	0.0027*** (6.72)	0.0023*** (5.92)	0.0024*** (6.16)	0.0025*** (6.22)	0.0025*** (6.14)
<i>POPULATION</i>	0.0001* (1.76)	0.0001** (2.07)	0.0001** (1.99)	0.0001 (1.15)	0.0001 (1.52)
<i>FIRMS</i>	-0.0397** (-2.48)	-0.0377** (-2.37)	-0.0392** (-2.46)	-0.0380** (-2.40)	-0.0379** (-2.36)
<i>FOREIGN INCUMBENCY</i>	0.0739 (1.05)	0.0764 (1.09)	0.0783 (1.10)	0.0784 (1.11)	0.0783 (1.11)
<i>MERGER</i>	-0.0456 (-0.59)	-0.0479 (-0.62)	-0.0484 (-0.62)	-0.0470 (-0.61)	-0.0415 (-0.57)
<i>AFRICA</i>	0.1488*** (2.77)	0.1341*** (2.66)	0.1638*** (3.07)	0.1322** (2.07)	0.1571** (2.22)
<i>ASIA</i>	0.0925** (2.10)	0.0938** (2.13)	0.0989** (2.18)	0.0837* (1.86)	0.0945** (1.96)
<i>NORTH AMERICA</i>	0.1862*** (3.64)	0.1519*** (3.08)	0.1413*** (2.92)	0.1555*** (3.18)	0.1756*** (3.53)
<i>LATIN AMERICA</i>	0.0551 (1.51)	0.0370 (1.02)	0.0575 (1.60)	0.0307 (0.69)	0.0411 (0.89)
<i>PACIFIC</i>	-0.0354 (-1.14)	-0.0437 (-1.42)	-0.0475 (-1.56)	-0.0368 (-1.14)	-0.0138 (-0.43)
<i>CONSTANT</i>	0.1845*** (3.20)	0.1651*** (2.76)	0.1717*** (2.88)	0.2717** (2.09)	0.1438 (0.87)
<i>TIME EFFECTS</i>	YES***	YES***	YES***	YES***	YES***
<b>N</b>	3,923	3,923	3,923	3,923	3,923
<b>F-Test vs. (1)</b>		9.89***	5.37**	7.93**	9.77**
<b>F-Test vs. (3)</b>				0.96	8.25**
<b>F-Test vs. (4)</b>					5.12**

*t* statistics in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## 6. DISCUSSION AND CONCLUSIONS

This paper sheds light on the understanding of the conditions which lead incumbents to survive or even outperform rivals when confronting a radical technological innovation. We bring the institutional theory into our analysis by arguing that complementary resources that allow incumbents to succeed in radical technological environments are contingent to the institutional context they compete in. Our research contributes to the existing literature by integrating research on technological discontinuities and the new institutionalism literature (Oliver, 1997; Peng et al., 2009). By bringing the institutional theory to our research, we aim at responding to both the call by Peng et al. (2009), claiming that institution-based view must be considered as the third leading perspective in strategic management, and the one made by Bamberger (2008) on using *context theories to narrow the micro-macro gap in management research*.

Our conclusions confirm the importance of complementary assets as mediators in the relationship incumbent-performance after a radical technological change. This result is consistent with previous findings (Mitchell, 1991; Tripsas, 1997; Hill and Rothaermel, 2003). The study also provides some evidence on the conditions that allow incumbents to survive in changing technological environments.

Additionally, our results show that the value of complementary resources varies across institutional environments. More precisely, these resources are more important to support incumbents' performance in markets with a less *formal* institutional development. Under these circumstances, complementary assets do not only support incumbents' performance, but also serve to counteract institutional constraints to economic activities, such as contractual and political risk, by increasing information, reducing transaction costs and legitimating firm to operate into the market. On the contrary, with high *formal* institutions, external formal mechanisms replace informal ties and protect the property rights of the parties. As a consequence, complementary assets become less important to support firm performance.

Interestingly, our results on the influence of geographical regions on performance suggest that the average European market is more competitive, while markets in North America, Asia or Africa seem to be less competitive with the subsequent effect on firm performance. This finding is consistent with recent industry reports (Gillet, 2011) on the competitiveness of the European market vis-à-vis other regions. Companies in less competitive markets are then able to take advantage of their market power. This finding



could be useful in future research at explaining the internationalization process followed by the main mobile communications companies in the last decade.

Our research has also some implications for the management literature. Although most of the literature has been keeping its attention mainly on incumbents' disadvantages, we have offered additional empirical evidence in that incumbents' advantages may exist. Complementary assets built in previous relationships by incumbents with their stakeholders are difficult to copy by newcomers. This evidence could also have important implications for MNE to select the entry mode into a new market. To the extent that complementary assets are important determinants of firm performance, we argue that entering into a market with less *formal* institutional context – where there has been a radical technological change – will be more beneficial through a joint venture or an acquisition of an established company than through a greenfield, to the extent that it facilitates the appropriation of specialized resources. Several studies have extended this link between institutional development and modes of entry (Brouthers et al., 2008; Meyer et al., 2009; Rothaermel, 2001) and this clearly constitutes a promising avenue for further research.

Our study also provides interesting results from a policy point of view. One of the main objectives of the regulator is to foster market competition, with a subsequent increase in social welfare. The availability of a regulatory framework that favours economic exchanges may have *undesirable* consequences on firm's performance. Policy makers have an important role in establishing a legal context that better supports market efficiency and enhances the entry of new competitors, thus weakening incumbents' advantages.

For instance, extant literature (Lieberman and Montgomery, 1988; Mitchell, 1991) as well as our own research has shown that entry timing constitutes a strategic weapon in explaining incumbents' survival after a radical technological innovation. The existence of first mover advantages has been shown as a determining factor at explaining the success of incumbents in the mobile telecommunications industry (Usero and Fernández, 2009; Gomez and Maicas, 2010). If governments want to encourage competition after a technological innovation, it is important to adopt a proactive behaviour to foster the early entry of new players. This attitude is especially important in the case of mobile communications, where the availability of the radio spectrum limits the licences, and the regulator has to decide the number of competitors in the market and the number of licences it grants at any time. Thus, if the regulator gives a licence to the former state monopolist in fixed telephony (incumbent) and do

not introduce competition at the proper time, the incumbent can obtain a great advantage over the newcomers.

In spite of the contribution of our research by integrating literatures on technological management and new institutional-based view, several issues deserve additional attention. We have exclusively focused on the role of complementary resources that are based on the relationships that the incumbent has previously built. However, further empirical and theoretical study is needed to determine how these complementary assets are integrated with technological and investment capabilities to increase firm competitive performance. Besides, the link between resources and institutions should also be elaborated more strongly. We have paid attention to the development of *formal* institutions as a whole. However, other studies have tended to identify different dimensions of institutions, such as economic, political or social ones (Chan et al., 2008). Future research should develop the interplay between complementary resources and the dimensions of institutions.

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