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Technological change and internationalization in network industries : An institutional approach

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TECHNOLOGICAL CHANGE AND INTERNATIONALIZATION IN NETWORK INDUSTRIES : AN INSTITUTIONAL APPROACH

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DOCTORAL THESIS

TECHNOLOGICAL CHANGE AND INTERNATIONALIZATION IN NETWORK INDUSTRIES: AN INSTITUTIONAL APPROACH

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CHAPTER 1. INTRODUCTION

CHAPTER 2. RESEARCH SETTING: MOBILE COMMUNICATIONS INDUSTRY

Chapter 1.

INTRODUCTION

1.1. INTRODUCTION

Strategic management has traditionally focused on the strategic choices that firms should make in order to gain a sustainable competitive advantage. In other words, firms seek to obtain a performance that exceeds the average of the industry (Porter, 1985). To explain the sources of sustainable competitive advantage, the management literature has mainly focused on external (industry-based, Bain, 1956, 1968; Mason, 1939) and internal (firm-based, Penrose, 1959; Barney, 1991) factors. The continuous change in the focus of analysis between these two approaches has been compared to a "pendulum swing" (Hoskisson, Hitt, Wan and Yiu, 1999).

The latest swing, which took place in the first decade of the 21st century, again focused on two external factors, namely, network effects and institutions, as key determinants of firm behavior and performance. This has led to the strategic consideration of variables that have traditionally been either underestimated or considered as background conditions (McIntyre and Subramaniam, 2009; Meyer, Estrin, Bhaumik and Peng, 2009; Peng, Sun, Pinkham and Chen, 2009; Suarez, 2005).

First, competition under network effects has its origin in technological developments which, since the 80's, have led to an increasing worldwide presence of information industries, such as software, hardware, telecommunications and social networks. For instance, at the end of 2011, the number of tweets per day passed the 200 million mark, there were more than 500 million Facebook users and 5,300 million mobile users. These are only some examples of industries that have been

recently created and have rapidly increased their presence across the world. In this type of industries, the presence of network effects means that user utility depends not only on product characteristics, such as price and quality, but also on the number of other users consuming the same product (Katz and Shapiro, 1994). Users prefer to join the network with a higher number of users and this accelerates product penetration (Gruber, 2005). Shapiro and Varian (1998) determined that network effects do not change economic laws and, thus, traditional perspectives of strategic management can be applied in this context. But it is important to note that competition under network effects introduces several particularities in strategic management analysis. In contrast to traditional industries in which product characteristics - e.g. price and quality – are key variables to determine strategy and performance, in network industries, network characteristics – e.g. size and composition – are more important in conferring competitive advantages (Arthur, 1990; McIntyre and Subramanian, 2009; Suarez, 2005).

The literature has highlighted that, in network industries, value does not reside in the product itself, but in the network of users. This means that traditional strategies based on quality differentiation and cost leadership (Porter, 1985) become less important. In network industries, strategic decisions should try to influence users' expectations about the future size of the network to increase current network value. In this way, price and quality lose importance as key strategic variables, while reputation and brand value become more prominent (Katz and Shapiro, 1994). Surprisingly, the analysis of strategic management to increase network

value and firm performance in network industries remains underdeveloped (McIntyre and Subramaniam, 2009).

Secondly, the institutional environment in which firms operate has traditionally been considered as a background condition (Peng, Wang, and Jiang, 2008). Institutions, such as laws, traditions and culture, have been relegated to being control variables in empirical analysis instead of constituting key explanatory variables. In the mid 1950's, the neoinstitutionalist perspective emerged in sociological studies to analyze the structure and behavior of organizations (Scott, 2008). Several decades later, North (1990) incorporated the role of institutions into the economic discourse from a transaction costs perspective. However, strategic management literature has recently taken into consideration the institutional perspective of firm strategy (Peng, Sun, Pinkham and Chen, 2009). From this perspective, institutions, along with industry and resource conditions, are understood as key determinants of strategic choices and firm performance. Under the institution-based perspective of strategic management, strategic choices are understood as the result of the dynamic interaction between organizations (conditioned by industry structure and resource allocation) and institutions (both formal and informal). Thus, the behavior and performance of an organization should be analyzed within the institutional framework where it operates (Peng et al., 2005; Peng, 2002) because strategies which are successful in one institutional context can fail in others (Hoskisson et al., 1999). Surprisingly, the use of the institution-based view of strategy remains underexplored (Peng et al., 2009).

Both network effects and institutions have traditionally been considered as background conditions and included as control variables in empirical analyses (McIntyre and Subramaniam, 2009; Peng et al., 2009). Consequently, there is still a great deal left to do in the strategic analysis of these two key elements. Not taking into account the importance of managing network value, instead of product value, and the direct impact of institutions on the outcomes of strategic choices can result in mistaken decisions which prevent firms from achieving a sustainable competitive advantage and expel them from the market.

This dissertation aims to analyze the key role of network effects and institutions in strategic management analysis in depth. The following sections try to contextualize and develop the basic concepts of both research lines. Section 1.2 introduces the main concepts of competition in network industries, while Section 1.3 offers a review of the institution-based view of firm strategy. Section 1.4 describes the structure, content and contributions of the other chapters of this dissertation.

1.2. COMPETITION IN NETWORK INDUSTRIES

1.2.1. Network effects: concept and typology

Network industries are those which exhibit network effects. *Network effects* arise when user utility from consuming a product increases with the number of other users consuming the same good or service (Katz and Shapiro, 1994; Farrell and Klemperer, 2007).

The traditional typology of network effects differentiates between direct and indirect network effects (Birke and Swann, 2006; Farrell and Klemperer, 2007; Katz and Shapiro, 1985, 1994; Suarez, 2005). *Direct* network effects appear when the increase in the number of users of a network directly benefits network users (Birke and Swann, 2005). Paradigmatic examples of industries with direct network effects are telephony, fax, e-mail and social networks. In this kind of industries, the use of the main product – e.g., a handset or a fax machine – does not offer any utility to a user if there are no other users consuming the same product because its utility derives from exchanging information. Thus, the intrinsic design of the product is usually a driver of direct network effects (McIntyre and Subramaniam, 2009).

Indirect network effects appear when the increase in the number of users of a network indirectly benefits network users by increasing the availability of complementary and compatible products to the main product of that network (Birke and Swann, 2005). Examples such as software, hardware, video consoles and the videogame industry serve to illustrate this kind of network effects. The increase in the number of users consuming a product stimulates the interest of designers and manufacturers to develop complementary products which, ultimately, increases the utility of network users of the main product.

An alternative classification of network effects differentiates, depending on the type of user under consideration, between total and marginal network effects. *Total* network effects refer to the increase in the utility of current users of a network when a new user is added to that network,

whereas *marginal* network effects refer to the increase in the incentives of potential users to join the network when a new user is added (Farrell and Klemperer, 2007). In this classification, marginal network effects refer to another of the drivers of network effects, namely, user expectations. Users choose between networks depending on the future size that they expect the network will have. The rise in the number of current users increases potential users' expectations and, thus, their incentives to join the network in the future (marginal network effects).

Finally, it is important to note that network effects can take place at industry-level and firm-level. *Industry-level* network effects occur when the increase in the number of users of a firm increases the utility of users of that product of other firms in the same industry. It means that there is compatibility between products of two firms of the same industry, e.g. in the fax-machine industry. *Firm-level* network effects take place when the products of two firms have some degree of incompatibility which prevents users of two different networks from being able to exchange information without extra costs. An additional user only benefits users of the same firm, but not users of the other companies of the industry. For instance, firm-level network effects appear in the mobile telecommunications industry because firm networks are usually technologically compatible (users can make calls between two different networks) but are economically incompatible (users have to pay more for off-net calls than for on-net calls) (Grajek, 2010).

1.2.2. The extent and importance of network industries in the worldwide economy

One of the reasons that strategic management in network industries deserves extra attention is that there are numerous examples of businesses that exhibit network effects. However, it is important to note that the intensity of network effects varies across industries. Table 1.1, borrowed from Srinivasan, Lilien and Rangaswamy (2004), shows 45 network industries ordered according to their degree of intensity of network effects. They carry out a survey in which experts score, from 1 to 7, the degree of direct and indirect network externalities of a set of products. They build an overall index which is the sum of the scores for the intensity of direct and indirect network effects. The overall index has values between 2 (no network externalities) and 14 (high network externalities). Industries which show the most intensive network effects are software (operating system, word processing and spreadsheet), personal data assistant, fax machine, internet service provider and cellular telephone industries.

As McIntyre and Subramaniam (2009) highlight, a high intensity of network effects can be explained by factors such as product design (e.g. fax machine and mobile telephone), degree of necessity of complementary products (e.g. software/hardware and video games/ consoles) and importance of social dynamics in product adoption (e.g. internet service providers).

Table 1.1 Examples of network industries by intensity of network effects

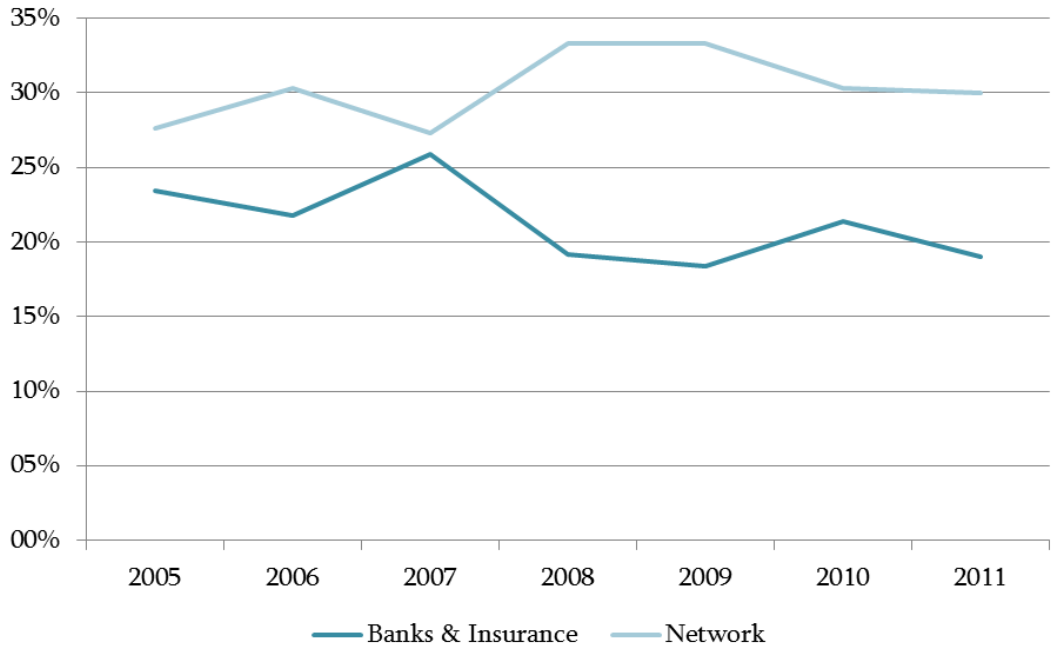
Rank	Product	Intensity of network effects
1	Operating system for personal computer	12.1
2	Personal data assistant	10.7
3	Fax machine	10.6
4	Word processing software	10.4
5	Spreadsheet software	10.2
6	Internet service provider	10.1
7	Cellular telephone	10
8	Database software	9.6
9	Workstation	9.6
10	Digital videodisc player	9.4
11	Home VCR	9.4
12	Videogame	9.4
13	Audiocassette player	9.3
14	CD player	9.3
15	CD-ROM drive	9.3
16	Mailframe computer	9.3
17	3.5 inch floppy disk drive	9.1
18	Personal computer	9
19	Automatic teller machine	8.9
20	Desktop publishing software	8.7
21	Notebook computer	8.7
22	Color television	8.4
23	High-definition television	8.4
24	Internet browser	7.6
25	Pager	7.4
26	Presentation Software	7.1
27	Antivirus Software	6.8
28	Computer-aided design software	6.8
29	Personal finance software	6.8
30	Flat-bed scanner	6.6
31	Digital camera	6.2
32	Ink-jet printer	6.2
33	Laser printer	6.2
34	Camcorder	6.1
35	Dot matrix printer	6
36	Home microwave ovens	5.8
37	Projection television	5.6
38	Instant photography	5.4
39	Photocopier	4.7
40	Single-use camera	4.4
41	Cordless telephone	4.3
42	Telephone answering machine	4.3
43	Food processor	4.1
44	Electric toothbrush	3.4
45	Pocket calculator	3.4

Source: Srinivasan, Lilien and Ragaswamy (2004)

Network industries do not only have academic interest. They also have important economic effects. As an illustration, the FT 500 Index, provided by the Financial Times Group, is made up of the 500 largest firms in the world by market value (in US dollars). In 2011, 20% of the firms belonged to the financial sector (that includes banks, financial services and insurance firms). Hardware, software and telecommunication firms (which are *network firms*) accounted for 13%. The relative importance of other traditional industries in this index such as oil and gas (11%), mining (6.5%), retailing (4.4%) and pharmaceutical (4%) is lower than that of network firms.

Even though the financial sector has the highest number of firms in the index, it is important to note that network firms tend to be better positioned. Figure 1.1 shows that from 2005 to 2011, on average, 30% of network firms in the FT 500 Index rank in the top 100, whereas only 20% of financial firms do.

Figure 1.1. Percentage of FT 500 Index firms in the top 100 by industry (2005-2011)



Source: FT 500 Index (2005-2011)

Table 1.2 shows the network firms ranked among the 100 largest firms in the world from 2001 to 2011. In the software/hardware industry, firms such as Microsoft and IBM have maintained a leading position. Apple has climbed up the table and became the third largest firm in the world in 2011. In telecommunications China Mobile, AT&T, Vodafone and Telefónica are among the 50 largest firms.

Table 1.2. Position of network firms in the FT 500 Index (2001-2011)

Firm	Industry	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Apple	Hardware							85	39	33	5	3
Microsoft	Software	5	2	1	2	3	3	3	7	6	3	10
IBM	Software	18	12	10	14	13	26	31	27	14	21	14
China Mobile	Telecom	34	59	66	67	64	38	16	5	5	10	16
AT&T	Telecom	54	63				37	5	8	7	24	20
Oracle	Software	14	46	45	60	66	77	65	62	37	37	22
Google	Software						60	51	56	39	30	28
Vodafone	Telecom	8	17	13	12	12	29	32	28	34	42	30
Samsung	Hardware		85	67	45	52	35	56	58	51	43	36
Telefónica	Telecom	61	69	57	47	38	64	47	35	32	48	44
Intel	Hardware	9	7	15	8	15	33	46	42	40	40	47
Verizon Com.	Telecom	21	19	22	26	33	41	45	55	38	58	48
Cisco	Hardware	2	20	24	11	27	24	28	32	28	27	57
Qualcomm	Hardware	80			78	75	57	101	99	52	77	62
Hewlett-Packard	Hardware	68		53	50	68	45	48	48	44	39	64

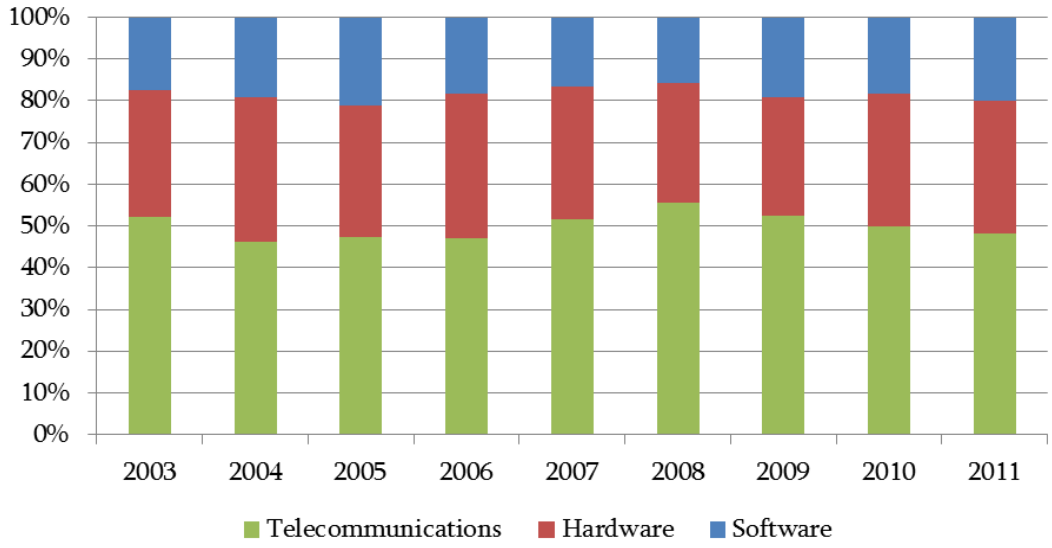
Table 1.2. Position of network firms in the FT 500 Index (2001-2011) (continuation)

Firm	Industry	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
AMX	Telecom								87			76
NTT Docomo*	Telecom	16	14	19	25	42	80	77	92	56	83	85
SAP	Software		73		85	97	82			84	97	91
France Telecom	Telecom	39		71	53	49			72	55	91	
Canon	Hardware										93	
Deutsche Telekom	Telecom	40	51	56	40	40	75	96	88	67	99	
Nokia	Hardware	12	30	31	30	54	46	62	43	81		
Nintendo	Videogame								90	92		
Dell	Hardware		48	30	36	36	81					
Bellsouth	Telecom	53	47	64	83		97					
SBC	Telecom	17	18	35	41	45						
Telecom Italia**	Telecom	84	64	59	91	74						
Telstra	Telecom			96		99						
Texas Instruments	Hardware	44	61	99	80							
Vivendi	Telecom	66	94									

* NTT Docomo includes fixed and mobile business from 2001 to 2010 ** Telecom Italia includes fixed and mobile business from 2001 to 2005
Source: FT 500 Index (2001-2011)

With regard to the weight of each type of network industry in the FT 500 Index, Figure 1.2 shows that most network firms belong to the telecommunications industry, followed by hardware and, lastly, software.

Figure 1.2. Percentage of firms by network industry of the FT 500 Index (2003-2011)



Source: FT 500 Index (2005-2011)

Based on the data presented above, the telecommunications industry, and especially mobile telephony, is an interesting research setting to analyze competitive dynamics in network industries.

Mobile telephony ranks 7th among the industries with the most intensive network effects, see Table 1.1, and is the network industry with the most firms positioned in the top 500, see Figure 1.2.

1.2.3. Competing in network industries: Changing the focus from product value to network value

Shapiro and Varian (1998) already pointed out in the last century that *technology changes, economic laws do not.* This means that traditional perspectives of strategic management analysis could be used to analyze firm competitive behavior in network industries. However, network industries have some differences compared to traditional industries that must be taken into consideration. For instance, whereas in traditional industries value mainly resides in the product offered by the firm, value in network industries comes from the network of users which consume the same product of the firm (McIntyre and Subramaniam, 2009). Thus, network size determines the incentives of current users to remain in the network (*total* network effects) and the incentives of potential users to join the network (*marginal* network effects) (Farrell and Klemperer, 2007). The importance of network size to determine the choice of potential users of a firm network in the future has several implications for strategic management.

First, the network size of the firm becomes a key element to compete with rivals since it gives utility to users. This means that firms which entered the market earlier and rapidly built an installed user base are in a better position than later entrants. This competitive advantage is based on achieving an early network size, even when the quality of the product is worse. The literature has highlighted that network industries are characterized by *path dependence* (McIntyre and Subramaniam, 2009). There are several examples of technologies or products which

failed because they entered the market later, even though the quality was higher. One was the failure of the alternative standard to the QWERTY keyboard (David, 1985) and the light water technology for nuclear power reactors (Cowan, 1990). Whereas, in traditional industries, product quality is a strategic variable that directly influences performance (Porter, 1981), in network industries, strategic choices focused on quality improvement will not have the same effect.

Second, given that an increase in network size increases the incentives of potential users to join the network (*marginal* network effects), an increase in the network size in one period will lead to a higher network size in the following period. This has been called *positive feedback* (Arthur, 1990). In the words of Shapiro and Varian (1998), *positive feedback makes the strong get stronger and the weak get weaker*. If this process continued over time, it would result in markets with a monopolistic company. This case has been conceptualized as the *winner-take-all* situation and it would appear if all customers considered that only one firm will dominate the market in the future (McIntyre and Subramaniam, 2009). Thus, expectation management plays a key role in determining the success of firms in network industries. Strategic choices which increase user expectations about the future network size of the firm, such as brand and reputation management, will be especially important for achieving a better performance than its rivals (Katz and Shapiro, 1994; Shapiro and Varian, 1998).

Finally, Katz and Shapiro (1985) determined that, when network effects exist, *if consumers expect a seller to be dominant, then consumers will*

be willing to pay more for the firm's product, and it will, in fact, be dominant. In contrast to traditional industries, in network industries users are willing to pay more to be part of a firm network even when there are competitors that offer lower prices because users want to benefit from a larger network size. The product is more valuable as more people use it (Doganoglu and Gryzbowski, 2007). Thus, strategic choices based on price management are less important in network industries.

In sum, network effects require a change in the focus of attention from product value to network value. Strategic decisions based on managing users' expectations and network size will take on a key role in achieving competitive advantage, in contrast to traditional decisions based on price and quality. Economic laws do not change but the key elements of strategic management do. Overall, strategic management analysis in network industries remains underexplored (McIntyre and Subramaniam, 2009) and this dissertation tries to shed light on this issue.

1.3. THE INSTITUTION-BASED VIEW OF STRATEGY

1.3.1. An overview of strategic management research

The institutional perspective of strategic management has received increasing attention in recent years (Cuervo-Cazurra and Genc, 2008; Makino, Isobe and Chan, 2004; Meyer, Estrin, Bhaumik and Peng, 2009; Peng et al., 2009). This interest in institutions is a result of an evolution in the theories of strategic management, whose attention has varied in a "pendulum swing" between internal and external factors (Hoskisson et al., 1999).

During the 1960's, strategic management literature mainly consisted of case studies which focused on the role of manager skills (Andrews, 1971; Ansoff, 1965; Chandler, 1962). The next swing of the *pendulum* in the 1980's highlighted the importance of industry structure in determining differences in performance between firms. The structure-conduct-results paradigm and the analysis of external competitive forces emerged in strategic management literature (Bain, 1956, 1968; Mason, 1939; Porter, 1980, 1981, 1985). However, explanations about differences in performance between firms of the same industry remained underexplored. As a consequence, a new perspective based on the internal factors of firms was developed during 1990's. The resource-based view proposed resource and capabilities allocation as drivers of firm performance (Barney, 1991; Dierickx and Cool, 1989; Penrose, 1959; Peteraf, 1993; Rumelt, 1984; Wernerfelt, 1984). The firm, as a set of valuable, rare, inimitable and irreplaceable resources, once again became the unit of analysis.

As could be expected, the 21st century has seen the return of the environment as a key determinant of firm behavior and performance. However, strategic management analysis has not focused on specific industry environments, as it did in the 1980's. The new perspective highlights the macroeconomic environment which is common to all industries. Formal institutions, such as laws and regulations, and informal institutions, such as customs, traditions and culture, are understood to determine both strategic decisions and performance (Peng et al., 2009). Interest in institutional variables, which are usually country specific, is mainly a consequence of the globalization process which most

industries have undergone in recent decades (Dunning and Lundan, 2008).

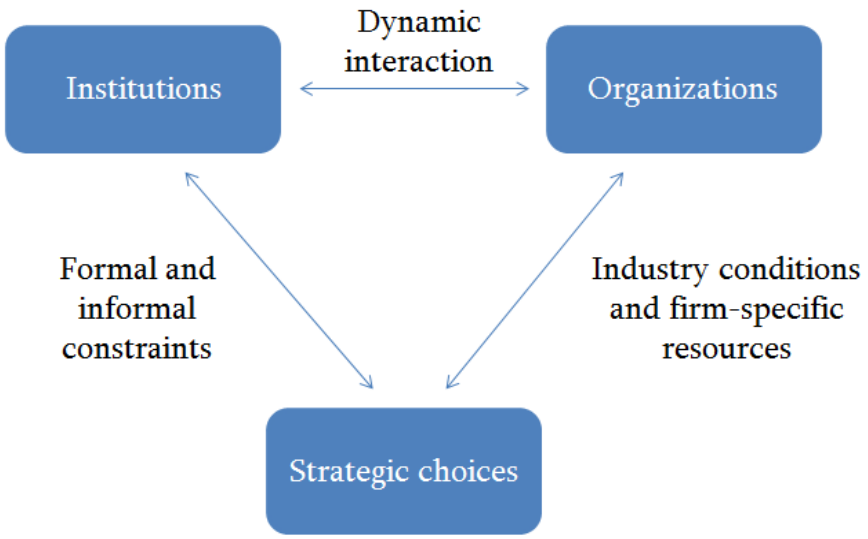
1.3.2. The institution-based view of strategic management

Institutions are 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). They have been also defined as *cognitive, normative and regulative structures and activities that provide stability and meaning to social behavior* (Scott, 2008: 33).They are gaining more and more relevance in the explanation of market competition and firm performance. It is argued that strategic choices do not only depend on industry structure (industry perspective) and firm resources and capabilities (resource perspective), but also on formal and informal restrictions from the institutional context (institutional perspective). It is acknowledged that *firm strategies, organization structures, and governance mechanisms successfully pursued and implemented in a particular institutional context may not achieve the same outcomes in another institutional context* (Hoskisson et al., 1999: 445).

The interaction between institutions, organizations and strategic choices has recently become a research issue in management literature (Peng et al., 2008). The behavior and performance of an organization should be analyzed within the institutional framework in which it operates (Peng et al., 2005; Peng, 2002; Singh, 2007). According to the model of Peng (2000) (Figure 1.3), strategic choices are the outcome of a dynamic interaction between institutions and organizations which is conditioned

by formal and informal rules, industry conditions and resource allocation.

Figure 1.3. Institutions, organizations and strategic choices



Source: Peng, MW (2000). Business Strategies in Transition Economies. Thousand Oaks, CA: Sage

The difference between this institution-based view of strategic management and previous theories is that it integrates the industry and resource-based perspectives. The institution-based view complements previous theories and, according to Peng, Sun, Pinkham and Chen (2009), constitutes 'a third leg for a strategy tripod'. This perspective uses the theory of transaction costs economy (TCE) to explain how institutions reduce uncertainty and asymmetric information between contractual parts (North, 1990) and how this can affect strategic choices and performance (Meyer et al., 2009).

The introduction of the institution-based view into strategic literature is recent. Empirical analyses have mainly focused on foreign direct investment (FDI) decisions made by multinational enterprises (MNEs) (Brouthers, Brouthers and Werner, 2008; Chan, Isobe and Makino, 2008; Cuervo-Cazurra and Genc, 2008; Meyer et al., 2009). These studies have focused on the effect of macroeconomic institutions, such as property rights protection, corruption, rule of law and cultural distance, in host country selection and entry mode choice (Dunning and Lundan, 2008).

In sum, although the institution-based view of strategy is considered a third key perspective in strategic management analysis (Peng et al., 2008), its integration with previous perspectives and strategic management issues requires further attention. Moreover, the influences of formal and informal institutions in strategic management have been analyzed separately, instead of being considered as complementary parts of the same puzzle (Makino and Tsang, 2011). Thus, further research which incorporates the role of context, both formal and informal, in the strategic management analysis is necessary (Bamberger, 2008; Peng, 2002).

1.4. STRUCTURE

This dissertation aims to analyze the key role of network effects and institutions in strategic management analysis in depth. In the following chapters, the traditional consideration of both these elements as background conditions is replaced by their taking on a key role in explaining firm choices and performance within an industry. Figure 1.4

shows a summary of the structure of the dissertation, which is explained below.

Chapter 2, titled "*Research Setting: Mobile Telecommunications Industry*", describes the evolution of the mobile industry in European and non-European countries and identifies the main characteristics which make this industry an adequate research setting for the three empirical analyses of the following chapters.

Chapter 3, "*Strategic choices, network value and performance: a strategic approach to network value in network industries*", aims to extend previous literature by analyzing the role that firm strategy plays in markets where network effects are important. In a context of competition under direct and firm-level network effects, this chapter posits that firms can benefit from the existence of network effects through their strategic choices. It proposes a theoretical model in which strategic choices can improve network value by influencing the antecedents of network effects, i.e. expectations, coordination, and compatibility.

The main contributions of Chapter 3 are the following. First, it proposes a theoretical model about how strategic choices influence network value and, thus, firm performance. Second, it empirically tests this model by considering the impact of three key strategic choices on network value, namely, timing of entry, the degree of internationalization and switching costs management. Finally, Chapter 3 proposes a new measure of network value which corrects previous measures by considering not only network size but also the intensity of network effects.

Chapter 4, *"Strategic choices and institutions in the FDI process: where to enter"*, aims to analyze the influence of the institutional environment, both formal and informal, on host market selection by MNEs. This chapter takes as its context the process of internationalization, which has been the traditional focus of attention of the institution-based view. It proposes that strong formal institutions, such as laws, regulations and judicial systems which support economic exchanges by reducing contractual risks, can diminish the negative effect that cultural distance has on the likelihood of entering a country.

The main contributions of Chapter 4 are the following. First, formal and informal institutions are considered complementary in explaining host market selection, whereas previous studies have tended to focus on formal and informal institutions separately. Second, this chapter offers a very rich empirical setting by covering home and host countries from five continents, while previous studies have tended to focus on entry decisions of MNEs from the same home country.

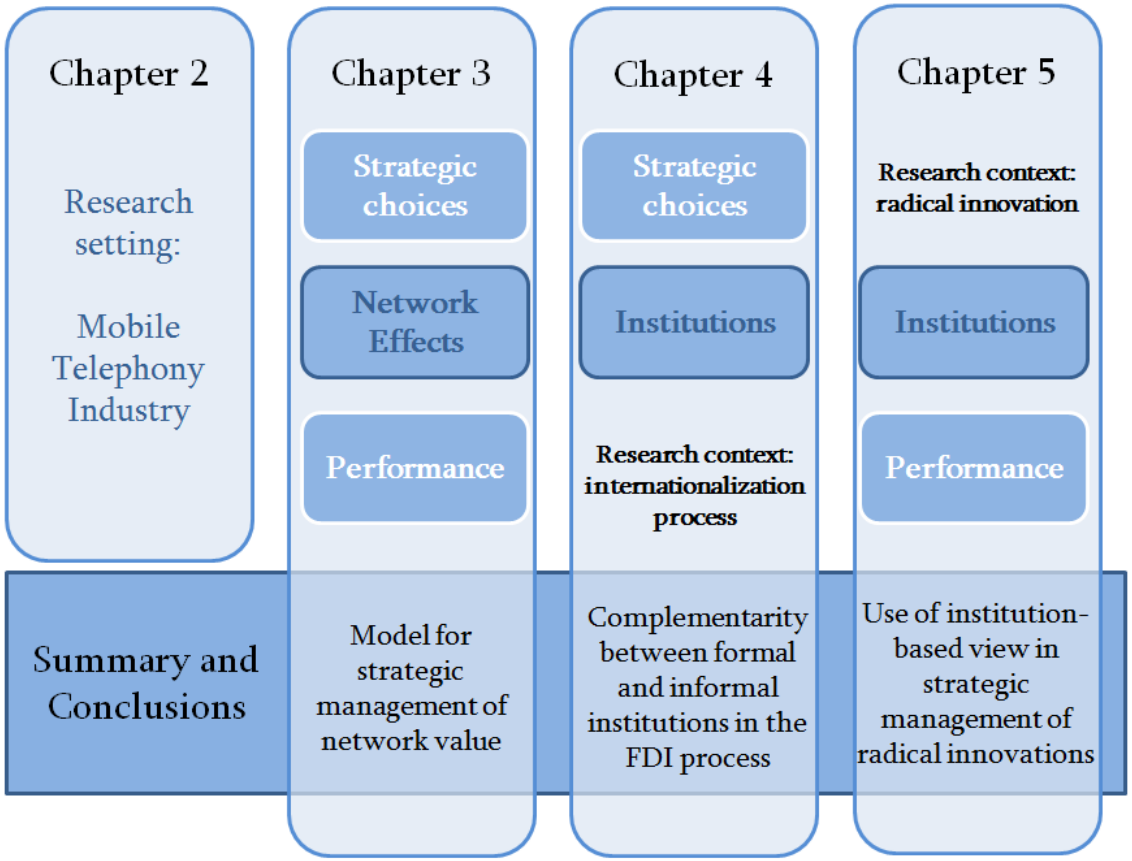
Chapter 5, *"Institutions and performance after a radical technological change: How the value of specialized complementary resources varies across markets"*, aims to analyze the impact of formal institutions on the achievement of incumbents' advantages after a radical technological change. The institutional perspective is used in a research topic which has traditionally been analyzed from the resource-based view. This chapter posits that, after a radical technological change, the value of specialized complementary resources – resources attained by incumbents that help them to commercialize the innovation and are difficult for

newcomers to replicate – depends on the institutional environment in which the firms operate. The key hypothesis of this chapter is that the degree of development of formal institutions (weaker vs. stronger) moderates the relationship between the stock of specialized complementary assets and firm performance.

The main contributions of Chapter 5 are threefold. First, the technology management and the institution-based view literature are integrated to understand how complementary resources can help incumbents to succeed in turbulent environments. Second, it offers additional empirical support for incumbents' advantages in technological dynamic environments. Third, evidence based on a wide sample of countries covering the five continents is presented, which allows a higher level of generalizability for our results.

Finally, *"Summary and Conclusions"*, includes a summary of the main findings and contributions of this dissertation.

Figure 1.4. Dissertation structure



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Chapter 2.

RESEARCH SETTING:

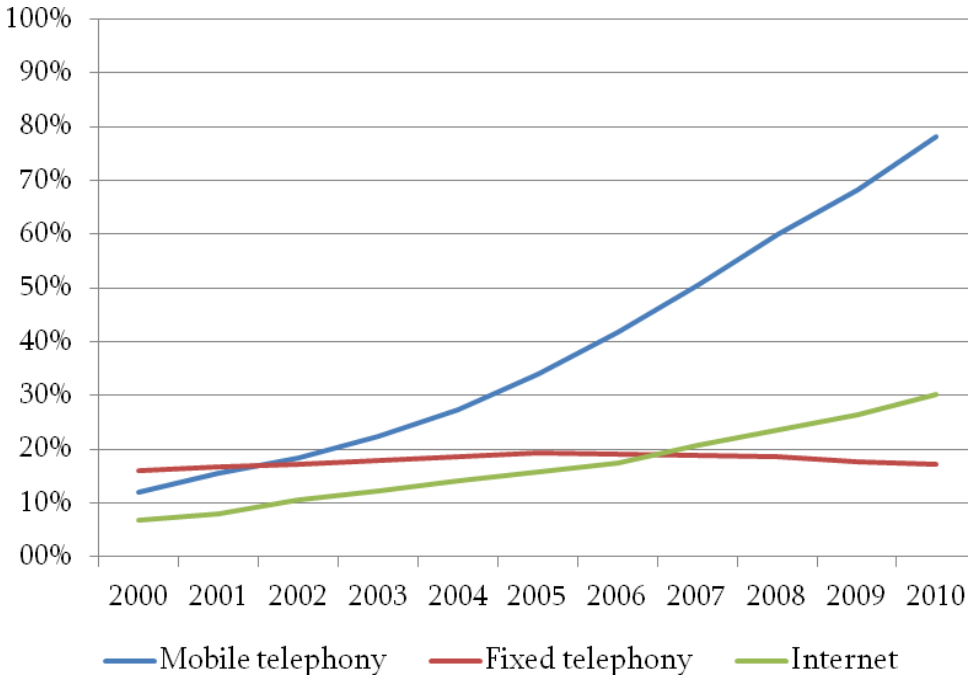
MOBILE COMMUNICATIONS INDUSTRY

2.1. INTRODUCTION

The mobile communications industry has attracted the attention of scholars from many different disciplines (Birke and Swann, 2006; Fuentelsaz, Maicas and Polo, 2012; Gruber and Verboven, 2001, Jang, Dai and Sung, 2005; Maicas, Polo and Sese, 2010), which is not surprising given the social and economic importance of mobile communications in our society (Fuentelsaz, Maicas and Polo, 2008).

Mobile telecommunications are now part of daily life. To illustrate this, Figure 2.1 shows that the mobile penetration rate grew substantially from 12% in 2000 to 78% in 2011. This means that, nowadays, almost everybody around the world possesses at least one handset. Having a mobile has become the rule when 10 years ago it was the exception. This quick diffusion of mobile technology has no precedents in other technologies. Figure 2.1 also shows that, for instance, fixed telephony and the Internet have not reached such high penetration rates and their growth rhythms are very different to that of mobile telephony. Although the worldwide presence of the Internet is increasing, its annual growth is lower than that of mobile communications. The penetration rate of fixed telephony and its comparison with mobile communications will be the focus of our attention in Section 2.5.

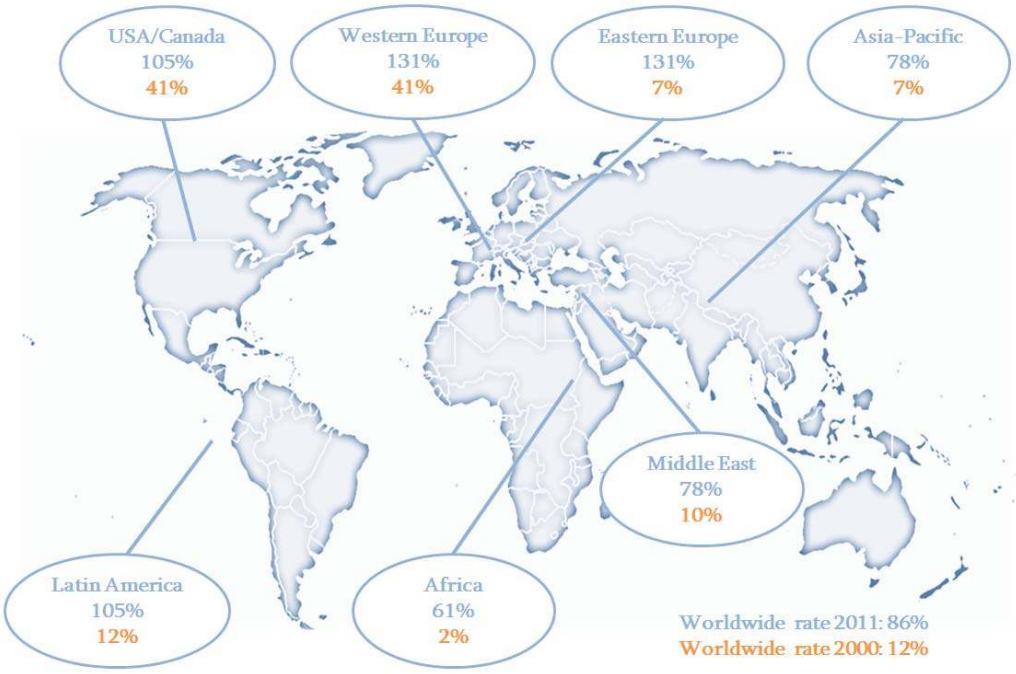
Figure 2.1. Worldwide penetration rate (2000-2010)



Source: WDI (2012)

It is important to note that there are remarkable differences in the mobile penetration rate across the world. For instance, in 2011, mobile telecommunications in Europe and America had a penetration rate of over 100%, whereas other regions, such as Africa (61%), Asia Pacific (78%) and the Middle East (78%), had lower penetration rates (Figure 2.2). However, if we look at the penetration rates in 2000 the situation was somewhat different. Although Western Europe and USA/Canada had penetration rates of above 40% - mainly because they were the birthplace of mobile communications -, the industry had a low diffusion rate in other regions. Only 2% of the population in Africa had a handset, 7% in Eastern Europe and Asia, 10% in the Middle East and 12% in Latin America. Only 10 years later, Eastern Europe and Latin America had penetration rates of over 100%.

Figure 2.2. Mobile penetration rate by region (2011)



Source: Own elaboration from Wireless Intelligence (2012)

The rapid diffusion of mobile technology around the world is strongly linked to the existence of network effects (Doganoglu and Gryzbowski, 2007; Gruber, 2005). As Economides and Himmelberg (1995) highlight that, in network industries, it is necessary to achieve a critical mass after which network effects start to work. In the case of the mobile communications industry, this threshold in the critical mass was encouraged by the introduction of the GSM standard, initially in Europe (birthplace of the GSM technology) and subsequently in the rest of the world.

In what follows, Section 2.2 analyzes the evolution of the mobile communication industry and the introduction of the GSM standard in the different regions previously defined. The next sections are devoted to highlighting the characteristics which make the mobile

communications industry an adequate research setting in which to carry out the three empirical analyses of the following chapters. Section 2.3 describes the type of network effects, according to the classification in Chapter 1, which takes place in mobile communications industry. Section 2.4 shows that international groups which operate in very different institutional contexts have become the big players in this industry. Section 2.5, describes in depth the technological change which took place between fixed and mobile telephony. Section 2.6 closes the chapter by relating mobile industry characteristics to the research lines of this dissertation.

2.2. EVOLUTION OF MOBILE COMMUNICATIONS INDUSTRY

2.2.1. Evolution of mobile communications industry in Europe

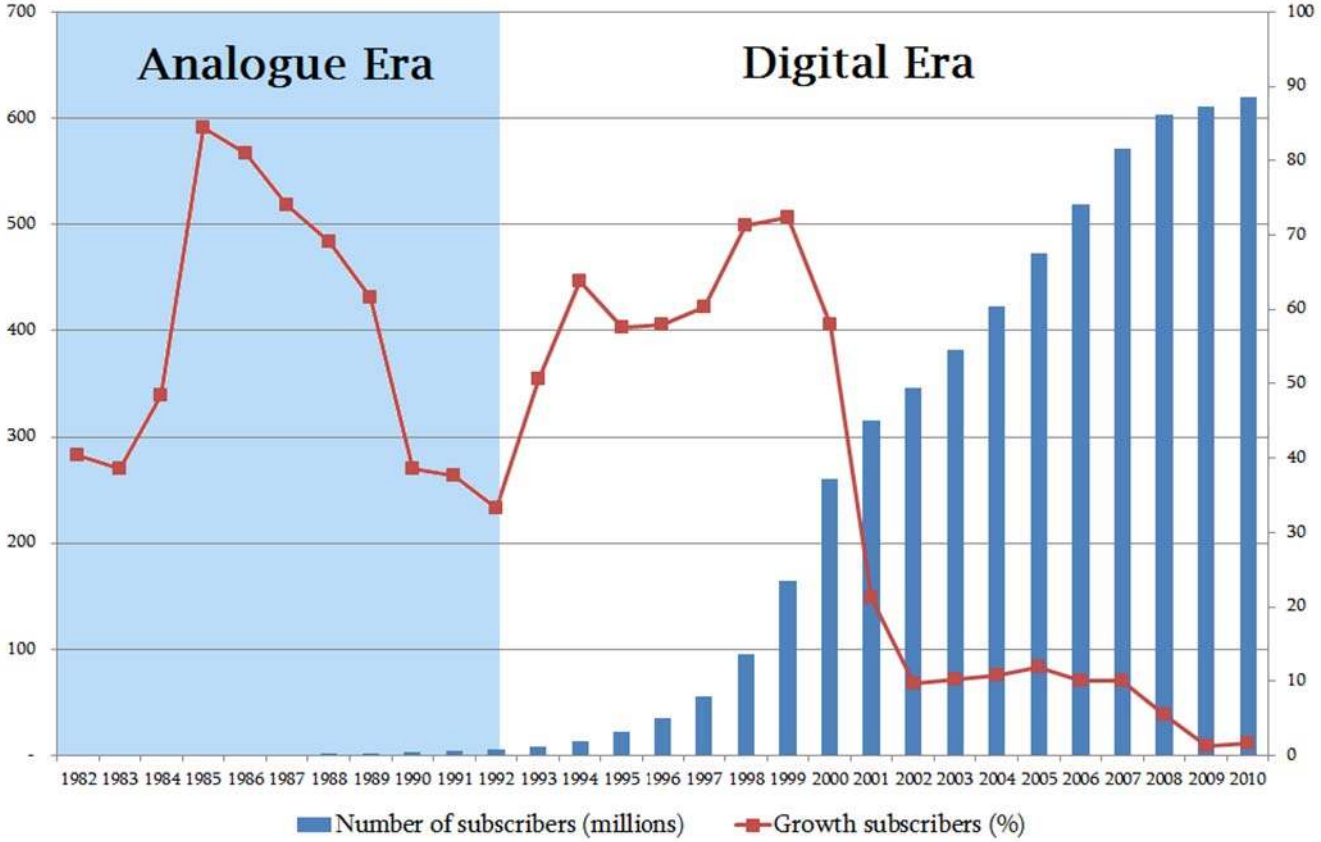
The European region is characterized by an early and homogeneous development of mobile communications in most countries. The first mobile telephone system in Europe was commercialized by Swedish Telecom in 1956. Later, mobile systems were launched in Germany (1959), the United Kingdom (1959) and other European countries in the 60's and 70's (Gruber, 2005). In spite of these first attempts, the industry was not really developed until the 80's, with the introduction of analogue systems.

The analogue systems were based on radio waves that varied in frequency and technology across countries (Gruber, 2005). As can be seen in Figure 2.3, the early 80's show a substantial growth in the

number of subscribers, probably due to the novelty of the technology. Nevertheless, the number of users was still moderate in this first stage in comparison with the following years. The literature has suggested several reasons for this low number of users, including the high prices in a monopoly regimen, the inexistence of a critical mass and the technology restrictions derived from incompatible standards between the networks of different countries. As an example of the latter, it can be mentioned that the independent development of mobile systems in each country made international roaming impossible in a European Union area that was moving towards integration (Fuentelsaz et al., 2008).

Consequently, increasing concern arose about the necessity of making mobile systems compatible. As a result, the Group Special Mobile (GSM) was created in 1982 to work on the development of a compatible standard across European countries aimed at improving the quality and efficiency of phone services. Although the first agreement to implement the GSM standard was signed in September 1987 by 14 operators from 13 countries (Hillebrand, 2002), its commercial take-off occurred in 1992. This year can be considered as the beginning of the *digital era* of mobile technology in Europe.

Figure 2.3. Number and growth of subscribers in European Union countries (1982-2010)



Source: WDI (2012)

As can be observed in Figure 2.3, the number of subscribers started to grow radically after 1992. The success of GSM was based on several advantages over the analogue system that Fuentelsaz et al. (2008) summarize as (i) a more efficient use of the radio spectrum, (ii) cost advantages related to microelectronic technology, (iii) the possibility of international roaming, (iv) the exploitation of scale economies by manufacturers and (v) a better distribution of the sunk costs of R&D among the European countries. The fast increase in the number of subscribers was accompanied by a growth in wireless technology penetration. The success of the GSM system is also reflected in the high intensity of network effects (Gruber, 2005; Srinivasan, Lilien and Ragaswamy, 2004), which leads to faster mobile adoption. After the introduction of the UMTS (Universal Mobile Telecommunications System) standard in 2003, the annual growth has declined, which shows that the mobile communications industry in Europe has reached an advanced maturity stage in its life cycle.

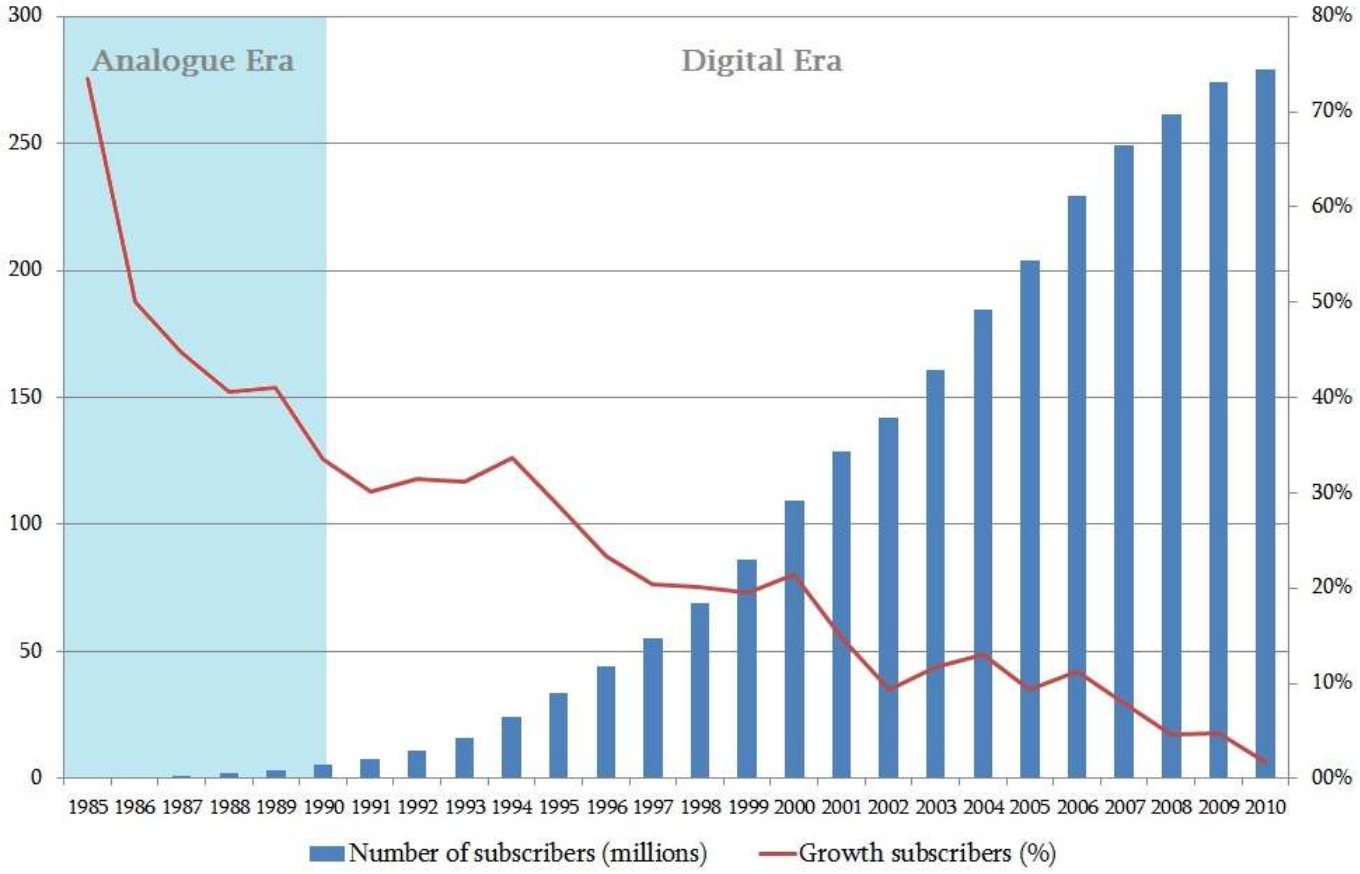
2.2.2. Evolution of mobile communications industry in the U.S.

In the United States, the first mobile communication took place in 1921 (Noble, 1962) and radio communications had an important role of radio communications during the Second World War. The first true mobile telephone appeared in 1946 and it allowed an interconnection with the fixed telecommunications system (Gruber, 2005). At that time, mobile communications started to take place at city level and were extended to

regional level, mainly under the control of the old AT&T. In the 1980s, the first analogue systems appeared in United States under the AMPS (Advance Mobile Phone System) standard. The introduction of this standard, as occurred with the GSM in Europe, allowed interstate roaming and handset compatibility (Fuentelsaz et al., 2008). After the introduction of the AMPS standard, other incompatible standards appeared in the United States in the 1990s' as part of 2G technologies, such as TDMA (Time Division Multiple Access), CDMA (Code Division Multiple Access) and GSM. This essentially meant that users from different companies in the same market were unable to communicate with each other. The situation arose because the regulator allowed the market to decide which standards to employ in contrast to the European case (Church and Gandal, 2005). According to Gans, King and Wright (2005: 247) *the failure of the U.S. to adopt a common 2G standard, with the associated benefits in terms of roaming and switching of handsets, meant the first-generation AMPS system remained the most popular mobile technology in the U.S. throughout the 1990s.* The lack of technological compatibility also resulted in the penetration rate in the United States usually being lower than that of Europe (Gans et al., 2005).

As can be seen in Figure 2.4, the number of subscribers gradually increased in the United States until it reached more than 275 million in 2010, which meant a penetration rate of close to 100%. As in Europe, this industry has reached an advanced maturity stage in its life cycle and, thus, annual growth in recent years has been decreasing slightly. But, in comparison to Europe, the mobile communications industry in the

Figure 2.4. Number and growth of subscribers in the United States (1985-2010)



Source: WDI (2012)

United States did not grow suddenly with the introduction of digital technology during the 1990's. This slower growth of the mobile communications industry in the United States can be explained by the initial incompatibility between standards and, thus, the lower intensity of network effects (Gans et al., 2005; Gruber, 2005).

2.2.3. Evolution of mobile communications industry in other regions

Other regions, given the success of the GSM standard in European countries, chose the GSM standard as the main technology in order to be compatible and benefit from European technological improvements (Fuentelsaz et al., 2008). This has led to technological compatibility among most of the networks of different firms in different countries. This technological compatibility has encouraged mobile adoption. As Gruber (2005:147) states, with positive network effects, *standards lead to faster market growth.*

It is important to note that mobile penetration still differs among the regions analyzed. Curwen and Whalley (2008) describe some characteristics of these regions that can explain the differences in mobile diffusion. For instance, the Asia Pacific witnessed an important growth in mobile penetration rates from 7% in 2000 to 78% in 2011 (Figure 2.2). This rapid growth took place mainly in China, India, Japan, Indonesia, the Philippines, Thailand, South Korea, Vietnam, Bangladesh, Malaysia, Taiwan and Australia. Although these countries do not have a common regulator (as in the United States and the European Union), national

authorities decided to join the GSM system. However, penetration rates are still lower than in Europe and the United States because of the later introduction of mobile technology and the lower average income.

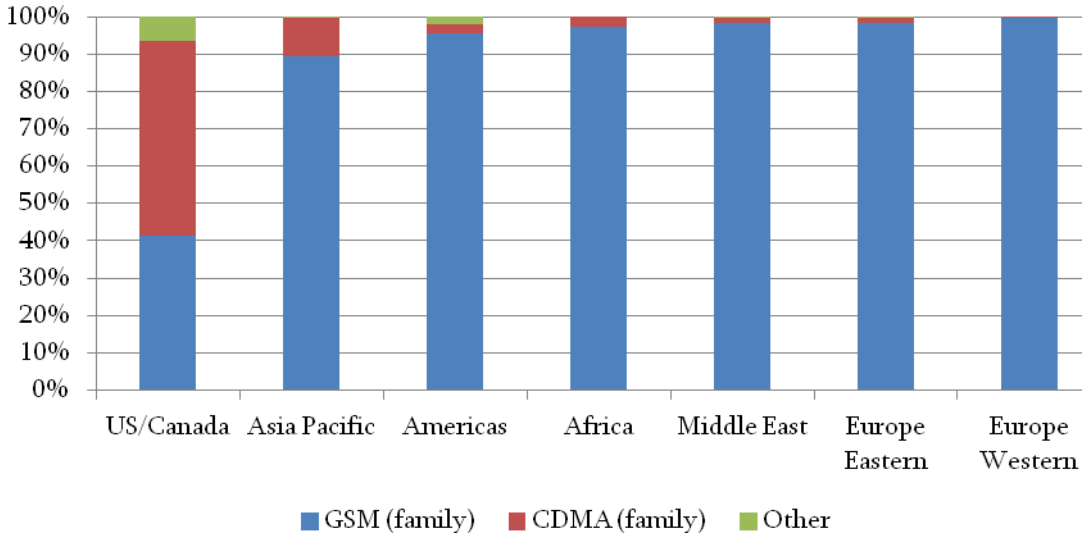
Latin America is an example of a very fast introduction of mobile communications industry. Whereas, in 2000, only 12% of the population had a handset, in 2011, the penetration rate reached 105%. Curwen and Whalley (2008) highlight that competition in Latin America has been high because of the presence of international groups , such as América Móvil, Telefónica, Telecom Italia and Portugal Telecom which, operating under the GSM standard, have encouraged mobile penetration by adapting to local conditions.

Africa has seen a more moderate growth in the number of users and penetration rates than other regions. Africa is a region of contrasts in terms of mobile penetration. In 2011, there were countries whose penetration rate exceeded 100%, e.g. Algeria, Botswana, Egypt, Gabon, Libya and Tunisia, while penetration rates did not reach 30% in other nations, e.g. Burundi, Congo D.R., Djibouti, Eritrea and Ethiopia. The lower penetration rates can be explained by a lower level of competition, which is a consequence of the late liberalization of mobile telecommunications. This has discouraged, along with *political and institutional instability, corruption, foreign exchange, economic instability, inflation, high interest rates, lack of financial markets, inadequate regulation, poor corporative governance and unpaid bills* (Curwen and Whalley, 2008: 101), the entry of foreign investors into

African markets. The lower level of competition has resulted in higher prices in a region with a low average income.

In sum, the birthplace of the GSM standard was Europe. Technological compatibility and the existence of network effects allowed a quick diffusion of mobile communications industry in this area. The GMS standard was also adopted in most regions (with the exception of the United States) (Figure 2.5), making networks of different countries technologically compatible and also encouraging a late and rapid mobile phone penetration. Nevertheless, mobile phone penetration varies between and within regions depending on factors such as average income, competition and institutional conditions.

Figure 2.5. Percentage of subscribers by technology (2011)



Source: Wireless Intelligence (2012)

2.3. Network effects in mobile communications industry

As pointed out in Chapter 1, mobile communications industry is 7th in the classification of industries with intensive network effects. It has been considered as a paradigmatic case of an industry with *direct* or *pure* network effects in which a new user increases the utility of current users of the network because the possibilities of communication increase (Katz and Shapiro, 1995).

From a technological viewpoint, networks of different firms - given the generalized adoption of the GSM standard – are compatible. Users from one network can communicate with users from other networks. Thus, it could be thought that an increase in the number of users of one network directly benefits users from other firms' networks. In other words, that the mobile industry is characterized by *industry-level* network effects.

However, part of the literature has suggested that the mobile industry is really characterized by *firm-level* network effects because the increase in the number of users of one network mainly benefits users from the same network (Church and Gandal, 2005). This occurs because of the economic incompatibility between firm networks. Given that on-net calls are usually cheaper than off-net calls[1], users perceive economic incompatibility between networks. This incompatibility has been highlighted by Grajek (2010:141) who finds *compatibility between* (firm) *networks to be low, in particular, when operators' pricing strategy involves on-net discounts, in which case networks are perfectly*

[1] On-net calls refer to calls that are originated and terminated on the same firm network, whereas off-net calls refer to calls between two different networks.

incompatible. Thus, *firm-level* network effects exist and users prefer to join the firm network with the greatest number of users to avoid additional costs from making off-net calls. *Firm-level* network effects have also been called *tariff-mediated* network effects because they have their origin in differences in prices between on-net and off-net calls (Laffont, Rey and Tirole, 1998).

The existence of firm-level network effects allows a better understanding of the role of strategy in the management of firm network value to increase performance. As Chapter 3 "*Strategic choices, network value and performance: a strategic approach to network value in network industries"* aims to analyze how strategy helps firms to manage network effects to increase their own network value and performance, the mobile communications industry is an adequate research setting for the empirical analysis.

2.4. Mobile communications players in network competition: From national operators to international groups

Nowadays, international groups have become the big players in network competition. In the last two decades, they have increased their presence in mobile communications industry. This section tries to explain the

evolution of these international groups in terms of the number of subsidiaries and the distance of these subsidiaries from their home markets.

The introduction of a common worldwide standard through the GSM system not only improved mobile technology diffusion, but also encouraged the internationalization of wireless operators. Gerpott and Jakopin (2005: 636) argue that *the internationalization of telcos received an additional impetus with the licensing of digital mobile networks in numerous countries with most of these networks using the Global System for Mobile Communications (GSM) standard.*[2]

As Sarkar, Cavusgil and Aulakh (1999) explained, the internationalization of telecom firms was in part driven by exploiting scope and scale economies based on factors such as, for example, the achievement of an efficient use of network capacity and a higher negotiating power over equipment suppliers. The existence of a common standard allowed multinationals to take advantage of the technology knowledge of their home countries to develop networks in other countries. It resulted in cost reductions, with the subsequent positive impact on performance.

Given that the telecom industry had been a traditional regulated industry and the radio spectrum was considered a scarce resource, the authorities controlled the number of competitors in each market by

[2] GSM was initially the abbreviation of Group Special Mobile but it was changed to refer to the standard, Global System for Mobile Communications, when the group was renamed Standard Mobile Group (SMG).

offering few GSM licenses. Thus, when firms decided to internationalize, they usually had to acquire equity of existing national operators which had obtained GSM licenses during 1990's. In most cases, the international groups acquired a minority participation in a national operator which was later extended. For instance, Gerpott and Jakopin (2005:648) observed that *based on the minority investment experiences until the mid-1990s some of the European MNO* [Mobile Network Operators] *began to implement new majority takeovers of foreign firms, which had already been in the MNO business, and to transform several of their minority stakes into majority holdings.*

The introduction of 3G standards gave a second boost to the internationalization of telecom operators through the launching of new licenses by authorities. It gave international groups the possibility of expanding into new markets through the purchase of 3G licenses (Curwen and Whalley, 2008). For instance, in 2003, the international group Hutchison (Hong Kong) acquired 3G licenses to enter Austria, Denmark, Italy, Sweden and the United Kingdom, and, in 2005, Ireland.

In sum, the internationalization of telecom firms started in the 1990's and increased during the 2000's, especially with the introduction of 3G technology. This increasing scope of MNEs can be appreciated in Table 2.1 that shows the number of countries in which each international group is present in 2000 and 2010. As can be observed, most international groups have increased the number of countries in which they operate in this 10-year period with the only exceptions of AT&T, KPN, Millicom, TDC and Telecom Italia.

Table 2.1. Evolution in number of subsidiaries by MNE (2000 – 2010)

Group	2000	2010
Abu Dhabi	-	5
Access Industries	-	3
AF	-	4
Altimo	-	17
América Móvil	6	17
AT&T	5	3
Axiata	7	8
Batelco	1	4
Belgacom	1	2
Bharti Airtel	1	19
Bite	1	2
Cable & Wireless	24	26
Deutsche Telecom	10	18
Digicel	-	32
Elisa	2	2
Etisalat	2	16
France Telecom	34	42
Hutchison	13	13
JT	1	2
KPN	8	3
Magyar	1	3
Maroc Telecom	1	5
Maxis	1	3
MegaFon	1	4
Millicom	18	14
Mobistar	1	2
MTN	6	23
MTS	1	6
NII	5	5
NTT Docomo	7	8
Oger	-	2
Orascom	4	12
OTE	5	7
Portugal Telecom	3	7
Qtel	1	14
Saudi Telecom	1	8
SingTel	5	26
Sistema	1	7
Sonatel	1	4
Sudatel	-	6

Group	2000	2010
TDC	6	1
Tele2	6	7
Telecom Argentina	2	2
Telecom Italia	8	5
Telefónica	16	20
Telekom Austria	4	8
Telekom Slovenije	1	4
Telekom Sribija	1	3
Telenor	10	21
Telia Sonera	13	25
Telstra	2	2
Trilogy	-	4
Turkcell	6	8
Viettel	-	3
VimpelCom	1	10
Vivendi	5	8
Vodacom	3	5
Vodafone	23	33
Wataniya	1	6
Wind	-	13
Zain	1	9

Source: Wireless Intelligence Database (2012)

International groups in this industry come from different regions although European MNEs are the most internationalized groups because of their longer experience in this industry. Figure 2.6 shows the international groups that were operating at the end of 2010 by region of origin. As can be observed, most international groups come from Europe and Asia, whereas Oceania and Latin America show the lowest number of international groups.

Figure 2.6. International groups by worldwide region (2010)

Source: Wireless Intelligence (2012)

Although international groups tended to expand first to geographically close countries, most of them have gone one step further by entering countries in other regions which differ in terms of language, law, tradition and customs from their home countries.

To illustrate this, we have selected one international group from each region that is representative of this gradual expansion process. Figure 2.7 shows a summary of regions in which Telefónica (Europe), Hutchison

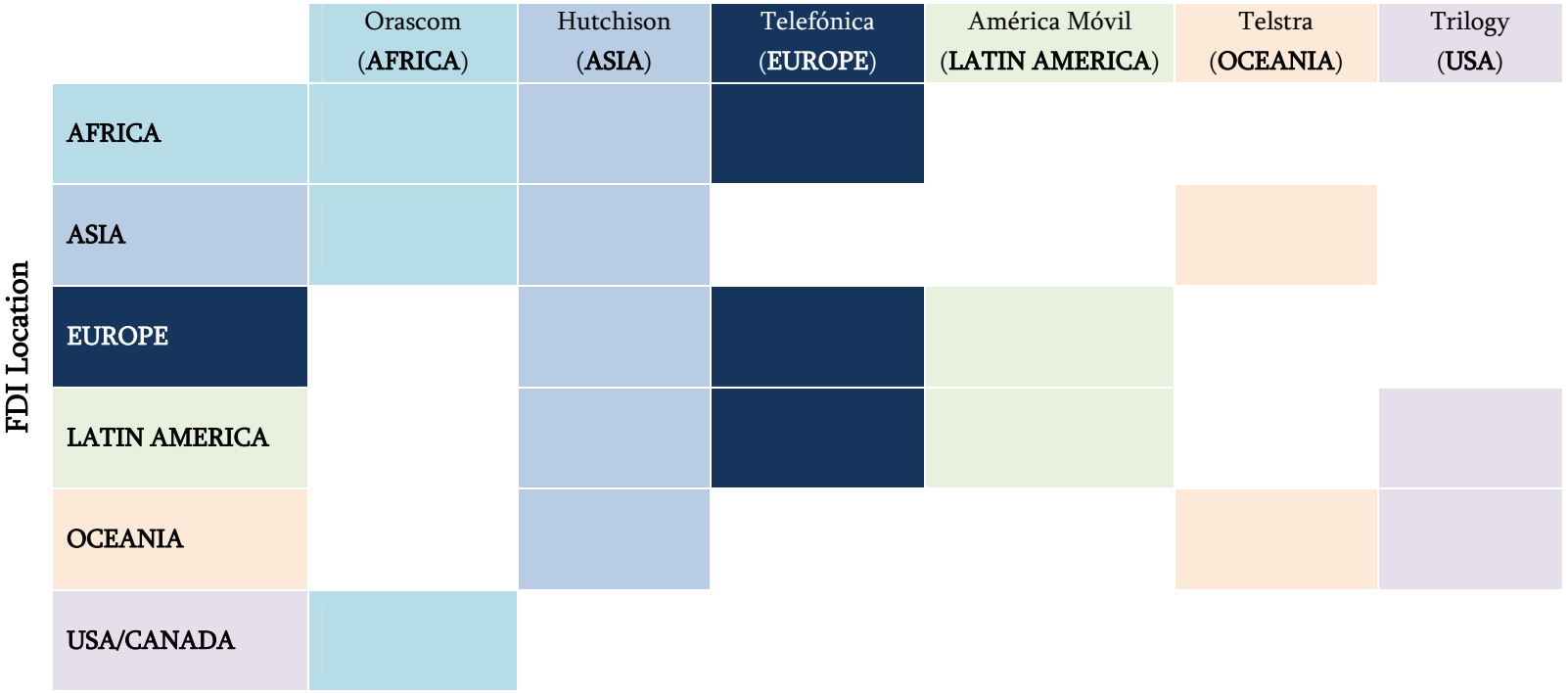
Whampoa (Asia), Telstra (Oceania), América Móvil (Latin America), Orascom (Africa) and Trilogy (United States) have invested.

Orascom started its operations in Egypt in 1998 and entered other African countries including Algeria, Ghana, Burundi, Congo, Chad, Central African Republic, Namibia, Tunisia and Zimbabwe. Orascom has also expanded into countries in the Middle East such as Israel, Iraq and Syria. This company acquired a minority participation in Hutchison in 2005 in order to be present in Hong Kong, Indonesia, Macao, Sri Lanka and Vietnam, but finally sold it in 2007. Since 2009, Orascom has operated in Canada after acquiring 65.08% of Wind Mobile.

Hutchison has mainly expanded from Hong Kong to Europe (Austria, Denmark, Ireland, Italy, Sweden and the United Kingdom) by acquiring 3G licenses. It also entered Paraguay and Ghana, although it sold these participations in 2005 and 2008, respectively.

Telefónica (Spain) initially expanded during the 90's to Latin American countries, such as Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Mexico, Nicaragua, Panama, Peru, Uruguay and Venezuela. In the mid-2000's, it started its European expansion to the Czech Republic, Germany, Ireland, Italy, Slovakia and the United Kingdom. Although Telefónica also entered Morocco by acquiring 31.74% of Meditel, it finally sold off this investment in 2009.

Figure 2.7. FDI location by MNEs from all regions



Source: Wireless Intelligence (2012)

América Movil, a Mexican international group, has mainly expanded into Latin American countries such as Argentina, Brazil, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Paraguay, Peru and Uruguay. Thus, this international group has become Telefónica's main competitor in the region. Although América Móvil has focused on Latin America, in the second quarter of 2012, it acquired 27.70% of the European KPN. This operation has allowed América Móvil to enter The Netherlands (home country of KPN), Germany and Belgium.

Telstra is the only international group from Oceania and its international presence is limited, only operating in Australia (its home country) and Hong Kong.

Trilogy is based in the United States and has entered Oceania (New Zealand) and Latin America (Bolivia, Dominican Republic and Haiti). It is important to note that US and Canadian international groups, such as Trilogy, AT&T and NII Nextel, are present in few countries because their domestic markets are so large that they have traditionally focused on regional instead of international competition.

In sum, the number of international groups and the markets in which they are operating has increased greatly in the last two decades. Moreover, the examples given above illustrate that mobile MNEs have entered countries with important differences in terms of language, law, culture, etc. to their home countries.

Chapter 4 *"Strategic choices and institutions in the FDI process: where to enter"* aims to analyze how host market selection by MNEs depends on the institutional context, both formal and informal, of the host countries. The mobile communications industry is an adequate research setting to empirically analyze host market selection from the institution-based view because MNEs have entered countries whose institutions greatly differ from those of their home countries.

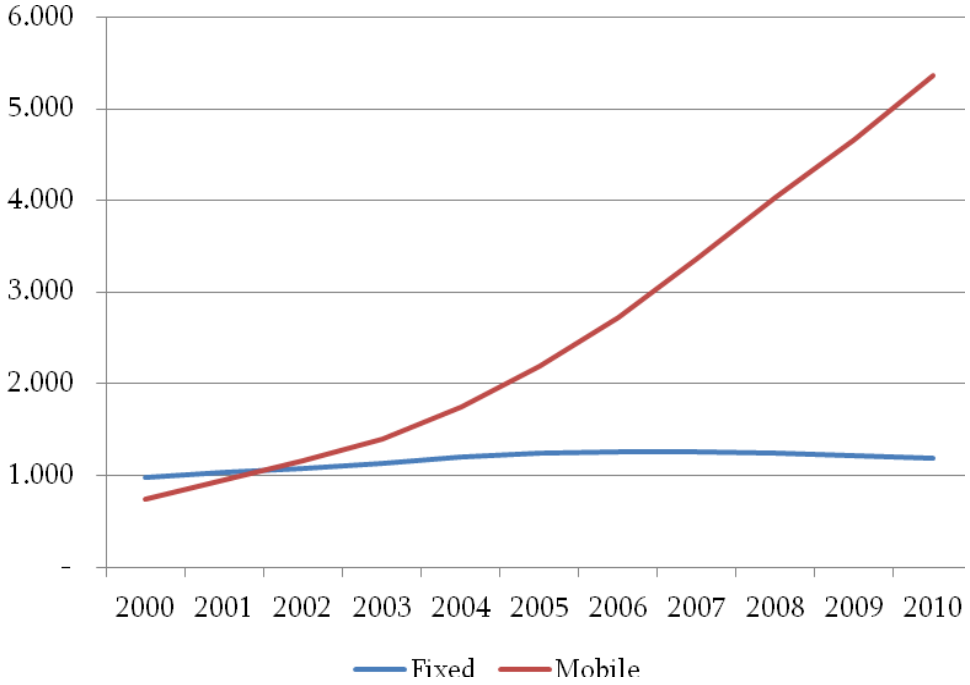
2.5. The change from fixed to mobile communications

Mobile and fixed communications have coexisted in the market in the last two decades. The evolution of the penetration rates of the two technologies seems to reflect a substitution process (Cadima and Barros, 2000; Gans et al., 2005; Horvath and Maldom, 2002). The existence of advantages in mobile services compared to fixed telephony such as, higher competition, lower prices and higher functionality, may explain this substitution effect (Gruber and Verboven, 2001; Gans et al., 2005; Rodini, Ward and Woroch, 2003).

As can be seen in Figure 2.8, the number of adopters of mobile technology has continuously increased during the last decade. On the contrary, the number of users of fixed-telephony remains, roughly speaking, steady and, from 2007, starts slightly decreasing. More

importantly, from 2002 on, the number of mobile users is substantially higher than the number of fixed users.

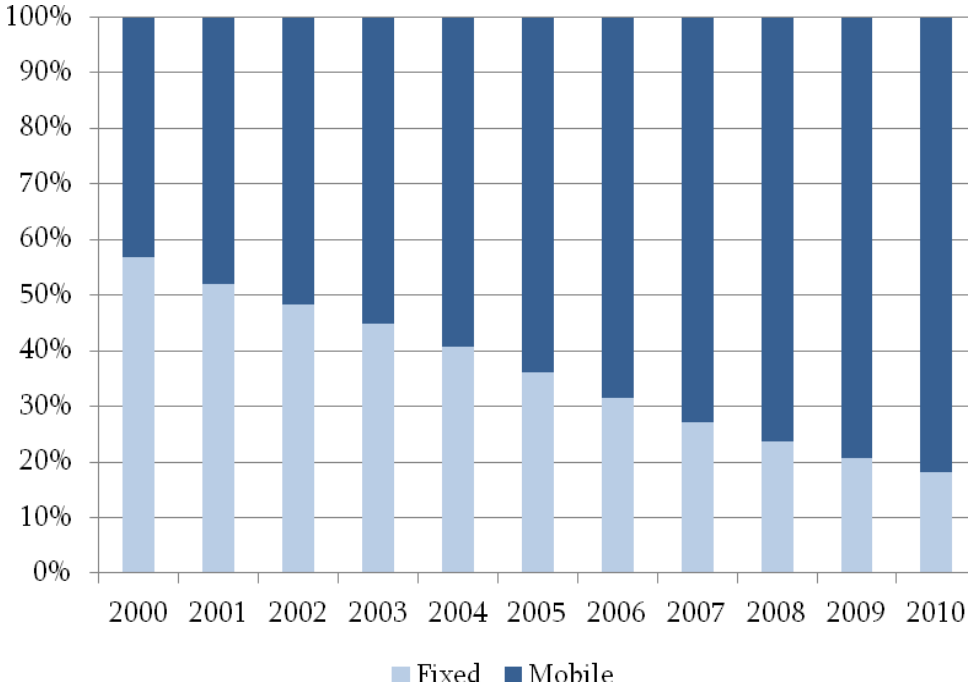
Figure 2.8. Worldwide millions of subscribers by technology (2000-2010)



Source: Wireless Intelligence Database (2012); WDI (2012)

This substitution effect can be more clearly observed in Figure 2.9. If the total number of connections (fixed and mobile) is considered, mobile technology has evolved from representing 43% of connections worldwide in 2000 to 82% in 2010. This confirms the substitution of fixed by mobile telephony.

Figure 2.9. % of connections by type of technology over total (2000-2010)



Source: Wireless Intelligence Database (2012); WDI (2012)

This phenomenon has been previously analyzed by Gans et al. (2005) and Cadima and Barros (2000). It is a consequence of the radical technological change from fixed technology – based on a solid medium, such as metal wire or optical fiber – to wireless technology – based on new methods of exploitation of the radio spectrum to allow voice transmission (Rothaermel and Hill, 2005).

In this context of radical technological change, most fixed telecommunications companies– which were usually state-owned – invested in mobile communications. When the 2G mobile system appeared and new networks were launched in most markets, incumbents

had to face competition from new entrants. This new competitive framework was established in most countries because of the worldwide scope of mobile telephony (Figure 2.2).

As Chapter 5 "*Institutions and performance after a radical technological change: How the value of specialized complementary resources varies across markets"* aims to analyze how incumbents' advantages, based on the possession of complementary resources, depend on the institutional context of the market in which they operate, the mobile communications industry is an adequate research setting because of the radical technological change from fixed to mobile technology in this worldwide industry.

2.6. SUMMARY

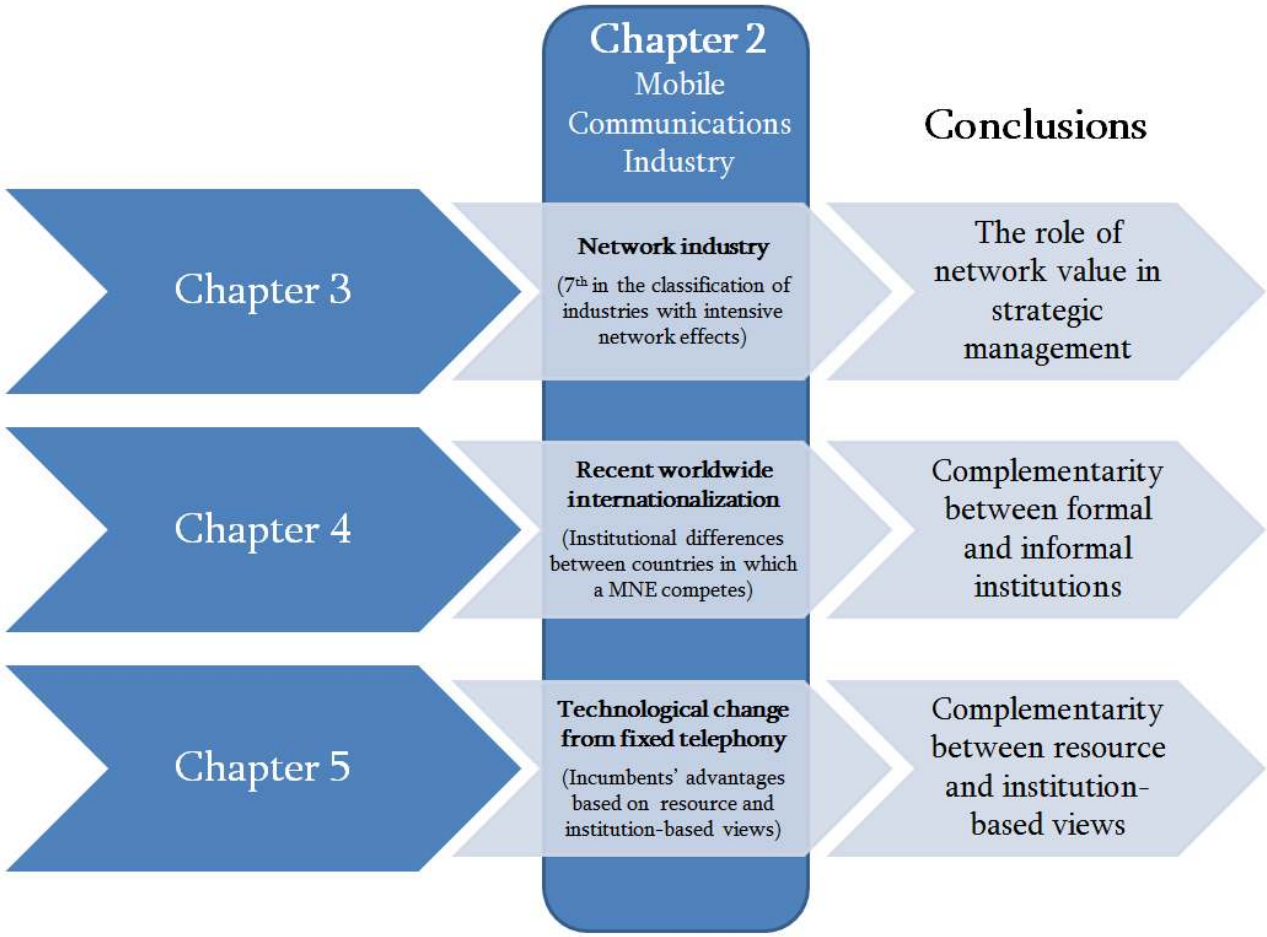
Figure 2.10 summarizes the main characteristics of the mobile communications industry which justify its use as the research setting of this dissertation.

First, mobile telephony ranks 7th in the classification of industries with intensive network effects. This industry is a paradigmatic case of an industry driven by direct and firm-level network effects. This allows us to test, in Chapter 3, the effect of strategy in leveraging network effects to achieve a greater firm network value and performance.

Second, the mobile industry has recently been internationalized with the entry of MNEs in all regions. International groups and their subsidiaries have recently increased and have entered into countries whose institutions (laws, culture, etc.) greatly differ from those of their home countries. This institutional variability is suitable for us to test, in Chapter 4, the effect of the institutional context, both formal (e.g. laws) and informal (e.g. culture) in MNEs' entry decisions.

Finally, the mobile industry is the result of a radical technological change from fixed telephony. The worldwide presence of this industry and the permanence of fixed companies as mobile operators will allow us to test, in Chapter 5, the moderating role of the institutional context in the achieving of incumbent advantages based on the possession of complementary resources.

Figure 2.10. Mobile communications industry as an adequate research setting



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Chapter 3.

STRATEGIC CHOICES, NETWORK VALUE AND PERFORMANCE:

A Strategic Approach to Network Value in Network Industries

3.1. INTRODUCTION

Network industries, defined as those in which network effects are important to understand how firms compete, represent a large and growing portion of today's economy. As shown in Chapter 1, software, mobile communications and video games are just a few examples of industries where network effects drive market competition (Shankar and Bayus, 2003; Tanriverdi and Lee, 2008). In recent years, management and economic literature have devoted increasing attention to these industries (Farrell and Klemperer, 2007; McIntyre and Subramaniam, 2009; Shankar and Bayus, 2003). This may be a reaction to evidence that network industries seem to challenge much of the thinking derived from previous models and findings (Shapiro and Varian, 1998; Suarez, 2005). However, although recent literature recognizes that the foundations of network effects have received an increasing amount of attention from researchers (Varian and Shapiro, 1998; Farrell and Klemperer, 2007), a deeper understanding of the role that firm strategy plays in leveraging network effects is needed (McIntyre and Subramaniam, 2009).

One of the main premises of businesses such as software and telecommunications is that the firm's installed customer base can be considered a key strategic asset to gain sustainable competitive advantages (Shankar and Bayus, 2003). This is because the existence of network effects implies that consumers' utility is directly affected by the number of consumers using the same product or technology (Shy, 2011) and, thus, customers' willingness to pay increases, with the subsequent

potential impact on firm performance (Shapiro and Varian, 1998; Shankar and Bayus, 2003).

There is a growing body of literature that attempts to measure network effects in a variety of industries. This stream of research is mainly focused on technological standards competition (Cowan, 1990; David, 1985; Garud and Kumaraswamy, 1993), technology adoption and diffusion (Gandal, Kende and Rob, 2000; Goolsbee and Klenow, 2002; Majumdar and Venkataraman, 1998; Park, 2004) or the analysis of hedonic price functions for products exhibiting network effects (Brynjolfsson and Kemerer, 1996; Hartman and Teece, 1990, Gandal 1994). However, only a few papers have analyzed how firms' strategic decisions may influence performance when network effects are important. These papers have paid attention to the impact of strategic dimensions such as entry timing and learning orientation (Schilling, 2002), product diversification (Tanriverdi and Lee, 2008) and pioneers' advantages (Eisenman, 2006). One commonality of these works is that they focus their attention on specific attributes of strategic choices, without establishing a general model about how strategy helps firms to gain a competitive advantage in network industries.

This chapter attempts to explain how firm-initiated strategic actions can help firms to benefit from the existence of network effects. Following McIntyre and Subramaniam (2009), this chapter aims to study the implications of strategy in network industries in greater depth. It is built on both economic and strategic literatures under the premise that understanding the drivers of network effects will allow firms to adopt a

more proactive position and intensify the network effects to their own benefit. This chapter also extends previous research by suggesting that network value, defined as *the value stemming from other consumers already using the product* (McIntyre and Subramaniam, 2009:1496), is more accurate than network size for assessing a firm's competitive position in the presence of network effects. In contrast to most of the existing empirical literature (Brynjolfsson and Kemerer, 1996; Schilling, 2002), this chapter proposes an adjusted measure of network value, based on Metcalfe's law, that includes not only network size but also network intensity.

Previous literature has identified three elements that act as antecedents of network effects (Farrell and Klemperer, 2007; Katz and Shapiro, 1994; Shapiro and Varian, 1998), namely, users' expectations, users' coordination and compatibility among competing networks. This chapter postulates that firms, by managing these elements through their strategic decisions, can leverage network effects and increase network value in the industries in which they operate. In particular, it is analyzed how several strategic initiatives based on the management of the installed base, such as entry timing, internationalization and switching costs, are related to users' expectations, users' coordination and compatibility among competing networks and, eventually, to network value.

Focusing on firm-initiated actions that shape the firm's competitive destiny in network industries, this chapter brings a strategic dimension to the research in this field by offering a theoretical model that relates

strategic actions and the drivers of network effects. This analysis focuses on the concept of network value, which has been previously analyzed from a theoretical perspective in the literature. The main contribution of Chapter 3 lies in the proposal and analysis of an improved measure of network value that integrates the size and intensity dimensions of network effects in an empirical analysis. Finally, this chapter not only seeks to expand on prior findings by including the effect of firm strategy on network value, but also analyzes the impact of network value on firm performance.

The rest of the chapter is organized as follows. The next section develops the theoretical model, paying special attention to the relationship between network effects and network value and between the latter and its main antecedents: expectations, coordination and compatibility. This section also provides a theoretical explanation of the effect of three strategic initiatives, namely, entry timing, internationalization and switching costs management, on network value. Section 3.2 also analyzes the relationship between network value and the performance of firms. The data from the European mobile communications industry and the variables used are presented in the third section 3.3, while the section 3.4 describes the estimation procedure. Following that, evidence on the impact of entry timing, internationalization and switching costs on network value and the influence of the latter on firm performance is provided. Section 3.6 closes the chapter by discussing its main findings and its managerial and policy implications.

3.2. THEORY AND HYPOTHESES

3.2.1. Installed Base, Network Effects, Network Value and Network Intensity

Previous literature has highlighted the role of the installed base as a strategic asset in network industries (Brynjolfsson and Kemerer, 1996; Chacko and Mitchell, 1998; Shankar and Bayus, 2003). The installed base can be defined as *the cumulative number of users at any given time in the product's life* (McIntyre and Subramaniam, 2009:1495). This strategic consideration of the installed base in network industries is explained by the existence of network effects that are present when *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). Thus, user utility is dependent on the size of the installed base (Shapiro and Varian, 1998) and this results in interdependent demand (Rohlfs, 1974).

The importance of the installed base to gain competitive advantages is clear in markets whose network effects are direct or pure,[1] such as the telephone, fax and e-mail industries. Stand-alone benefit is negligible because the product or service has to be integrated into a network to obtain value from it (DePalma and Leruth, 1996; Grajek, 2010). Given

[1] The literature has traditionally distinguished between direct and indirect network effects. The first refer to when *adoption by different users is complementary, so that each user's adoption payoff, and his incentive to adopt, increases as more others adopt*. The second arise *through improved opportunities to trade with the other side of a market* (Farrell and Klemperer, 2007: 1974). This Chapter focuses its attention on direct network effects, although most of the arguments offered would also stand for indirect network effects.

the existence of network effects, the main competitive advantage of the firm is based on creating a higher network value than its rivals, and not exclusively on generating a higher network-independent value based on quality issues (McIntyre and Subramaniam, 2009).[2] Network value has been defined as *the value stemming from other consumers already using the product* and it *is the reflection of the benefits associated with a large cohort of fellow adopters (installed base) for the product* (McIntyre and Subramaniam, 2009:1496). As a consequence, network value directly depends on the size of the installed base. The higher the number of users of a network, the higher the interaction possibilities between its members and, thus, the greater the utility they receive from belonging to that network.

It is necessary to note that network value is not merely the size of the installed base. Network value must also take into account the existence of network effects, which make it important for users to consume the product within a community. McIntyre and Subramaniam (2009) recognize that the relationship between the installed base and network value is not linear but depends on the strength of network effects or network intensity, which can be defined as the relative value generated

[2] This chapter focuses on the network value that is directly dependent on the existence of other users consuming the product, that is, the value that comes from the existence of network effects. McIntyre and Subramaniam (2009) also identify a part of network value that can be network-independent. This network-independent value captures quality characteristics of the product that "*are under the full control of the producer*" (Bental and Spiegel, 1995:197), such as, in our industry, network coverage or network reliability. Accordingly to McIntyre (2011), companies with higher network value also tend to offer, from the organizational learning perspective, greater network-independent value since they have accumulated more experience and capabilities in the industry.

by network size for the consumer. Thus, network value is a growing function of both network size and network intensity.

Network intensity depends on variables such as the product design (McIntyre and Subramaniam, 2009), the stage of the product life cycle at which users adopt the product (Farrell and Klemperer, 2007),[3] the value of rival networks (Shapiro and Varian, 1998)[4] and the existence of local network effects (Suarez, 2005). For example, the importance that users confer to the existence of other users consuming the same good is higher in communication markets than in the videogames industry (Shankar and Bayus, 2003). Early adopters of a technology tend to obtain a higher utility from the existence of other users than late adopters (Farrell and Klemperer, 2007). Users take into consideration the number of users who consume the product of rival incompatible networks (Shapiro and Varian, 1998). They do not confer the same importance to the network as a whole because they achieve more utility by interacting with only part of it – friends or family, for example – (Birke and Swann, 2006; Suarez, 2005).

Due to possible economic and technological incompatibility between two firms' services or products (García-Mariñoso, 2001; Grajek, 2010), network effects often appear linked to the users of a given firm instead

[3] As I will explain in Section 3, the importance of the stage of the product life cycle has been considered in our measure of the network value by differentiating between early and late adopters.

[4] The value of rival networks has also been taken into account when calculating the measure of network value that I propose in the chapter. For more details, see Section 3.

of being linked to the installed base of the industry as a whole.[5] When the installed base of a firm grows, so does the network value of that firm as a result of network effects. But the extent of this growth of network value when the installed base increases will depend, precisely, on the network intensity.

3.2.2. The Antecedents of Network Value: Expectations, Coordination and Compatibility

It is important to identify the circumstances under which network effects lead to a reinforcement of network value. The literature on network industries has highlighted three main elements that interplay with network effects and allow a reinforcement of installed base and, thus, of network value: users' expectations, users' coordination and compatibility among competing networks (Katz and Shapiro, 1994).

The management of expectations has received attention from extant literature (Chacko and Mitchell, 1998; Eisenmann, 2006; Shapiro and Varian, 1998). The current installed base of a firm affects users' expectations about which firm will dominate the market in the future (Brynjolfsson and Kemerer, 1996; Farrell and Saloner, 1986). Users

[5] It must be noted that this Chapter will focus on the scope of the firm's network and not on the total size of the market. This is because, in some cases, the products or services of different firms do not necessarily facilitate interaction between users. Apart from technological incompatibility, it can also be found artificial or economic incompatibility, which is based on price discrimination between on-net and off-net communication exchanges (Laffont, Rey and Tirole, 1998). Price discrimination generates tariff-mediated network effects, which appear at firm-level instead of industry-level (Grajek, 2010). This is precisely the situation of the research setting, as told in Chapter 2. A further discussion about economic incompatibility and price discrimination in the mobile communications industry is contained in Section 3.3.

prefer to consume goods and services from a firm with a larger installed base (Kim and Kwon, 2003; Birke and Swann, 2006). As a consequence, expectations are important because, if consumers believe a firm will dominate the market, then it will (Katz and Shapiro, 1985).

Given that expectations condition the size of the installed base, firms have strong incentives to launch signals to influence user expectations about their future network dominance. These signals can be quantitative or qualitative. Among the former, it can be mentioned the size of the installed base (Kim and Kwon, 2003) or the early achievement of a large market share (Brynjolfsson and Kemerer, 1996). Qualitative signals include brand value or reputation (Katz and Shapiro, 1994) or the preannouncement of a new product or service that is not yet in the market, as in the case of the battle between Div-X and DVD (Dranove and Gandal, 2003).

While expectations have an individualist orientation, coordination requires a plural action. Users' coordination implies that several users join a system that allows them to interact with one another (Katz and Shapiro, 1994). When there are other incompatible networks, coordination of all users in a market to the same network is difficult for several reasons: confusion about what other people will do, different expectations about the dominant network, fear of taking the first decision, etc. Farrell and Klemperer (2007) use the term inertia to refer to a possible instrument that drives coordination. Inertia arises because later adopters choose a firm with a larger installed base even though there are better options. This literature has also referred to inertia as

bandwagon effects, and this concept assumes that users tend to do the same thing as others (Liebenstein, 1950; Rohlfs, 2001). It means that consumers are conformists because they have a "desire to join the crowd" (Grajek, 2010). Examples of how inertia can determine the standard chosen by the industry even though it is not the best option are the QWERTY keyboard (David, 1985) or the light water technology for nuclear power reactors (Cowan, 1990).

The third element in network industries is compatibility. Compatibility arises when the products of different firms can be used together (Katz and Shapiro, 1985). In these situations, the scope of the users' network includes the installed base of the reference firm as well as the base of compatible industry competitors (Grajek, 2010). Users will prefer compatibility because it offers them greater communication possibilities. Incompatibility prevents firms from achieving a maximum network size since users are fragmented in different networks and are not able to interact between them. In the presence of incompatibility, the user's perceived utility will be lower (Katz and Shapiro, 1994; Lee and Mendelson, 2007) and, thus, network value will also decrease.

Expectations and coordination have to do with users' behavior whereas compatibility is a firm or policy decision. Compatibility is preferred by small rivals. It is a less risky option for entering into a market and allows them to exploit the network effects that come from the larger installed bases of their rivals. Therefore, compatibility often neutralizes the competitive advantage of a large network (Farrell and Klemperer, 2007). On the contrary, larger competitors with a strong reputation or brand

value prefer incompatibility in order to deter the entry of new rivals (Katz and Shapiro, 1994). However, incompatibility is also a risky option because users may not have so much trust in a new network (Katz and Shapiro, 1985). Sometimes the regulator decides to make compatibility obligatory among networks in order to increase social welfare and avoid the dominance of a less efficient technological standard in the market due to path dependency. This is the case, for instance, of the mobile communications industry in Europe, where the European Union decided to establish a supranational and common standard among networks (Fuentelsaz, Maicas and Polo, 2008; Gruber, 2005).

An example of the trade-off between large and small companies with respect to compatibility can be found in the competition between Microsoft and Apple. In recent years, Apple has designed a strategy based on increasing the compatibility between its computers and Windows applications. Apple has opted for compatibility to increase users' utility and reduce the obstacles they perceive if they choose its network. The increase in network value derived from being able to exchange compatible information with other Macintosh users has put Apple in a better competitive position. Microsoft, on the contrary, has made no effort to be compatible with other operating systems because it has the largest network value and the positive feedback helps it to continue growing.

This preference of small firms for compatibility can also be found in the research setting. Big operators tend to establish a higher gap between on-net and off-net calls, increasing the (economic) incompatibility with

rivals' networks. On the contrary, small operators offer very similar conditions to their users regardless of the destination of their calls. For instance, Ofcom (2009) determined that Three and T-Mobile, two of the smallest operators in United Kingdom, were the only operators which charged the same price for on-net and off-net calls in both prepaid and postpaid plans.

3.2.3. Strategic Choices, Network Value and Performance

First-mover advantages (FMA) and network value. The study of FMA has been one of the cornerstones of the strategy and management literatures (Carpenter and Nakamoto, 1989; Kalyanaram and Urban, 1992; Lambkin, 1988; Lieberman and Montgomery, 1988). FMA have also played an important role in the context of network effects research (Farrell and Klemperer, 2007; Katz and Shapiro, 1994; Srinivasan, Lilien and Ragaswamy, 2004).

In markets with network effects, firms will be interested in building a large installed base as an indicator of future dominance (Brynjolfsson and Kemerer, 1996). These efforts will be especially important in the early stages of competition. Firms that enter the market earlier will increase their possibilities of achieving an advantageous position (Arthur, 1990). As a result of early entry, the firm will be able to determine the dominant design of the product (Arthur, 1989) and influence the formation of users' preferences (Carpenter and Nakamoto, 1986) given that pioneers usually receive disproportionate attention from consumers because of the newness of their product (Lieberman and Montgomery, 1988). As a consequence, I suggest that a firm with a

longer time in the market has a larger network value because it has had more time to make efforts in the management of users' expectations through the achievement of an early installed base before the entry of rivals.

It is also important to note that the inertia that has been discussed before will lead late users to choose the firms with a larger installed base. If a pioneer is able to convince early users about its dominance, late consumers will prefer to follow them into the same network and the pioneers' product will become the standard in the industry (Schmalensee, 1982; Carpenter and Nakamoto, 1986; Farrell and Klemperer, 2007). Having achieved a leading position, the pioneers' installed base will persist because of the difficulty of modifying users' preferences (Lieberman and Montgomery, 1988). This is the main idea of the bandwagon effects which have been previously referred to. Accordingly, it is expected that time in the market increases the firms' opportunities to influence user expectations about their networks. As a result of inertia, the network value of a firm that has been in the market a long time will be higher.

H1. The time that a firm has been operating in the market has a positive effect on its network value

Internationalization and network value. The literature has tended to study markets with indirect network effects in which diversification in complementary products plays an important role (Hill, 1992; Schilling, 2002; Tanriverdi and Lee, 2008). However, less attention has been paid to other growth strategies in markets with direct network effects such as

international diversification, especially when international network effects operate (Gruber and Verboven, 2001).

Internationalization is, nowadays, an important topic of discussion because many firms are trying to compete globally (Barkema and Drogendijk, 2007; Grant, 2005). As a result, not only are firms present in various countries, but customers also "think" globally. National and regional preferences are disappearing as a consequence of a process of homogenization derived from technology, communication and travel (Grant, 2005). This means that customers are becoming more and more familiar with international firms and their brands. The internationalization of firms could be a means of attracting the interest of users in different countries since users value established brands (Lane and Jacobson, 1995). It would be expected the internationalization of a firm to influence its network value through its impact on expectations, coordination and perceived compatibility.

First, internationalization can be understood as a signal that influences users' expectations about future network dominance. There is an advantage for a firm entering a new local market when it has a wide international scope. It will have a larger perceived installed base compared to new domestic firms. Accordingly, the literature has highlighted the existence of international network effects through which *the utility of each consumer rises with the increase in the number of consumers who use the same brand regardless of whether they live in their own country or abroad* (Shy, 2001: 92). Thus, an international firm will reinforce the positive expectations of users about its future survival

on the basis of being present in other countries and the familiarity of domestic users with its brand through the leverage of international network effects.

Consequently, I also expect that internationalization will facilitate coordination through international bandwagon effects. If users know that a firm has been chosen by users in other countries, inertia could lead them to make the same choice in their home market. Users will have more incentives to choose the international firm, replicating the choices of foreign users, since they want to imitate global trends (Grant, 2005). Firms with an international presence try to create interdependences among different countries, which result in a close relation between the competitive position in one national market and the competitive position in others (Ghoshal, 1987: 425).

Finally, it is also important to note that compatibility among inter-country networks is necessary to influence users' decisions. In the case of mobile telecommunications, Gruber and Verboven (2001) suggest that, with GSM wide-ranging international roaming, users may have greater incentives to adopt mobile communications since they benefit from international network effects. The firms that offer comparable, seamless and compatible services across international markets will obtain the commitment of users that exchange information internationally (Sarkar, Cavusgil and Aulakh, 1999).

As a consequence, it is expected that the presence of the firm in various countries will create a larger network value through its influence on expectations and coordination as firms try to compete globally in order

to attract users across countries. Compatibility will reinforce the influence of internationalization on network value by allowing international network effects.

H2. The level of internationalization of a firm has a positive effect on its network value

Switching costs and network value. Switching costs are present in all network markets and their management has a strategic dimension (Gomez and Maicas, 2011; Shapiro and Varian, 1998). Consumer switching costs appear when *consumers who have previously purchased from one firm have (or perceive) costs of switching to a competitor's product, even when the two firms' products are functionally identical* (Klemperer, 1995: 515). The literature has highlighted how switching costs can increase the market power of a firm, allowing it to create entry barriers (Karakaya and Stahl, 1989; Kerin, Varadarajan and Peterson, 1992) and obtain abnormal returns that allow the firm to achieve sustainable competitive advantages (Amit and Zott, 2001; Klemperer, 1987; Lieberman and Montgomery, 1988; Schmalensee, 1982). However, the effectiveness of this mechanism as a basis for sustainable competitive advantages in information markets has been questioned (Mata, Fuerst and Barney, 1995). The effect of high switching costs may result in the loss of network value through their impact on expectations and coordination, as argued below.

As mentioned before, network value depends on the installed base and users' utility in the presence of network effects. While switching costs have been used as an instrument to maintain the installed base by

reducing customers' desire to leave their current provider (Burnham, Frels and Mahajan, 2003), these costs reduce users' utility (Maicas, Polo and Sese, 2009) not only because switching from one provider to another is costly but also because users perceive the threat of opportunistic firm behavior that could lead to future price increases in a bargain-then-rip-off pricing strategy (Farrell and Klemperer, 2007). It is not surprising that this expected opportunism leads users to form a negative image of the firm (Mata et al., 1995). Since potential users tend to form expectations about the future survival of the firm not only with quantitative signals such as the installed base, but also with qualitative signals like brand image or reputation (Katz and Shapiro, 1994), they will be reluctant to choose a firm with high switching costs. Frels, Shervani and Srivastava (2003) comment that a network of previous adopters is believed to influence adoption among non-adopters by providing opinions by word of mouth and observation. The negative experience of the current installed base will result in the formation of negative expectations about a firm network with higher switching costs and will prevent user coordination with this network, leading to a negative impact on network value. Mata et al. (1995: 490) explain that *the value of opportunities lost because of a reputation for exploiting captured customers can be much larger than the value extracted from those captured customers*.

Switching costs are especially high when networks are incompatible. In particular, technological incompatibility is one of the main drivers of consumer switching costs (Garcia-Mariñoso, 2001). It is costly to abandon a network because of learning costs or loss of communication

possibilities with current users. Economic or artificial incompatibility also arises when the costs of communication among users are cheaper if they belong to the same network (Grajek, 2010). In this case, economic incompatibility increases the pecuniary switching costs derived from the higher costs of communicating with users of the previous network. Thus, incompatibility will reinforce the negative effect of switching costs on utility and, consequently, on network value.

H3. Switching costs have a negative effect on firm network value.

Network value and performance. In network industries, current performance is strongly dependent on past events (Farrell and Klemperer, 2007; McIntyre and Subramaniam, 2009). This is the so-called positive feedback that *reinforces that which gains success or aggravates that which suffers loss* (Arthur, 1996: 100).

The literature has suggested that a continuous increase in network value is followed by an increase in the willingness to pay to have access to that network (Doganoglu and Grzybowski, 2007) and the subsequent decrease of the marginal costs of each information interchange (Arthur, 1990). This is because the value does not lie in the product itself, but in the size and intensity of the network (De Palma and Leruth, 1996; Grajek, 2010). The product is more valuable as more people use it (Doganoglu and Gryzbowski, 2007). While a greater network value permits a higher price, marginal costs decrease as more and more information ties take place. In spite of a large initial investment, the marginal costs of producing an additional exchange are relatively cheap

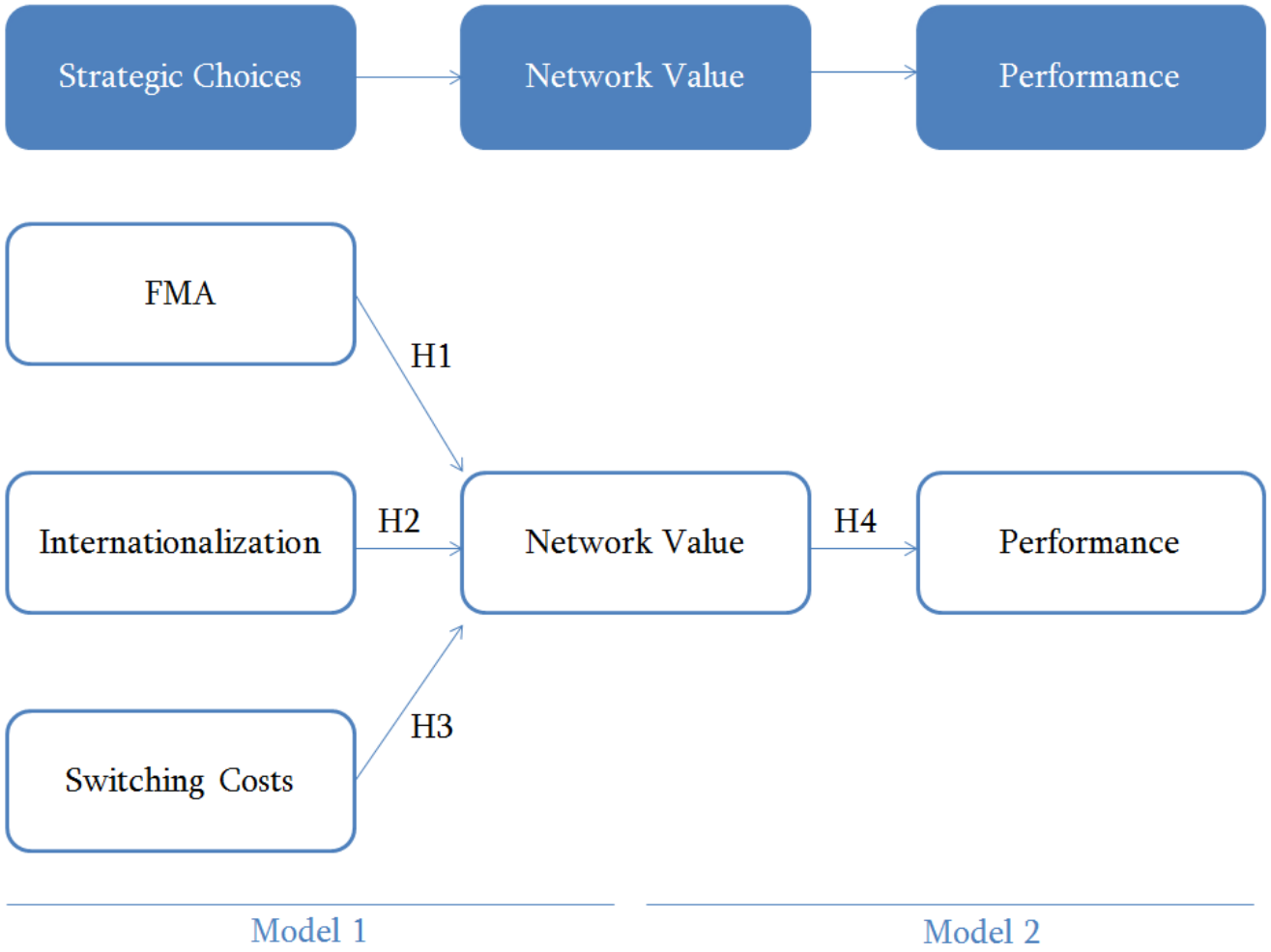
(Shapiro and Varian, 1998) because information markets are knowledge-based (Arthur, 1990).

It is expected that a firm with a larger network value will also obtain a higher marginal net income from each information exchange derived from a higher price and lower marginal costs. Thus, performance will be positively related to network value.

H4. Network value has a positive effect on firm performance.

According to previous arguments, I build a model to test in the following sections as it is shown in Figure 3.1.

Figure 3.1. Strategic Choices, Network Value and Performance (Hypotheses)



3.3. DATA AND VARIABLES

3.3.1. Research Setting: the European Mobile Communications Industry[6]

As told in Chapter 2, mobile technology has reached the highest penetration rate in European countries given the consecution of a common standard at the beginning of 1990s'. The European mobile communications industry represents a large, fruitful and growing portion of Europe's economy. This industry has become an important source of wealth in Europe. For instance, the telecommunications industry made up 2.83% of the GDP at the end of 2007, whereas, for example, agriculture constituted 1.82% (World Bank Group, 2010). The Financial Times Global 500 Index (2011) shows that 11 of the 50 largest firms in the world belong to network industries, five of them being mobile operators of which two, moreover, are European (Vodafone in the United Kingdom and Telefónica in Spain).

The literature emphasizes the role of expectations and users' coordination on users' choice of mobile network (Doganoglu and Grazybowski, 2007; Gandal, 2002; Church and Gandal, 2005). It has been

[6] Given that Chapter 3 does not introduce yet the institution-based view of firm strategy and focuses on strategic management on network industries, it has been preferred to focus on the mobile telecommunications in European countries. Using this mature industry in Europe assures a higher homogeneity in terms of competition, users' preferences and regulation. It will allow that sample is not biased by institutional differences between countries in terms of technology acceptance and regulation. Moreover, taking European countries assures the existence of a common standard and, thus, roaming availability between countries (in order to test Hypothesis 2).

shown that, among other factors, the total installed base of an operator plays an important role in users' expectations and coordination (Birke and Swann, 2006). Because of this, small operators in European markets may fail if they do not achieve a minimum critical mass to influence users' expectations and coordination (Economides and Himmelberg, 1995).

Incompatibility issues have been especially remarkable in the European context in determining the scope of networks and understanding the existence of tariff-mediated or artificial network effects. As previously mentioned, the scope of networks is dependent on technological and economic compatibility. With regard to technological compatibility, in 1984, the European Commission, through the Group Special Mobile (GSM), encouraged the development of a common technological standard which allowed mobile services within national and international networks. As a consequence, a user can employ his/her handset to make calls to the mobile phones of any firm in the country without technological restrictions and can use the same handset in any European country thanks to international roaming agreements.

Nevertheless, in spite of this technological compatibility guided by supranational authorities, an economic incompatibility between firms' networks comes from the price discrimination between on-net and off-net calls. It generates what the literature has called tariff-mediated network effects, which appear at firm-level (Grajek, 2010; Laffont, Rey and Tirole, 1998). Users prefer to belong to a larger network to reduce

the probability of making off-net calls and benefit from lower on-net prices.

Price discrimination between on-net and off-net calls has been identified by different authorities, including the Commission of the European Communities and Ofcom (the UK regulator), in most European countries (e.g., United Kingdom, Spain, Portugal and Germany).[7] Although authorities have considered price discrimination to be an issue, only Ofcom quantifies it. A report from 2007 observes that, between 2002 and 2006, price discrimination in the United Kingdom decreased from 17.5 to 5.4 pence per minute. In spite of the decrease, price discrimination still exists in the market (Ofcom, 2011).

This research setting is appropriate for analyzing the strategic actions described in the hypotheses above. First, entry timing strategies have been analyzed in the mobile communications industry and the results show that being the first into the market does pay (Bijwaard, Janssen and Maasland, 2008; Gomez and Maicas, 2011; Usero and Fernandez, 2009). Second, European mobile operators started their expansion around the world in the last years of the 20th century. The result of this internationalization process is that several groups, such as Vodafone, Teléfonica and T-mobile, have evolved from being mostly local operators to become highly internationalized. The internationalization of these operators has been studied in previous literature (Curwen and Whalley, 2008; Gerpott and Jakopin, 2005; Graack, 1996). Finally,

[7] For further information, see Commission of the European Communities (2007, 2009) and Ofcom (2007).

switching costs have been found to be linked to the industry and their impact on firm performance has been analyzed (Shy, 2001; Viard, 2007).

3.3.2. Sample

The database includes the whole population of mobile communications providers that operated in twenty European markets between the last quarter of 1998 and the second quarter of 2008[8]. This long period is important because the sample does not suffer from survival bias. It should be clarified that the data refers to the activity of each operator in each country because, in mobile communications, competition takes place within national markets.[9] Information 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. I have also collected information about the date of entry of the firms and their shareholder

[8] The European 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. Since the measure of network value which will be used in this study does not take into account price considerations, it has been considered the period 1998 to 2008 to avoid changes in the importance that users could confer to the price variable in selecting a network as a consequence of the recession which started to be noticed from the middle of 2008.

[9] Licenses granted by governments give the number of firms competing in a country. These licenses allow operators to use the radio spectrum inside the country. This means that, although international groups operate in several countries, our unit of analysis is the firm-market pair (e.g., Vodafone Spain, Orange France and O2 Germany).

structure, mainly from industry reports and the corporate information of the firms.

3.3.3. Measurement of Variables

Network value. The literature offers different approaches to the measurement of the network value of a firm. Swann (2002) describes the traditional ways to determine it. The simplest way, Sarnoff's Law, measures network value through the size of the installed base, *n* (Reed, 1999).

Nevertheless, it has been argued that network value does not only depend on the size of the installed base. My interest lies in network industries with direct network effects. In these industries, the possibilities of communication increase with the number of users consuming the good and, thus, their perceived utility grows. According to Church and Gandal (2004:3), *an adopter's link to the network has no value except to facilitate the transmission of information to, and from, other adopters*. Farrell and Klemperer (2007) suggest that the users of a communication network gain directly when other users adopt it because they have more opportunities for interaction with peers. Stabell and Fjelstad (1998: 431) also consider that in network industries *the dependency among customers is the main product delivered*. Thus, a second option for measuring network value is to proxy it by the number of possible communication ties that exist among the users of the same network. This is known as Metcalfe's Law and is measured as $n*(n-1)$. With this measure, I mainly focus on the possibilities of connectivity between users (Ross, 2003).

Metcalfe's Law has been criticized for giving the same importance to all users (Grajek, 2010; Briscoe, Odlyzko and Tilly, 2006). As mentioned in the second section, network intensity determines the relationship between network size and network value (McIntyre and Subramaniam, 2009). This intensity depends on several factors, including the stage of the product-life cycle in which users adopt the product. Farrell and Klemperer (2007:1975) suggest that early adopters are more important than later adopters, first adopters having an "excess early power" to determine the dominant network in the future. Early adopters generate more network value for the firm than later ones because of the inertia operating in these markets. For this reason, the literature has suggested a third approach that considers a decreasing marginal network value as $n*log(n)$, known as Zipf's Law (Briscoe et al., 2006). This expression acknowledges both the idea of users' connectivity and the differences between early and late adopters. It will be used this approach as first measure of network value (*NETWORK VALUE*).

However, Zipf's Law only considers the firm's own network size in the calculus of the network value of the firm. That is, with the same number of users, network value will be the same in different markets independently of the market characteristics (number of rivals, differences in size…). This does not introduce any bias into the calculus of network value if there is total compatibility among networks. Nevertheless, in mobile communications there is some degree of incompatibility among networks (Grajek, 2010). In this industry, economic incompatibility is reflected in the differences between on-net and off-net tariffs. For this reason, I propose an alternative measure of

network value that tries to overcome some of the inconveniences of Zipf's Law by taking into account the particular conditions of each market (e.g., number of rivals and differences in size) and, thus, the existence of different network intensities in different networks. With this measure, I try to determine which firms are capable of leveraging more intensive network effects or, in other words, which firms are more attractive to users depending on market structure (McIntyre and Subramaniam, 2009).

A very simplistic but illustrative example of the previous reasoning is going to be offered. Consider two markets, A and B, with two firms, firms 1 and 2, operating in each and the market shares shown in Table 3.1.

Table 3.1. Example

	Market A	**Market B**
Firm 1	60% (1,200 subscribers)	80% (1,200 subscribers)
Firm 2	40% (800 subscribers)	20% (300 subscribers)

In the two markets, firm 1 has the same network value using Zipf's Law (1,200*log(1,200)) and offers more communication possibilities than firm 2. However, users of firm 1 in market A have twice the probability of making off-net calls (40%) than users of firm 1 in market B (20%). Following the anecdotal evidence in the industry, there is a tendency in mobile communications to penalize off-net calls through a higher price than on-net calls (Birke and Swann, 2006; Grajek, 2010). Thus, users of

firm 1 in market B receive a higher utility from having selected firm 1 instead of firm 2 than in network A. In other words, the network of firm 1 in market B is more attractive than in market A and can leverage more intensive network effects, because of the price differences between on-net and off-net calls.[10]

The higher the expected probability of making on-net calls over the probability of making off-net calls, the more attractive the network of a particular firm is. I propose amending Zipf's Law with the ratio of on-net over off-net call probabilities ($prob_{on\text{-}net}$ / $prob_{off\text{-}net}$), assuming that the calls from one network to another are proportional to the sizes of the installed bases. In this way, a firm that has achieved a larger installed base in comparison with its direct rivals in its specific market is rewarded since the probability of users that have chosen it supporting an additional cost derived from making off-net calls is inferior ($prob_{on\text{-}net} > prob_{off\text{-}net}$). Likewise, this ratio penalizes those firms that have a lower network size, with a higher probability of their users making off-net calls and, thus, supporting higher call costs ($prob_{on\text{-}net} < prob_{off\text{-}net}$).

In order to calculate the expected probability of making on-net calls over off-net calls ($prob_{on\text{-}net}$ / $prob_{off\text{-}net}$), I borrow the example provided by Birke and Swann (2006) who develop a likelihood matrix that represents the pattern of calls between rival networks in a given market. Let's assume that there are four operators (i = 1,…, 4) competing in a market and that the market share of each is given by mi. Assuming that

[10] As mentioned in footnote 5, the literature has referred to this phenomenon as tariff or price-mediated network effects (Laffont, Rey and Tirole, 1998; Birke and Swann, 2006), and these lead to artificial or economic incompatibility among firm networks.

there are no price differences between on-net and off-net calls and accepting that the calls from one network to another are proportional to the sizes of the installed bases, the expected call probability among users of different networks is given by the product of their respective market shares as shown in the following matrix (Table 3.2).

Table 3.2. Likelihood Matrix of Calls Across Networks

		To Network			
		1	2	3	4
Calls from Network	1	$m_1 m_1$	$m_1 m_2$	$m_1 m_3$	$m_1 m_4$
	2	$m_2 m_1$	$m_2 m_2$	$m_2 m_3$	$m_2 m_4$
	3	$m_3 m_1$	$m_3 m_2$	$m_3 m_3$	$m_3 m_4$
	4	$m_4 m_1$	$m_4 m_2$	$m_4 m_3$	$m_4 m_4$

Source: Birke and Swann (2006).

The probability of making on-net calls ($prob_{on\text{-}net}$) is given by the elements of the matrix diagonal ($m_i m_i$), whereas the off-diagonal elements ($m_i m_j$) refer to off-net call probability ($prob_{off\text{-}net}$) between networks for each firm. Thus, the probability of making on-net calls over off-net calls for each firm i in a market with M companies is given by the ratio:

$$\frac{m_i m_i}{\sum_{j=1}^{M-1} m_i m_j} = \frac{m_i}{1 - m_i} \qquad [i \neq j] \qquad (3.1)$$

By modifying Zipf's Law with this ratio, the adjusted network value (*NETWORK VALUE'*) is expressed as:

$$n_i \log(n_i) \frac{m_i}{1 - m_i} \tag{3.2}$$

As a consequence, the adjusted network value will be higher when: a) there is a larger installed base that allows greater communications possibilities among current users of the network (network size dimension of network value); b) there is a larger difference between the network sizes of the reference firm and its rivals, which gives it a competitive advantage to leverage more intensive network effects and make its network more attractive to potential users (network intensity dimension of network value).

Performance (*PERFORMANCE*). Firm profitability is measured through EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) divided by the total revenues of the firm. Both EBITDA and revenues are calculated for each firm in each national market.

Time in the market (*TIME*). Different concepts of pioneering have been used when modeling first-mover advantages. Srinivasan et al. (2004) consider the pioneer to be the first firm to commercialize a new product. Lieberman and Montgomery (1988) suggest some alternative measures such as the numerical order of entry, rates of company survival, duration of advantages and time from pioneer entry. Brown and Lattin (1994) suggest time in the market as an adequate measure of FMA.

Finally, this variable counts the number of months that a firm has been operating in digital wireless technology (GSM). The decision to take GSM as the starting point of the market responds to the scarce acceptance of analogical technology. For example, in the ten years between 1980 and 1990 when analogical technology was available, the rate of penetration only grew from 0.0% to 0.92%. Accordingly, it is assumed that the market was almost non-existent before the introduction of the digital generation.

International presence (*INTERNATIONALIZATION*). The literature has traditionally measured international diversification through variables such as international sales over total sales (Strike, Gao and Bansal, 2006), number of workers abroad (Brock, Yaffe and Dembovsky, 2006), sales in a country weighted by the importance of this market (Hitt et al., 1997), number of international subsidiaries (Barkema and Drogendijk, 2007; Strike et al., 2006) and the number of countries in which the firm operates (Brock et al., 2006). In this chapter, it has been chosen the number of countries in which the firm is present with an ownership of above 50%. The theoretical rationale is that to influence network value, the level of firm internationalization has to be in the users' minds. Therefore, the main reason to choose the number of countries in which the firm is operating is that this information is known by the user, while other alternatives previously mentioned – number of workers abroad, international sales… – are not easy for the user to identify.

More importantly, the criteria of 50% of ownership has been selected to assure that the international group considers the national operator as

part of the core organization and that international network effects can develop. After reviewing annual reports of international groups in Europe, it is observed that there has been a gradual acquisition of the ownership of national operators, from minority to majority, by international groups. Only after acquiring more than 50% of the ownership, have international groups included the national companies as part of their organizational chart. Moreover, for international network effects to exist, users must be able to recognize the same firm operating in different markets (Shy, 2001), so the international groups in Europe have started to build global brands. The rebranding of acquired operators by international groups has only taken place after the acquisition of an ownership above 50%.

Switching costs (*SWITCHING COSTS*). According to the existing literature, there is an important gap between the theoretical and the empirical research on switching costs (Stango, 2002; Grzybowski, 2007; Chen and Hitt, 2007; Viard, 2007). Only a few articles have tried to properly measure their magnitude. I closely follow the model proposed by Shy (2002). This author develops a method for estimating switching costs among firms in a context where it is only needed to have information about prices and market shares. It is important to note that Shy's method has been previously used in the literature with very similar purposes to those of this chapter (Carlsson and Löfgren, 2006; Gomez and Maicas, 2011; Krafft and Salies, 2008).

Shy (2002) considers a market with two firms (A and B). Consumers are assumed to be distributed between the firms so that, initially, N_A

consumers have already purchased brand A (type a consumers) and N_B consumers have already purchased brand B (type b consumers). p_A and p_B represent firm A and B prices, respectively, and s is the cost of switching brands. The utility U_A (U_B) for a user who is now buying from A (B), can be written as:

$$U_A \overset{def}{=} \begin{cases} -p_A & \text{staying with brand A} \\ -p_B - s & \text{switching to brand B} \end{cases}$$

The number of subscribers for A (B), n_A (n_B) in the following period is given by,

$$n_A = \begin{cases} 0 & \text{if } p_A > p_B + s \\ N_A & \text{if } p_B - s \le p_A \le p_B + s \\ N_A + N_B & \text{if } p_A < p_B - s \end{cases}$$

If it is assumed that the firm's production costs are zero, the profit, π_A (π_B), of each firm is:

$$\pi_A(p_A, p_B) = p_A n_A$$

Shy (2002) postulates that the pair of prices that solve the problem for firms A and B and constitute a Nash-Bertrand equilibrium are:

$$p_A = \frac{(N_A + N_B)(N_A + 2N_B)s}{(N_A)^2 + N_A N_B + (N_B)^2} \quad \text{and} \quad p_B = \frac{(N_A + N_B)(2N_A + N_B)s}{(N_A)^2 + N_A N_B + (N_B)^2}$$

Shy (2002) extends the model to a multi-firm industry. He considers the possibility of more than two firms, each indexed by i, i = 1,…, M (firms

in order of higher to lower market share). The expressions for switching costs in a multi-firm industry are:

$$s_i = p_i - \frac{N_M P_M}{N_i + N_M}$$, if I $\in$ {1, …, M-1} and $$s_M = p_M - \frac{N_1 P_1}{N_1 + N_M}$$

In this model, it is important to have a precise measure of sizes and prices. Sizes are incorporated into the switching costs function through the market shares of the firms. A more controversial issue is to define prices in mobile communications. Prices usually vary depending on the characteristics of the user, the receiver of the phone call (on-net vs. off-net calls) or the time of the day. To solve this problem, Shy (2002) derives prices from the Average Revenue per User (ARpU) in his calculation of switching costs in mobile communications in Israel. Furthermore, the use of ARpU as a proxy of prices is also motivated by *its widespread use in industry and regulatory circles* (McCloughan and Lyons, 2006:523). An additional advantage of ARpU is that it makes comparisons among countries possible.

Control variables. Besides the variables described to test the proposed hypotheses, models also control for additional covariates. First, there is a control for the population in each national market (*POPULATION*), which is expected to have a positive relationship with network value and performance because the communication possibilities in each national market will be higher. Given that population can be considered as a proxy of the potential size of the industry, the introduction of this variable also allows us to control for the existence of industry-level network effects. Country-specific rivalry is also controlled by taking into

account the number of firms operating in each market (*FIRMS*). This variable is expected to negatively affect firm performance. However, the relationship between the number of firms and network value is not so clear. A higher number of firms would probably result in smaller networks, decreasing network value. But the increase in the number of firms could also constitute an improvement in the competitiveness of the market and price reductions. It might enhance users' utility and technology adoption, with a subsequent increase of network value. Finally, the model also includes year dummies to control for time-specific influences (*YEAR*).

3.3.4. Descriptive Statistics

Descriptive statistics are shown in Tables 3.3 and 3.4. The first includes the determinants of the network value model and the second those of the profitability model. The existence of missing values in dependent variables implies that the final sample has 2,032 observations for the network value model and 1,991 for the profitability model.

As can be seen in Table 3.3, the average value of the first measure of network value (*NETWORK VALUE*) is 15.28, while it is 9.25 for the adjusted network value (*NETWORK VALUE'*). Moreover, the average European firm has been operating in the market for nine years (107.5 months) at the end of the study range, has established a presence in 8 countries around the world and has positive switching costs of around 17 euros per user. The average number of firms per market is 3. When the correlation matrix is analyzed, it can be observed that both network value and adjusted network value are highly correlated with population

and with time in the market. Nevertheless, the correlation among the independent variables is moderate. Table 3.4 shows that the performance is better than the performance in the previous period, exhibiting a positive relationship with network value but a negative one with population and number of firms.

Table 3.3. Descriptive Statistics Model 1 (n= 2,032)

Variable	Mean	Std. Dev.	Min	Max	1	2	3	4	5	6	7
1. NETWORK VALUE	15.28	24.09	-0.37	140.08	-						
2. NETWORK VALUE'	9.25	17.14	-0.13	105.38	0.92*	-					
3. TIME	107.48	44.36	3.00	258.00	0.37*	0.33*	-				
4. INTERNATIONALIZATION	7.95	7.04	1.00	28.00	0.28*	0.21*	0.31*	-			
5. SWITCHING COSTS	17.22	11.19	-18.28	56.51	0.07*	0.15*	0.24*	0.13*	-		
6. FIRMS	3.27	0.65	2.00	5.00	0.14*	0.03	-0.10*	0.15*	0.02	-	
7. POPULATION	27.12	25.64	3.87	82.541	0.76*	0.56*	0.08*	0.13*	-0.02	0.31*	-

$^{*}p < 0.01$

Table 3.4. Descriptive Statistics Model 2 (N=1,991)

Variable	Mean	Std. Dev.	Min	Max	1	2	3	4	5	6
1. PERFORMANCE $_{t}$	0.29	0.24	-3.57	.58	-					
2. PERFORMANCE $_{t-1}$	0.28	0.38	-9.17	0.58	0.90*	-				
3. NETWORK VALUE	15.59	24.29	-0.37	140.08	0.16*	0.17*	-			
4. NETWORK VALUE'	9.54	17.49	-0.07	105.38	0.18*	0.18*	0.91*	-		
5. FIRMS	3.28	0.66	2.00	5.00	-0.14*	-0.15*	0.14*	0.03	-	
6. POPULATION	26.48	25.57	3.87	82.54	-0.01	0.01	0.73*	0.57*	0.31*	-

*$p < 0.01$

3.4. METHODS

In this section, I develop two econometric models that help to describe and empirically examine the determinants of network value and the impact of the latter on firm performance. First, the network value and firm profitability models are presented separately. After that, I discuss the procedure to estimate the system of equations.

3.4.1. Network Value Model

It is modeled the network value of firm *i* (competing in market k) in period *t* (*NETWORK VALUE*$_{ikt}$) as a function of the time that firm *i* has been competing in the market (*TIME*$_{ikt}$), the international presence of firm *i* (*INTERNATIONALIZATION*$_{it}$), and the switching costs of firm *i* (*SWITCHING COSTS*$_{ikt}$). To control for additional sources of variation in network value, I introduce a set of control variables that include the population in market *k* in period *t* (*POPULATION*$_{kt}$), the number of firms competing in market *k* in period *t* (*FIRMS*$_{kt}$) and year effects (*YEAR*). The network value model is presented in Equation (3.3) as follows:

$$NETWORK\ VALUE_{ikt} = \beta_1\ TIME_{ikt} + \beta_2\ INTERNATIONALIZATION_{it} + \beta_3\ SWITCHING\ COSTS_{ikt} + \beta_4\ POPULATION_{kt} + \beta_5\ FIRMS_{kt} + \beta_6\ YEAR + \varepsilon_{ikt} \quad (3.3)$$

3.4.2. Profitability Model

Consistent with the proposed conceptual framework, I relate the network value of the firm to performance outcomes. The performance of

firm i in market k in period t ($PERFORMANCE_{ikt}$) is modeled as a function of network value. Following previous literature, especially in industries with increasing returns where there is a path dependency from performance in previous periods, I control for past realizations of the dependent variable ($PERFORMANCE_{ikt-1)}$. Additional factors that potentially affect profitability are also controlled, including the population in market k in period t ($POPULATION_{kt}$), the number of firms in market k in period t ($FIRMS_{kt}$) and time controls (YEAR).

$$PERFORMANCE_{ikt} = \lambda_0 + \lambda_1 PERFORMANCE_{ikt-1} + \lambda_2 NETWORK\ VALUE_{ikt}$$

$$+ \lambda_3 POPULATION_{kt} + \lambda_4 FIRMS_{kt} + \lambda_5 YEAR + \varphi_{ikt} \qquad (3.4)$$

3.4.3. Estimation Procedure

Equations (3.3) and (3.4) are estimated as follows. I propose static panel estimators to explore the determinants of network value (Hypotheses 1 to 3). A fixed effect model where network value is the dependent variable is estimated. The fixed effects estimation method is used in longitudinal panel analyses and allows the unobserved individual effects to be correlated with the included variables (Greene, 2003). The existence of these individual effects has been tested by the Lagrange multiplier of Breusch and Pagan (1980) and the preference for fixed effects estimation over random effects derives from the test of Hausman (1978). However, dynamic panel estimators are considered for the profitability model (Hypothesis 4) since the lagged performance is introduced as the explanatory variable of the performance equation (4.2).

Hypothesis 4 is tested by estimating a System Generalized Method of Moments model (System GMM), proposed by Arellano and Bover (1995) and fully developed by Blundell and Bond (1998). It is frequently used in profitability models in which current performance is highly conditioned by firm performance in the previous period. Jointly with the lagged performance, I also include network value as a regressor to test the impact of this key element on firm performance.

3.5. RESULTS

3.5.1. Strategic Choices and Network Value

Table 3.5 reports the parameter estimated for the fixed effects models. All the equations present heteroskedasticity and autocorrelation consistent (HAC) estimates. To test the three first hypotheses, eight regressions with two dependent variables have been run: network value (NETWORK VALUE) from equation A.1 to A.4 and adjusted network value (NETWORK VALUE') from B.1 to B.4. Equations A.1 and B.1 only include the control variables, while the remaining explanatory variables are added consecutively in a nested way, so that models A.4 and B.4 present the estimation that includes all the explanatory variables. The hypothesis that the independent variables are jointly equal to zero is rejected for both models, A.1 and B.1 ($p < 0.01$), as can be inferred from the F-test (not shown). Compared with equations with no explanatory variables, the full models, A.4 and B.4, show a significantly better fit.

Model A.2 shows that the variable *time in the market* presents a positive and highly significant effect, which supports Hypothesis 1: network

value increases with the time that the firm has been operating in the market. Model A.3 adds the variable *internationalization*. Its value is also positive but non-significant, thus, Hypothesis 2 cannot be accepted. Finally, model A.4 also includes the variable *switching costs*, with a negative and significant coefficient: the presence of switching costs decreases the network value, as proposed in Hypothesis 3. The F-test, which compares different nested models, is also shown at the end of Table 3.5 and confirms that the estimation presented in column A.4 is the one that best fits the data. In this model, the global fit is quite satisfactory, with an R-squared around 0.6. In any case, it is also important to note that the value of the coefficients of the main explanatory variables of the model remains highly stable in all the estimations.

With respect to the control variables, *population* in each national market has a positive and significant influence on network value in all models. This means that the total size of the market, proxied by population, is positively related to the dependent variable and reveals that the mobile communications industry also presents network effects at industry-level, which is consistent with previous findings (Kim and Kwon, 2003). The variable *firms* is significant only in the final model A.4. One possible explanation may be the low but positive correlation between firms and switching costs. When both are included in model A.4, they are significant. When the switching costs variable is dropped in model A.3, its impact on network value might be partially captured by the remaining variables. In this case, firms in equation A.3 may reflect the positive influence of firms on network value but also the negative one of

switching costs on network value. This results in a reduction of the direct positive effect of firms on network value by the introduction of the negative effect of switching costs, making the final coefficient non-significant.

If it is considered the set of models that use the adjusted network value as the dependent variable, the sign and significance of the main coefficients does not change. As can be seen in Table 3.5, *time in the market* increases adjusted network value and switching costs decrease it, supporting Hypotheses 1 and 3, respectively. *Internationalization* has no significant effect on network value, which means that Hypothesis 2 is not supported. These coefficients remain highly stable in all the estimations. As for the control variables, time dummies are globally significant and *population* preserves its positive and significant influence on network value. However, the variable *firms* loses its positive significance. The F-test confirms that model B.4 is the estimation that best fits the data. In this model, R-squared presents a value of 0.46. Note that the measure of network value that takes into account the disutility perceived by the existence of rival networks in the presence of economic incompatibility reduces the coefficients of the main explanatory variables although the sign of the relationship with network value does not substantially change.

TABLE 3.5. DETERMINANTS OF NETWORK VALUE (FE)

	NETWORK VALUE				NETWORK VALUE'			
	(A.1)	(A.2)	(A.3)	(A.4)	(B.1)	(B.2)	(B.3)	(B.4)
TIME		0.242***	0.229***	0.224***		0.117***	0.113***	0.110***
		(5.70)	(5.46)	(6.06)		(4.81)	(4.74)	(5.31)
INTERNAT.			0.230	0.168			0.076	0.035
			(1.02)	(0.79)			(0.59)	(0.30)
SW. COSTS				-0.539**				-0.348***
				(-2.60)				(-2.90)
FIRMS	1.899	1.971	1.781	4.636**	0.006	0.042	-0.020	1.823
	(1.12)	(1.17)	(1.09)	(2.37)	(0.01)	(0.04)	(-0.02)	(1.44)
POPULATION	6.225***	6.210***	5.991***	6.434***	2.855**	2.847**	2.776**	3.062***
	(3.48)	(3.47)	(3.16)	(4.06)	(2.50)	(2.49)	(2.35)	(3.07)
YEAR Dummies	YES***	YES***	YES***	YES***	YES*	YES**	YES**	YES**
Number of observations	2,032	2,032	2,032	2,032	2,032	2,032	2,032	2,032
R2	0.524	0.530	0.534	0.600	0.370	0.373	0.375	0.463
F-Test vs. 1		32.55***	16.70***	15.37***		23.14***	11.80***	11.51***
F-Test vs. 2			1.03	3.68**			0.34	4.21**
F-Test vs. 3				6.74**				8.41***

t-statistics in parentheses

* $p < 0.10$

** $p < 0.05$

*** $p < 0.01$

3.5.2. Performance and Network Value

The results of the estimations of the performance model are shown in Table 3.6. Model C.1 introduces the control variables and the lagged performance, whereas models C.2 and C.3 add network value and adjusted network value, respectively. The specification choice is based on a System GMM with first differences, a one-step estimation that is robust to heteroskedasticity and takes into account the potential endogeneity of the explanatory variables. To assess the validity of the System GMM estimators, I run the Arellano-Bond test for first-order and second-order serial correlation. Table 3.6 reports the significant m1 and insignificant m2 serial correlation statistics. This indicates that there is no second-order correlation in the level of residuals. The Hansen test is also reported and its non-significance validates the robustness of estimations.

Lagged *performance* has a positive and significant influence on performance with a coefficient that is highly stable in the three estimations. This means that performance in the previous period positively influences current performance. This result justifies the use of the GMM estimator in this part of the analysis. Firm *network value* has, as expected, a positive and significant impact on performance (models C.2 and C.3), which supports Hypothesis 4. The variable *firms* has a negative and significant influence on firm performance as a result of increasing rivalry and year dummies are also statistically significant. Population does not seem to influence performance, except for model C.2 in which the influence is marginally negative.

TABLE 3.6. PERFORMANCE AND NETWORK VALUE (SYSTEM GMM)

	(C.1) PERFORMANCE$_t$	(C.2) PERFORMANCE$_t$	(C.3) PERFORMANCE$_t$
NETWORK VALUE		0.002***	
		(3.99)	
NETWORK VALUE'			0.003***
			(2.97)
PERFORMANCE $_{t-1}$	0.467***	0.467***	0.464***
	(20.56)	(19.60)	(19.75)
FIRMS	-0.047***	-0.041***	-0.036**
	(-3.04)	(-2.92)	(-2.46)
POPULATION	0.001	-0.001*	-0.001
	(1.24)	(-1.75)	(-1.21)
YEAR Dummies	YES***	YES***	YES***
Constant	0.316***	0.286***	0.274***
	(7.26)	(7.48)	(6.94)
Number of observations	1,991	1,991	1,991
m1	-2.92***	-2.95***	-2.94***
m2	-0.04	-0.04	-0.04
Hansen Test	37.64	53.76	48.16
F-Test vs. 1		15.88***	8.85***

t -statistics in parentheses

* $p < 0.10$

** $p < 0.05$

*** $p < 0.01$

3.6. DISCUSSION AND CONCLUSIONS

This chapter contributes to the study of markets with network effects from a strategic perspective by introducing network value as a key concept. I have empirically tested a conceptual model in which the firm's strategy may condition network effects and firm profitability through the three main elements that the literature has highlighted in network markets, i.e.: expectations, coordination and compatibility. This chapter, by focusing on firm-initiated actions to leverage network effects, has led to a greater understanding of firm-level strategy in network industries.

Results reveal the importance of entry timing in markets with network effects. This result is highly consistent with previous findings (Gomez and Maicas, 2011; Usero and Fernández, 2009). Switching costs also appear as a key strategic tool that influences network value. High switching costs have been shown to dissuade the selection of a firm network by potential users with the subsequent negative effect on network value. Users distrust firms with high switching costs because they suspect that these firms will behave opportunistically (Mata et al., 1995), thus decreasing the effectiveness of network effects. Consequently, firms have to find a trade-off between creating high switching costs to retain their customers and being less aggressive so as to be perceived by potential customers as an appealing and trustworthy alternative. Contrary to what was expected, operating in various international markets is not a strategy that greatly influences users' expectations and, thus, its impact on network effects is not significant.

The explanation I can provide for this unexpected finding in the industry is threefold. First, while it is true that a number of mobile service providers are competing globally, users are restricted in their choices to companies operating in their local markets. In mobile telecommunications, users take into account only the network of the country where they live whereas, in other information industries such as software, hardware and online auctions, users do not perceive national boundaries in their decisions. Second, the internationalization of mobile operators could have become a strategic necessity. This seems to be clear from an analysis of the recent evolution of the industry in which the international diversification of the main operators has been quite similar. Finally, the availability of roaming services in all European countries, the similarity of roaming coverage and charges within operators, and the lack of complete information for users about roaming charges within the operators of the same international group (Salsas and Koboldt, 2004) may limit the existence of international network effects. Summarizing, although international network effects could exist in the industry, current market conditions do not favor them.

This chapter also analyzes how network value is an element that is positively related to firm performance. The main premise is that users are willing to pay more for being part of a network with a larger installed base since the product does not provide any value by itself. The value comes from the communication ties that the network offers to users and this allows firms to increase the price of their product or service.

Through the analysis of the above relationships, this research makes a contribution by offering a more accurate measurement of network value. Traditionally, network value has been considered to be proportional to network size. Although this can be reasonable, this chapter has added the intensity dimension to the traditional approach. I have adjusted previous measures by considering not only the firm's own network, but also its rivals' networks, that is, market competition is introduced into the assessment of network intensity and, thus, network value. Although the main findings do not substantially change, the adjusted measure I use shows a lower network value, which is perfectly understandable as it is considered the existence of other firms' networks that reduce users' utility since the probability of making off-net information exchanges with higher costs increases.

Chapter 3 has several managerial implications. It recommends paying special attention to entry timing strategies in network industries. Firms should try to attract users to their network as soon as possible to gain competitive advantage. Because of this, it is not surprising to observe that bargain-then-rip-off strategies are very common in the first stages of market evolution as an adequate mechanism to attract users that will be exploited at a later stage. Thus, entry timing and price strategy have to be considered simultaneously when network effects are important. However, firms in these markets should be aware of not overexploiting their customers when lock-in is a likely market outcome. The perception of high switching costs may lead users to suspect that firms will behave opportunistically, which could result in fewer incentives to enter into a relationship with the firm. This chapter also has implications for

managers about the international diversification of mobile operators. Apparently, international presence has no impact on network value, which, in my view, does not mean that firms need not pay attention to their international strategy, but rather that it may have become a strategic necessity to survive in the industry.

It is important to note that the research setting refers to an industry in which the regulator plays a key role. For this reason, several policy implications can also be derived. Importantly, the effectiveness of FMA in the mobile communications industry depends on the winning of a license that is granted by national authorities and that is compulsory to compete for. Governments should be aware of the direct impact that their decisions have on competition in each local market. A reduced number of licenses or restrictive criteria to start an activity could reduce the number of competitors. This initial restriction could constitute an entry barrier in the future because a firm that cannot obtain a license at the first stage of competition will lose time in the market, which has been revealed as a valuable resource. Additionally, results show the important effect of switching costs in reducing network value and consumers' welfare in network markets. Thus, the regulator should bear in mind that switching costs are a prevailing feature in the industry that can be harmful to customers' interests. Indeed, in the context of mobile communications, the regulator has already recognized the importance of this dimension, reducing switching barriers and developing several measures to make switching easier and less costly. Mobile number portability is, perhaps, the most noteworthy effort in this direction and

it has had, according to the literature, the desired effects (Lee, Kim, Lee and Park, 2006).

To our knowledge, this chapter is one of the first attempts to empirically integrate network size and network intensity as part of network value into firm strategy. However, several issues deserve further attention. First, I use an adjusted measure of network value, which does not confer the same importance to all users and takes into account the market position of each firm as a source of different network intensities. However, while it is true that it is made an effort to incorporate several dimensions into my network value approach, the way in which I consider the tendency to make on-net communication only includes market shares and not price differences. Future research should try to improve the measure of network value with detailed data that reflects a more accurate dimension of the probability of making on-net over off-net connections by incorporating an explicit quantification of price discrimination. Although I take the existence of price discrimination as an issue, the inclusion of the degree of price discrimination as a source of network intensity and its evolution over time would improve the measure of network value. In the same vein, another possible extension would be to incorporate the existence of social network effects that reinforce network value. Users do not only select a firm because they believe it will be bigger than the others. Consumer behavior is also influenced by the previous decisions of the people who are socially related to them.

Second, this chapter has taken a theoretical approach to refer to the three antecedents of network effects and network value, i.e. user expectations and coordination, and compatibility. Although they have been useful to build the theoretical foundations of the impact of strategic choices on network value, a deeper understanding and quantification of these elements would constitute a promising avenue for further research.

Third, it has been shown that time in the market is an important determinant of network value. However, it would be interesting to analyze how this expectation of dominance of the first mover can be counteracted by late entrants and diminished over time. Although this chapter has focused on the network-dependent value of a firm, further analysis should study how the improvement of network-independent value by late entrants can reduce the network-dependent advantages of early movers.

Finally, international presence has been shown not to have any significant impact on network value. Although some explanations have been put forward, a better understanding of how the internationalization process has influenced firm performance in these markets and become a strategic necessity is needed. The fact that various operators are competing simultaneously in the same markets would suggest the use of institutional or multimarket contact theories. Moreover, I have adopted a measure of the degree of internationalization that theoretically fits the mobile telecommunications industry. This measure assumes the existence of international network effects, but does not quantify them. With the aim of overcoming this limitation, further

studies should try to develop additional measures of international diversification to the specific context of network industries with international network effects.

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Chapter 4.

STRATEGIC CHOICES AND INSTITUTIONS IN THE FDI PROCESS:

Where to enter

4.1. INTRODUCTION

In recent decades, foreign direct investment (FDI, hereafter) has undergone an impressive worldwide growth. For instance, outward direct investment stocks of OECD countries increased from 1,714 billion US dollars in 1990 to 13,294 billion US dollars in 2007. Similarly, inward direct investment stocks grew from 1,292 to 10,996 billion US dollars in the same 17-year period (OECD, 2010). One of the main consequences of this process is that multinational enterprises (MNEs) have become important organizations that have extended their scope beyond their country boundaries. Since the 60's, there has been a transition from national to global firms whose drivers have attracted the attention of scholars. The main arguments for understanding this process are related to the exploitation of ownership advantages (Hymer, 1960, 1968), stage of product cycle in home country (Vernon, 1966), risk diversification (Lessard, 1976; Rugman, 1976; Agmon and Lessard, 1977), exchange rates theories (Aliber, 1970) and behavioral perspectives (Johanson and Vahlne, 1977, 1990).

One of the most prominent issues that has attracted the attention of scholars in international business (IB) literature is the host market selection. It has been identified as a *key ingredient in the FDI decision* (Xu and Shenkar, 2002: 609). Host market choice is the first step in the FDI process and has been traditionally linked to both exploiting the resource advantages of multinationals in their home countries for carrying out activities in foreign countries (ownership advantages) and appropriating the resources of host countries (location advantages).

Extant literature has offered numerous examples of ownership advantages which MNEs seek to exploit in host countries, including product innovations, financial resources and non-codificable knowledge. Location advantages are related to exploiting, for instance, natural resources, a qualified workforce and a key geographic situation (Dunning and Lundan, 2008; Peng, 2009).

From a theoretical point of view, the analysis of host market choice and internationalization advantages has mainly focused on traditional strategic perspectives, i.e. industry and resource-based views of strategy (Conner, 1991; Dunning, 1980, 1993). However, as Peng, Wang and Jiang (2008) point out, these perspectives ignore the potential influence of macro-institutions, such as regulation, culture and tradition, in strategic FDI choices and MNE performance.

One of the reasons that may explain why the IB literature has not fully considered the macro-institutional context is that it has traditionally focused on the inward and outward FDI of developed countries. Formal institutions in developed countries tend to be strong, in the sense that they help to reduce information asymmetries and enhance the protection of property rights derived from contractual relationships (Meyer et al., 2008). Informal institutions play a less important role than formal rules in enhancing market exchanges in developed countries because the latter can better support more complex transactions than the former (North, 1990; Peng, Sun, Pinkham and Chen, 2009). As McMillan (2007) explains, in developed countries, *the market-supporting institutions are almost invisible*, precisely because they work well in

supporting economic exchanges. This has meant that institutional considerations have been traditionally ignored by IB literature (Peng, Wang and Jiang, 2008). However, recently, interest has arisen for understanding the internationalization of successful MNEs from developing countries, which are characterized by weaker formal institutions (Cuervo-Cazurra, 2012; Meyer et al., 2009). According to McMillan (2007), in developing markets, *the absence of* [formal] *institutions is conspicuous.* In this context, informal institutions become more 'visible' as mechanisms to support economic exchanges (Peng et al., 2009). This has made it necessary to consider the role of the formal and informal institutional contexts, as well as industry and resource conditions, in the determination of the FDI decisions, such as host market selection (Meyer et al., 2009; Peng et al., 2008; Xu and Shenkar, 2002).

Host market selection as a key strategic choice of international business strategy, is *not only driven by industry conditions and firm capabilities, but* [is] *also a reflection of the formal and informal constraints of a particular framework that managers confront* (Peng et al. (2008:923). Formal (e.g. law, regulation and the judicial system) and informal institutions (e.g. culture, religion and tradition) are thought to influence host market selection (Dunning and Lundan, 2008; Peng, 2009). From being considered simply as background conditions, institutions have become key determinants of host market choice (Xu and Shenkar, 2002). This has led to the institution-based view as a third leading perspective of strategy (Ingram and Silverman, 2002; Peng et al., 2008).

In incorporating the institution-based view to the IB literature, cultural distance and formal institutional development[1] have been two key concepts which have gained increasing attention to determine how formal and informal institutions influence MNE host country selection (Kogut and Singh, 1998; Meyer, Estrin, Bhaumik and Peng, 2009).

This chapter aims to further analyze how formal and informal institutions jointly determine MNE host market choice. Although host country selection, cultural distance and formal institutional development are three parts of the internationalization puzzle, previous studies have tended to separately analyze the influence of formal or informal institutions on host market selection. For instance, García-Canal and Guillen (2008), Hermelo and Vassolo (2010) and Holburn and Zelner (2010) analyze the impact of formal institutional development on market choice, while Hutzschenreuter and Voll (2008, 2011) and Makino and Tsang (2011) focus on the effect of informal institutions on the destination of FDI. Few studies have analyzed the effect of both formal and informal institutions on host country selection and, in general, from a theoretical approach (e.g. Xu and Shenkar, 2002). Moreover, most previous literature has not simultaneously considered formal and informal institutions (North, 1990; Peng, 2002) in supporting MNEs' choices. Makino and Tsang (2011) propose a research line to explain *how formal and informal ties are linked together and how they jointly or independently influence FDI flows*.

[1] Although formal institutional development is formulated in positive terms, it has also been defined as formal institutional risk from a negative perspective (Schwens, Eiche and Kabst, 2011).

The contribution of this chapter is twofold. First, the institution-based view of strategy is brought into international business literature by simultaneously considering how formal and informal institutions influence host market choice. This simultaneous consideration of both types of institutions has not been considered in previous studies which take an empirical approach (Makino and Tsang, 2011). We consider all the entry decisions of all the international groups from the same industry, i.e. mobile communications, from 2000 to 2010. This is precisely what constitutes the second contribution of the paper. We offer a very rich empirical setting by covering the five continents, which allows a high level of generalizability for our results.

Employing the institution-based view of IB strategy, the chapter shows the reticence of MNEs to enter countries whose informal institutions (or culture) differ greatly from those of their home countries. It also proposes that a higher development of formal institutions (or stronger formal institutions) increases the incentives of MNEs to enter a host country. Finally, the chapter studies the simultaneous consideration of formal and informal institutions by showing that stronger formal institutions of a host country reduce the importance of cultural distance on host market selection.

The rest of the chapter is organized as follows. In Section 4.2, a review of the literature about internationalization and institutions is offered. Section 4.3 develops the hypotheses of how cultural distance and formal institutional development influence host market choice. Section 4.4 describes the data and variables, and Section 4.5 describes main findings.

The chapter closes with a discussion of its main conclusions, limitations and further research questions.

4.2. THEORY AND HYPOTHESES

4.2.1. A key decision in the internationalization process: where to go

In general terms, a MNE can be understood as a firm that makes a foreign direct investment (FDI) or, in other words, invests in, controls, and manages value-added activities of a subsidiary in other countries (Peng, 2009). The International Monetary Fund (IMF) and the Organization for Economic Co-operation and Development (OECD) determine that MNEs make a foreign direct investment (FDI) when they own at least 10% of the subsidiary equity in order to exercise management control rights. What do MNEs expect to gain when they make a FDI? According to the OLI paradigm (Dunning, 1980, 1993), MNEs expands to other countries with the aim of obtaining ownership (O), location (L) and internalization (I) advantages. First, they seek to extend skills, capabilities and resources accumulated in the home country, such as property rights, intangible asset advantages (e.g., experience, brand, reputation, non-codifiable knowledge and innovatory capacity) and governance skills, to subsidiaries in host countries. The exploitation of ownership advantages has been traditionally used to justify internationalization in the IB literature (e.g. Caves, 1971; Hymer, 1960, 1968; Johnson, 1970). Entering new markets allows MNEs to exploit accumulated resources to gain scale economies, synergies, complementary resources and innovation capacities. Ownership

advantages have been considered the 'why' of MNE activity (Dunning and Lundan, 2009).

Second, once a firm considers that it already has the skills and capabilities to internationally expand, it has to decide the target market of its FDI flows. The OLI paradigm links FDI destination choice to the exploitation of location advantages. Host market selection has been understood as a *key ingredient in the FDI decision* that affects location advantages (Xu and Shenkar, 2002: 609). Accordingly to Peng (2009), MNEs choose a host country looking for location-specific advantages that may come from the acquisition of natural resources, transport and communication infrastructures, strong market demand with customers willing to pay high(er) prices, economies of scale, low-cost factors and the abundance of innovative individuals, firms and universities. Dunning and Lundan (2009) add other location-specific advantages of some locations such as government policies (e.g. in import controls, investment incentives, taxes and labor costs).

Finally, entering a new country through FDI allows MNEs to change from incurring market transactions costs in foreign countries to costs of developing transactions inside the MNE organization. When external costs are higher than the internal costs of establishing a hierarchical system of transactions controlled by the firm, MNEs achieve internalization advantages by entering new markets through FDI (Dunning and Lundan, 2009). Entering a country through FDI seeks to reduce transaction or information costs, buyer ignorance and

uncertainty and protect property rights, among other reasons (Dunning and Lundan, 2009).

4.2.2. Institutions: cultural distance and formal institutional development

Institutions, as has been defined in Chapter 1, are the *rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction* (North, 1990:2). They *impose restrictions by defining legal, moral, and cultural boundaries, setting off legitimate from illegitimate activities* (Scott, 1995: 50). Institutions are important in a society because they help to reduce the uncertainty surrounding economic transactions by defining the expected behavior of individuals and organizations. Given that institutions reduce information asymmetries, they play an important role in supporting economic exchanges in the market by decreasing risks (Arrow, 1971; Casson, 1997; Meyer et al., 2009).

The traditional classification of institutions differentiates informal and formal institutions (North, 1990). *Informal institutions* can be understood as those constraints that people in a society impose upon themselves *to give a structure to their relations with others* (North, 1990). These rules are transmitted from one generation to another by teaching and imitation (Boyd and Richerson, 1995) and, according to North (1990:37), *are a part of the heritage that we call culture*. Tradition, religion, language, customs, values and trust-based relationships are some examples of informal institutions (Dunning and Lundan, 2008). The knowledge of this kind of institutions has been considered a

valuable firm resource (Helfat and Lieberman, 2002) which is difficult to obtain given that it is tacit and experiential (Hennart, 1982).

Informal institutions have their source in the values of a society, they are difficult to change over time (North, 1990) and are country-specific (Dikova and Sahib, 2010). Given that MNEs may operate in different informal institutional contexts, the IB literature, acknowledging the new institutionalism perspective, has created several terms to refer to the institutional disparity between two countries. Cultural distance (Kogut and Singh, 1988) and psychic distance (Johanson and Vahlne, 1977) have been the most frequent concepts used to refer to these factors, e.g. differences in language, traditions, education and behavior codes, which makes *the flow of information from and to the market* difficult (Johanson and Vahlne, 1977).

Following North (1990), who denotes informal institutions as culture, we will refer hereafter to differences in informal institutions between two countries as *cultural distance*. Previous studies have tended to analyze how cultural distance between home and host countries (Kogut & Singh, 1988) and within host-countries – added cultural distance – influences FDI decisions (see, for example, Tihanyi et al., 2005). The knowledge of informal rules becomes a key element in gaining internationalization advantages because it allows firms to be part of the informal business network and gain legitimation in a country (Helfat and Lieberman, 2002; Johanson and Vahlne, 2009). Accordingly, this informal knowledge will be important to take accurate FDI decisions (Xu and Shenkar, 2002; Harzing, 2002).

Formal institutions refer to explicit rules in a society such as laws, regulations, property rights protection, discipline of economic and political markets and contracts (Dunning and Lundan, 2008; Meyer et al., 2009). They have been explicitly established by an authority (such as the government or the judicial system in the case of laws and judicial resolution) or an organization/individual (e.g., in the case of a contractual relationship). They can change over time and can anticipate the desirable behavior of individuals and organizations from general and simply exchanges (e.g. through laws) to specific and complex ones (e.g. by a contract or a judicial resolution).

The MNE literature has incorporated the degree to which formal institutions are capable of favoring economic exchanges in each country. It has been observed that issues such as the extent to which property rights are enforced by judicial systems and the degree of respect of the state and citizens for formal rules vary across countries (Cuervo-Cazurra and Genc, 2008; Kaufmann, Kraay, & Zoido-Lobaton, 1999). MNE literature has defined the concept of *formal institutional development* as the extent to which the formal institutions in a country favor the effectiveness of economic exchanges (Meyer et al., 2009).

4.2.3. Institutions and host market selection

Cultural distance and host market selection. As explained above, reason a firm chooses to internationalize is to transfer skills, capabilities and resources from its headquarters to subsidiaries in order to exploit ownership advantages (Dunning, 1993). However, the routines developed in the home country are based on organizational structures

that are influenced by the national culture (Calori, Lubatki and Very, 1994). When cultural rules are similar in the home and host countries, the behavior of organizations is more predictable and increases trust between contractual parts (e.g., suppliers, customers or the workforce). In other words, when the cultural distance is low, there is a higher external conformity of firm values and structures with environmental requirements, which increases firm legitimation to operate in the market and survive (DiMaggio and Powell, 1983). Sharing the same language, religion, norms and conventions – sometimes determined by the existence of historical ties between countries, not only by geographic proximity (Makino and Tsang, 2011) – may facilitate economic exchanges and, thus, reduce the *liability of foreignness* (Johanson and Vahlne, 1977).

On the contrary, the greater the cultural distance between the home and host countries, the more difficult is the transmission of these strategic routines to a subsidiary (Kostova, 1999). The ownership advantages that MNEs expect to obtain can be reduced by cultural distance (Henisz, 2000; Kostova and Zaheer, 1999; Miller and Eden, 2006; Zaheer, 1995). Even the location advantages that the MNEs expect to obtain may be reduced when the cultural distance is high. The existence of high cultural distance can result in greater difficulties in exploiting and appropriating local resources, such as workforce or agglomeration advantages (Peng, 2009). The foreign company lacks the informal ties necessary to be considered as part of the business network in the country, which leads to problems with suppliers, investors and human resources recruitment. Johanson and Vahlne (2009) refer to this fact as

the *liabilitity of outsidership*. The greater the cultural distance between the home and host countries, the more difficult it will be to have this informal knowledge and these social ties with the business network of the country. It will make the appropriation of local resources by MNEs more costly.

Given the previous arguments, MNEs will prefer to enter countries that are more culturally similar to their home countries to better benefit from ownership and location advantages. Accordingly, the first hypothesis of this chapter is the following:

> *H1. The higher the cultural distance between the home and the host country, the less likely it is that MNEs will enter the latter.*

Formal institutional development and host market selection. Another element that may condition host market selection is the level of formal institutional development. A high level of development of formal institutions implies the existence of rules that do not depend on the trust relationships that a foreign firm has to build in the new country. There are economic and political agents that are responsible for enforcing formal rules, including market intermediaries (e.g. financial analysts, investment banks, auditors, solicitors, brokers, consultants) and government organizations (Meyer et al., 2009). It implies a higher enforcement of contracts, a reduction of information asymmetries and the protection of property rights. A local environment that reduces the uncertainty associated with contractual hazards diminishes the transaction costs of doing business abroad and, thus, increases internalization advantages.

Hermelo and Vassolo (2010) observe that a higher level of development of formal institutions favors the entrance of new firms, resulting in higher levels of FDI. They determine that strong formal institutions that enhance intellectual property rights *encourage local investment in technology and knowledge, (and) favor technology transfers from foreign firms to local subsidiaries*. This makes it possible to take advantage of ownership and location advantages, with a lower risk of asset expropriation (Feinberg and Gupta, 2009).

Following the previous reasoning, it is posited that MNEs will prefer to enter countries with a higher formal institutional development because internationalization advantages can be maintained with fewer risks.

> *H2. The higher the institutional development of a country, the more likely MNEs are to enter that country.*

Cultural distance, formal institutional development and host market selection. It has been suggested that, whereas a higher development of formal institutions can even replace informal institutions (North, 1990), in a context of a low development of formal institutions, *informal constraints will play a larger role in reducing uncertainty, providing guidance, and conferring legitimacy and rewards to managers and firms* (Peng et al., 2009). This means that a knowledge of the informal rules in a society with a low level of formal institutional development becomes an important asset for an organization in order to develop economic exchanges. It has been observed that, in this context, firms can take advantage of institutional advantages through having a better understanding of the informal environment. Helfat and Lieberman

(2002) consider a knowledge of the local environment (including informal rules) as an intangible and specialized resource that can be a source of competitive advantage. In this context, it is important to develop network-centered strategies based on informal relationships (Peng, 2003). As a consequence, the liability of outsidership of MNEs which come from countries with a high cultural distance becomes more damaging because MNEs lack both a knowledge of their informal environment and their informal connections with the business network of the market.

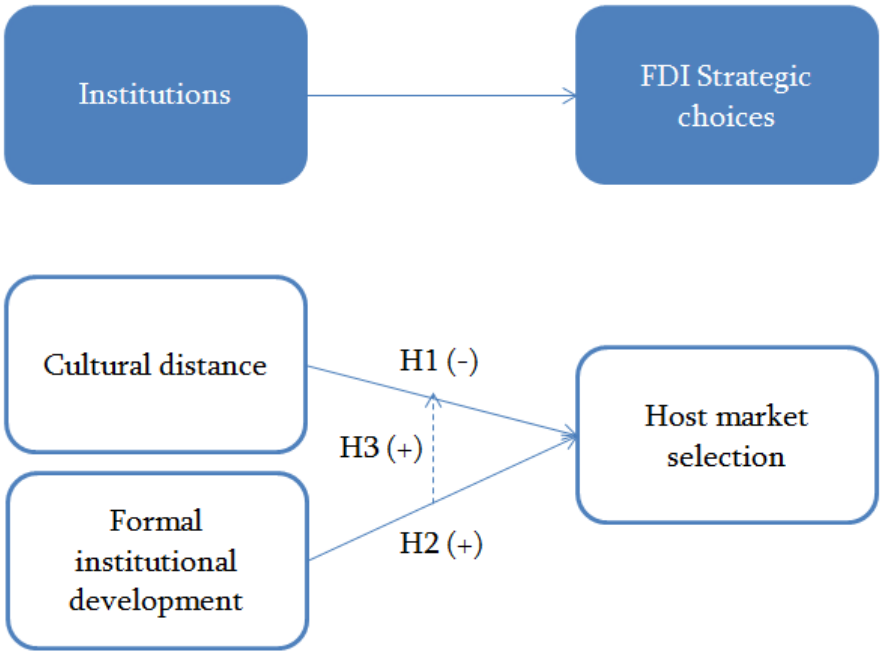
On the contrary, if the development of formal institutions is high, formal rules can replace informal ones because they are able to facilitate more complex economic exchanges (North, 1990). The existence of regulatory bodies that assure the effective engagement of contracts and law will reduce the necessity of creating trust-based relationships (Peng, 2002). Moreover, there are market intermediaries which help new entrants to integrate into the business network of the country (Meyer et al., 2009). This makes the liability of outsidership as a constraint to MNE entry less important.

In accordance with the previous arguments, it is posited that a higher development of formal institutions increases the likelihood of a MNE entering a country with a high cultural distance. Thus, the third hypothesis of this chapter is as follows:

> *H3. The higher the formal institutional development of a country, the lower the negative impact of cultural distance on the likelihood of a MNE entering that country.*

Figure 4.1 summarizes the previous hypotheses.

Figure 4.1. Institutions and FDI strategic choices



4.3. DATA, VARIABLES AND METHODOLOGY

4.3.1. Data

As explained in Chapter 2, the mobile telecommunications industry has been selected as the research setting because, since the late 90s, it has experienced an important worldwide internationalization process. This industry has also been previously selected as a suitable research setting in internationalization studies (Curwen and Whalley, 2008; Gerpott and Jakopin, 2005). Moreover, given the worldwide expansion of mobile communications, this industry is particularly suitable for measuring

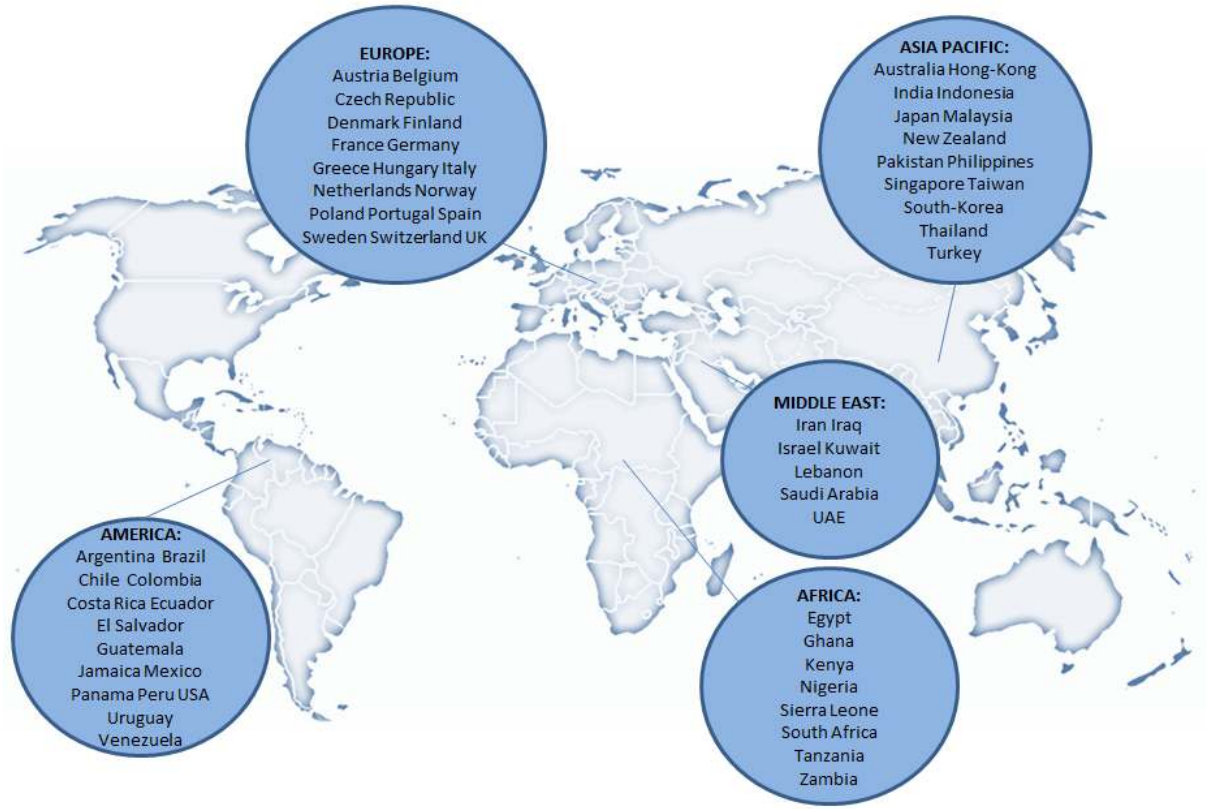
divergences in cultural distance and formal institutional development. Figure 4.2 shows the 62 countries included in the sample and that constitute the destinations of FDI flows of 32 MNEs.

The database includes 213 entries of 32 international groups. Table 4.1 shows the distribution of entries by region from 2000 to 2010 for all the international groups under analysis.[2] As can be observed, international entries have taken place worldwide, but particularly in Europe (34.3%), followed by Asia Pacific (19.2%), America (18.8%), Africa (17.8%) and Middle East (9.9%).

The data come from multiple sources, but the main one is the Wireless Intelligence Database. This publication provides information about the yearly ownership participation of international groups around the world by country and year in the mobile telecommunications industry. Country data, such as governance indicators, population, GDP growth and colonization links, has been obtained from the World Bank Group and the CEPII Database.

[2] In Chapter 4, the period 2000 to 2010 has been selected due to the availability of information. The percentage of ownership of international groups in national firms has been obtained from the Wireless Intelligence Database, which offers data from 2000. Given that part of the country-level data for 2011 was not available at the moment of the analysis, the time series ends at 2010.

Figure 4.2. Countries by region in the sample



UAE = United Arab Emirates; USA = United States of America; UK = United Kingdom.

Table 4.1. Sample Entries by Group and Region

Group	Host Country	America	Africa	Asia Pacific	Europe	Middle East	TOTAL
1. América Móvil	México	11	0	0	0	0	**11**
2. AT&T	USA	2	2	0	0	0	**4**
3. Axiata	Malaysia	0	2	3	0	2	**7**
4. Bharti Airtel	India	0	6	0	0	0	**6**
5. Centennial †	USA	1	0	0	0	0	**1**
6. Deutsche Telekom	Germany	1	0	0	7	0	**8**
7. Digicel	Jamaica	3	0	0	0	0	**3**
8. Etisalat	UAE	0	3	2	0	1	**6**
9. France Telecom	France	2	2	2	10	1	**17**
10. Hutchison	Hong Kong	0	1	4	6	1	**12**
11. KPN	Netherlands	0	0	1	5	0	**6**
12. Maxis Com.	Malaysia	0	0	2	0	0	**2**
13. MTN	South Africa	0	3	0	0	1	**4**
14. NTT Docomo	Japan	1	0	6	4	0	**11**
15.Orascom Telecom	Egypt	0	1	3	0	2	**6**
16.Portugal Telecom	Portugal	1	0	0	0	0	**1**

Table 4.1. (cont.)

Group	Host Country	America	Africa	Asia Pacific	Europe	Middle East	TOTAL
17. Saudi Telecom	Saudi Arabia	0	1	3	0	2	**6**
18. SingTel	Singapore	0	5	6	1	0	**12**
19. TDC	Denmark	0	0	0	4	0	**4**
20. Tele2	Sweden	0	0	0	1	0	**1**
21. Telecom Italia	Italy	5	0	0	1	1	**7**
22. Telefónica	Spain	10	0	0	7	0	**17**
23. Telenor	Norway	0	0	4	4	0	**8**
24. Telia Group†	Sweden	0	0	0	2	0	**2**
25. Telia Sonera	Finland	0	0	0	5	2	**7**
26. Telstra	Australia	0	0	1	0	0	**1**
27. Vivendi	France	0	1	0	0	0	**2**
28. Vodacom	South Africa	0	1	0	0	0	**1**
29. Vodafone	UK	1	5	3	14	1	**24**
30. Wataniya	Kuwait	0	0	0	0	2	**2**
31. Wind†	Italy	0	1	1	1	2	**5**
32. Zain	Kuwait	0	6	0	0	3	**9**
TOTAL		**40**	**38**	**41**	**73**	**21**	**213**
		18.8%	**17.8%**	**19.2%**	**34.3%**	**9.9%**	

UAE = United Arab Emirates; USA = United States of America; UK = United Kingdom; † Merged.
Source: Based on Wireless Intelligence (2012).

4.3.2. Measurement of variables

Dependent variable

Host market choice. This variable is defined through a dummy variable, which takes value 1 from the moment the international group enters a country and 0 otherwise. Value 1 implies that the international group owns at least 10% of the equity of an operator in the country of reference. This variable has been calculated for each of the 32 groups in each of the 62 countries for each period of time. It has resulted in a database with 16,621 observations corresponding to this dependent variable.

Independent variables

Cultural distance. Cultural distance between the home and host country is measured through the Kogut and Singh (1988) index. This index is based on the differences in scores of each dimension of the Hofstede Index (1980) of national culture: power distance, uncertainty avoidance, individualism, and masculinity.[3] It has been extensively used in other studies with similar purposes (e.g., Kirkman, Lowe and Gibson, 2006; Slangen and Hennart, 2008).

Formal institutional development. This variable is measured through an index based on the yearly Governance Index provided by the World Bank. Following Kaufmann, Kraay and Zoido-Lobaton (1999), the

[3] Given that the Hofstede Index is not available for all countries, the final selection of 62 countries consists of those that have a score in this source and allow the calculation of the cultural distance between the home and host countries.

governance index measures the degree to which institutions in a country allow the monitoring of political and social relationships in order to obtain an effective implementation of public policies and observation of contracts and laws. The index has six dimensions that can vary from -2.5 to 2.5 – voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption. This index has been extensively used in previous FDI studies for very similar purposes (Cuervo-Cazurra and Genc, 2008; Globerman and Shapiro, 2003). Following Cuervo-Cazurra and Genc (2008), to make interpretation easier, the original spread of – 2.5 to 2.5 has been modified to 0 to 5 by adding 2.5 to each score.[4] The next step has been to calculate the average of these six dimensions for each country and period. It is important to know that the Governance Index highly correlates with other institutional measures, such as the Economic Freedom Index (r=0.80) or the Transparency Index (r=0.91) also used in similar studies.

Control variables

There are control variables for the most important other factors that have been found to affect host market selection. First, there is a control for the market attractiveness of each country through two main variables. *GDPpc growth* takes into account the yearly growth of GDP per capita in each country (Hermelo and Vassolo, 2010) and *population*, in a logarithmic expression, measures the millions of inhabitants in each

[4] This does not alter the statistical significance of the coefficients (Cuervo-Cazurra and Genc, 2008).

country, which determine the size of the potential market (Holmes et al., 2011). Both variables are expected to positively influence the likelihood of MNEs entering a country because more habitants in a local economic growth cycle can favor the sustainability of firms in that country.

Second, there is also a control for the degree of internationalization of the group as the *number of countries* in which the group is operating in each period (Reus and Lamont, 2009). This variable tries to capture the previous international experience of the group. A positive influence of this variable is expected on the likelihood of group entering a country under the hypothesis that greater internationalization experience confers greater skills and capabilities to MNEs to diversify internationally.

Third, given that evolution of internationalization has been explained by the proximity between countries and by the historical ties between them (Makino and Tsang, 2011), two dummies to control for these expected effects in FDI decisions have been included. *Colonization* takes value 1 when there has been a colonial relationship between the home and host countries in the past, whereas *Proximity* takes value 1 when the home and host countries share land borders.

A control for the industry structure in each national market has been also included by considering the degree of market *concentration*, measured through the Herfindhal Index. A negative relationship is expected between the degree of market concentration and the likelihood of a MNE entering that market because MNEs prefer markets which are

more favorable to the entry of new competitors (Hermelo and Vassolo, 2010).

Finally, there is a control for *time* and *international group* effects which may come from ownership advantages such as management skills, industry experience and implicit internationalization capabilities.

4.3.3. Methodology

The model analyzes the presence of the international groups in the 62 countries under analysis from 2000 to 2010. We have a panel data structure with a binary dependent variable that changes over time and across countries. This means that the most suitable estimation technique is the binary logistic regression with panel data. We estimate the following model referring to group *i* in country *k* in period *t*. Logistic regression models with panel data are formally expressed as:

$$P(Y_{ikt} = 1 \mid X_{ikt}, \alpha_{ik}) = e^{(\alpha_{ik} + X_{ikt-1}\beta)} / (1 + e^{(\alpha_{ik} + X_{ikt-1}\beta)})$$

where Y_{ikt} is the dependent variable, X_{ikt-1} is the vector of independent variables, α_{ik} is the intercept parameter and β is the vector of regression coefficients. The dependent variable equals 1 when an international group has entered a country, so a positive regression coefficient indicates that a particular independent variable increases the probability of selecting that country as the destination of a FDI, all other factors being constant.

It is important to note that, because we are dealing with a decision model, we consider that MNEs take the decision in *t* according to the observation of independent and control variables in *t-1*. This implies that independent and control variables are included in the model with one lag (X_{ikt-1}). The justification for this is that country and group conditions in *t-1* set the context within which MNEs determine FDI investments in period *t* (e.g., for R&D investment, see Hansen and Hill, 1991).

4.3.4. Descriptive statistics

Descriptive statistics and correlations for our 16,621 observations are shown in Table 4.2. It can be observed that the cultural distance index between the home and host countries ranges from 0 to 9.27 and the formal institutional development from 0.58 to 4.48. Thus, the sample offers substantial variability in the institutional conditions to allow an accurate analysis of the influence of the institutional dimension on the likelihood of a group selecting a country as a FDI destination. The correlation matrix shows that a group entering a country (*host market choice* = 1) is positively related to country population, the degree of internationalization of the international group, colonization ties and geographic proximity between the home and host countries. However, it is negatively related to cultural distance and the degree of market concentration. Formal institutional development seems not to have a significant correlation to host market choice. In any case, the correlation between independent variables is moderate. The only exception is between formal institutional development and population, and

population and the degree of market concentration (r = -0.31). Larger populations are concentrated in countries, such as Brazil, India, Indonesia, Nigeria and Pakistan, with a lower level of formal institutional development. Furthermore, countries with a large population, such as India, Brazil and the United States, have a greater number of operators without important market share differences because they have tended to focus on regional instead of national competition.

Table 4.2. Descriptive Statistics (N=16,621)

Variable	Mean	Std. Dev.	Min	Max	1	2	3	4	5	6	7	8	9
1. Host market choice	0.08	0.26	0	1	-								
2. Cultural Distance	2.29	1.56	0	9.27	-0.10*	-							
3. Formal institutional development	2.91	0.95	0.58	4.48	0.01	0.10*	-						
4. Population (log)	3.03	1.35	0.66	7.05	0.07*	-0.13*	-0.32*	-					
5. GDPpc Growth	2.10	4.26	-42.77	42.83	0.01	-0.02	-0.11*	0.07*	-				
6. Number of countries	10.64	8.34	2	40	0.21*	-0.07*	-0.00	0.01	-0.02*	-			
7. Colonization	0.04	0.20	0	1	0.21*	-0.05*	0.04*	0.04*	-0.01	0.16*	-		
8. Proximity	0.03	0.18	0	1	0.18*	-0.16*	0.10*	-0.01	-0.03*	0.02*	0.07*	-	
9. Concentration	0.42	0.17	0.09	1	-0.08*	-0.03*	-0.25*	-0.31*	-0.07*	-0.03*	-0.06*	-0.02*	-

* $p < 0.01$

4.4. RESULTS

Table 4.3 presents the results of the random effects logistic regression analysis with panel data that has been carried out. The coefficients provided refer to the marginal effects of each variable on the likelihood of a group entering into country. To interpret these results, it is important to recall that marginal effects determine the variation in the likelihood of a group entering a country when the independent variables change by one unit (Hoetker, 2007). To test the hypotheses, four models were estimated. Model 1 only considers the influence of the control variables over the dependent variable. Models 2 and 3 include cultural distance and formal institutional development as independent variables. Model 4 includes the interaction effect between cultural distance and formal institutional development to test the moderating effect of formal institutional development on the relationship between cultural distance and host market choice. The explanatory power of all the models is good according to their chi-squared values ($p < 0.01$).

Model 1 shows the impact of the control variables on the market entry decision. As expected, both past historical ties of colonization (β = 4.52, $p < 0.01$) and geographic proximity (β = 7.89; $p < 0.01$) present a positive and significant influence, meaning that MNEs will be more likely to enter countries with those characteristics. Population also has a positive and significant effect on the probability of market entry (β = 0.50; $p < 0.01$). This means that the potential size of the market is an important argument for MNEs to decide where to enter. Moreover, the higher the degree of previous internationalization of the group, the

greater the probability of it entering a new market (β = 0.26; p < 0.01). Thus, it seems that previous internationalization increases MNEs' capabilities and skills to invest in new countries. As expected, market concentration has a negative effect on the probability of market entry (β = -3.20; p < 0.01). This means that MNEs prefer to enter more competitive markets with a lower degree of market concentration. Finally, both year and group dummies present significant effects.

Model 2 includes cultural distance. Its effect on host market choice is significant and negative (β = -0.76; p < 0.01) as postulated in Hypothesis 1. This means that, all other factors being constant, cultural distance has a negative impact on the likelihood of a group entering a new country. Model 3 adds formal institutional development. Hypothesis 2 predicted that this variable would exert a positive influence on the host country selection, all other variables being constant. However, Model 3 does not support Hypothesis 2 due to the non-significance of the marginal effect. For both these models, the control variables remain qualitatively the same.

Model 4 is the full model incorporating not only the direct effects of cultural distance and formal institutional development, but also their interaction. Although formal institutional development did not show a direct and significant effect on host country choice in Model 3, Model 4 shows that it indirectly influences the likelihood of an MNE entering a country by moderating the impact of cultural distance on host market selection. It can be observed that the marginal effect of the interaction of cultural distance and formal institutional development is significantly

positive (β = 0.92; p < 0.01). This means that the existence of a high development of formal institutions favors the entry of MNEs into countries with a higher cultural distance from the home country. In this way, formal institutional development reduces the importance of cultural distance as an obstacle to host market selection. This result supports Hypothesis 3 which predicted that, if there were a high level of formal institutional development, the negative effect of cultural distance would become weaker.

Table 4.3. Institutions and Host Market choice (N=16,621)

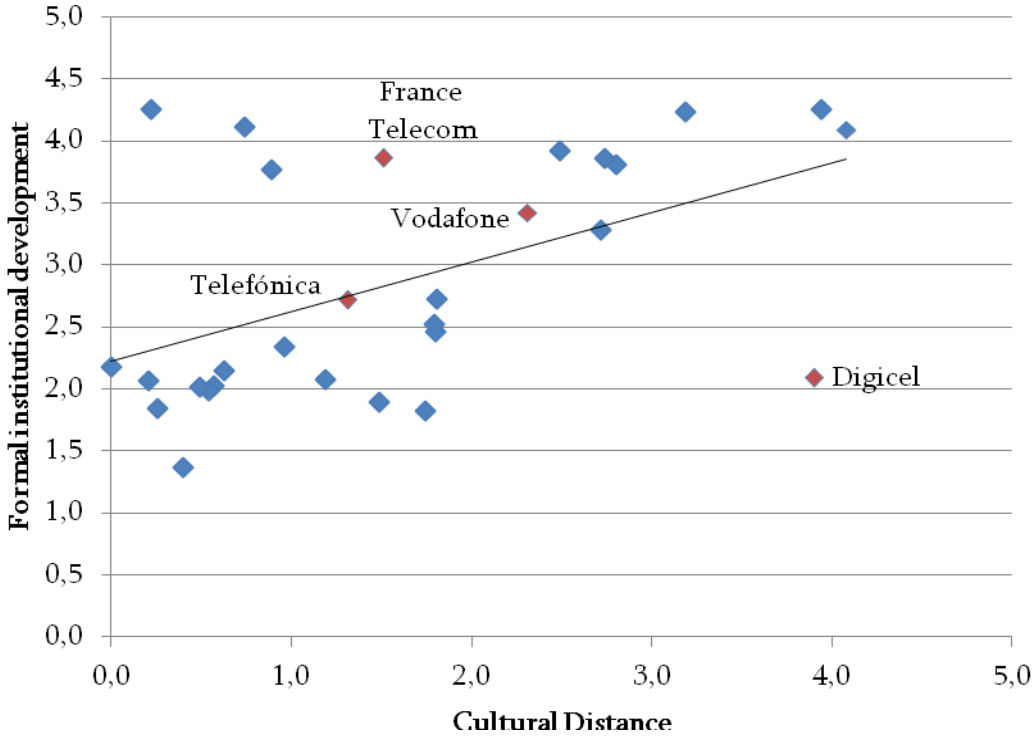
Dependent variable: Host market choice	(M.1)	(M.2)	(M.3)	(M.4)
Cultural Distance		- 0.76***	-0.76***	-3.84***
		(0.18)	(0.19)	(0.70)
Formal Institutional Development			0.08	-1.49***
			(0.23)	(0.38)
Cultural distance x Formal Institutional Development				0.92***
				(0.19)
Population	0.50***	0.38***	0.41**	0.46***
	(0.16)	(0.15)	(0.16)	(0.16)
GDPpc growth	-0.01	-0.01	-0.01	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)
Number of countries	0.26***	0.26***	0.26***	0.27***
	(0.03)	(0.03)	(0.03)	(0.03)
Colonization	4.52***	4.23***	4.18***	5.52***
	(0.85)	(0.94)	(0.94)	(1.05)
Proximity	7.89***	6.78***	6.81***	7.10***
	(1.27)	(1.24)	(1.28)	(1.28)
Concentration	-3.20***	-3.43***	-3.34***	-3.45***
	(1.00)	(0.98)	(1.01)	(1.03)
Year Dummies	YES***	YES***	YES***	YES***
Group Dummies	YES***	YES***	YES***	YES***
Wald chi-square	419.79***	430.62***	430.54***	380.08***
Log likelihood	-1344.38	-1336.32	-1335.76	-1323.99
Log-likelihood ratio test	4298.71***	4206.40***	4207.39***	4042.29***

Standard errors in parentheses.
* p<0.10, ** p < 0.05, *** < 0.01.

For each international group, Figure 4.3 depicts the interaction between the average cultural distance and the formal institutional development of the host countries.[5] It can be observed that international groups invest in countries with both high and low formal institutional development, although they tend to concentrate in countries that are less culturally distant. This figure also shows that international groups, with the exception of Digicel, have tended to expand into countries that are more culturally distant only in the presence of a high development of formal institutions in the host country (Hypothesis 3). Thus, cultural distance really becomes an important obstacle when formal institutions are less developed. It can also been observed that the most internationalized groups, whose home countries have a high development of formal institutions, also tend to invest in countries with a similar development of formal institutions. The three most internationalized groups, namely, Vodafone, France Telecom and Telefónica, have tended to expand into less culturally distant countries. Thus, even when they have a high level of FDI experience, it seems clear that international groups consider cultural distance as a negative constraint to expansion.

[5] For simplicity, countries with less than 50% ownership have been eliminated from the average calculation.

Figure 4.3. International groups, cultural distance and formal institutional development



Source: Own elaboration

4.5. CONCLUSIONS AND DISCUSSION

This chapter contributes to identifying the factors that affect the internationalization process by focusing on host market selection. It tries to further our understanding of this decision by considering institutional constraints. It closely follows Peng et al. (2009), who suggest that the institution-based view must be considered as the third leading perspective in strategic management, along with the well-developed industry and resource perspectives.

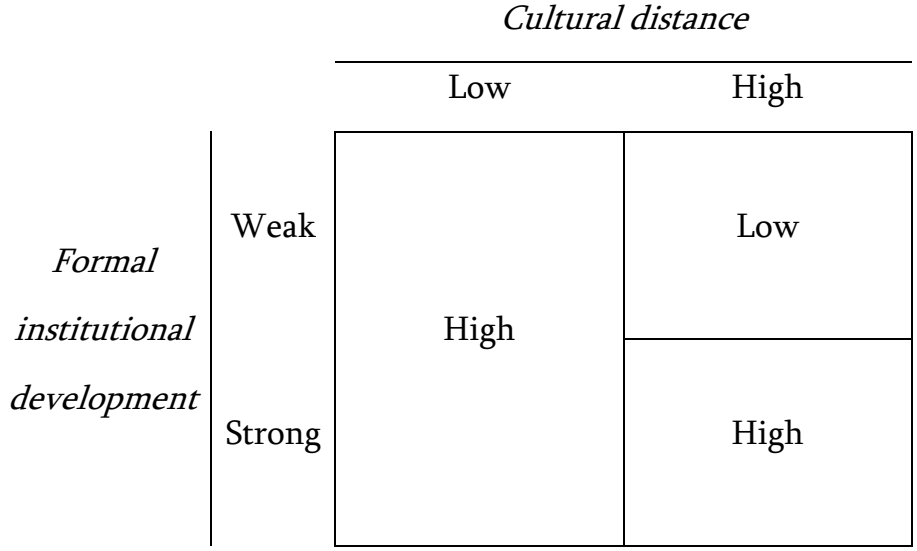
Results confirm that host country selection, one of the most important strategic decisions that MNEs have to take when they decide to diversify abroad, depends on the formal and informal rules of host countries. Thus, this chapter contributes to existing literature by integrating the institution-based view into the international business literature and by showing the joint effect of cultural distance and the development of formal institutions in the target country on deciding the destination of FDI flows.

Chapter 4, then, reinforces the idea of simultaneously considering both formal and informal institutions as determinants of host market choice in the FDI process. Previous studies have tended to analyze formal and cultural dimensions separately. It is shown that cultural distance negatively influences the likelihood of a country being selected as the destination of FDI flows, while its formal institutional development does not have a direct influence on this decision, at least, in our research setting. These results are consistent with previous findings. For instance, cultural distance has been shown to be an obstacle to foreign firms (Johanson and Vahlne, 1977). Although we expected a positive effect of the level of development of formal institutions on the likelihood of entering a country, our results do not support this prediction. One possible explanation is that MNEs may also benefit from a higher degree of corruption – low level of formal institutional development – in host countries when they have developed some political capabilities to take advantage of the discretionary action of governments and poor regulation (García-Canal and Guillen, 2008; Cuervo-Cazurra and Genc, 2008).

Importantly, results show that formal institutional development has a positive indirect effect through its moderating role on the relationship between cultural distance and host market selection. In particular, a higher level of formal institutional development reduces the importance of cultural distance as a constraint to FDI flows. The stronger the formal institutions of a country, the more likely a MNE will enter a host country with a higher cultural distance from its home country. Thus, formal rules help to enhance foreign investment in a country when the cultural distance between the home and host countries is high. Complementarily, with a low formal institutional development, the culture distance plays a key role in determining FDI flows.

MNEs have to consider the cultural distance between the home and host countries. When the cultural distance is low, they prefer to enter the new country because ownership and location advantages are not diminished by conflicts between contractual parts in the FDI process, such as suppliers, customers, governments and the local workforce. Home and host stakeholders tend to think similarly and there is a better understanding of local conditions, which allows a faster introduction into the business network of the new country, a faster transference of know-how from headquarters to subsidiaries and a reduction in transaction costs. However, when the cultural distance is high, MNEs consider the formal institutional development of the host country. They decide to enter that country when the formal institutions of the target market support economic exchanges by enhancing the protection of property rights and reducing information asymmetries and contractual and political hazards. Figure 4.5 summarizes the previous arguments.

Figure 4.5. Likelihood of host market entry by cultural distance and formal institutional development



Chapter 4 has several implications for management literature. It proves the need for integrating different approaches if we are to better understand existing management theories and) make them more relevant for managerial actions. In particular, it suggests formally incorporating the institution-based view of strategy into the international business discourse (Peng et al., 2009). In doing so, this chapter also responds to Bamberger (2008)'s claim for a more explicit incorporation of the context – in this case, the role of institutions – into the theories of management. In this vein, we show that it is necessary to simultaneously consider both the formal and informal dimensions of institutions in order to explain strategic actions. Formal and informal

rules should not be considered independently, but rather as interdependent parts of the institutional puzzle.

Chapter 4 also provides interesting results from a policy point of view. For example, if governments want to increase FDI flows to their countries, they have to consider the implications both of being culturally distant from the MNE's home country and of having a low level of formal institutional development. Given that cultural or informal rules are difficult to change (North, 1990; Scott, 1995), if countries are culturally distant from the MNE's home country, their governments should try to reduce uncertainty by reinforcing their formal institutions such as laws and regulations. Complementarily, the judicial system and other government agencies have to be controlled to assure the observance of contracts.

In spite of the contribution of this chapter in considering the joint effect of formal and informal institutions in the analysis of host market selection, several issues deserve extra attention. Host country selection has been understood as one of the main FDI decisions. However, it is closely related to entry mode decision. Xu and Shenkar (2002) have considered both decisions as key elements in the FDI process. Future studies should complement this research by considering the effect of formal and informal institutions on entry mode choice and comparing the effect of these two institutions on both the FDI decisions. Moreover, this chapter has also raised the dilemma of how to measure the institutional variables. We have selected cultural distance – taking Hofstede dimensions – and formal institutional development – through

the world development indicators –to explain FDI flows. However, there is an ample and growing literature on developing more accurate measures of both formal and informal dimensions. Further clarity on this topic is much needed, which opens a vast avenue for future research in the search for a greater consensus on the analysis of both formal and informal rules.

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Chapter 5.

INSTITUTIONS AND PERFORMANCE AFTER A RADICAL TECHNOLOGICAL CHANGE:

How the value of specialized complementary assets varies across markets

5.1. 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, 2012). 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 chapter, we empirically address the role of complementary resources for the incumbent success in a context of radical technological innovation. However, it is considered 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; Ceccagnoli, 2009; Kim and Min, 2012; Lieberman, 1989; Mitchell, 1989, 1991).

This chapter 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 chapter 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 chapter 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

chapter by discussing its main findings and its managerial and policy implications.

5.2. THEORY AND HYPOTHESES

5.2.1. 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 threats 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 chapter 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.

5.2.2. 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). 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.

5.2.3. 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) 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).[1] 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

[1] Although Teece (1986) distinguishes between specialized and cospecialized assets, we consider in this chapter "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).

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).

Several complementary assets haven been argued to complying 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 bases 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 chapter is stated as follows:

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

5.2.4. 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

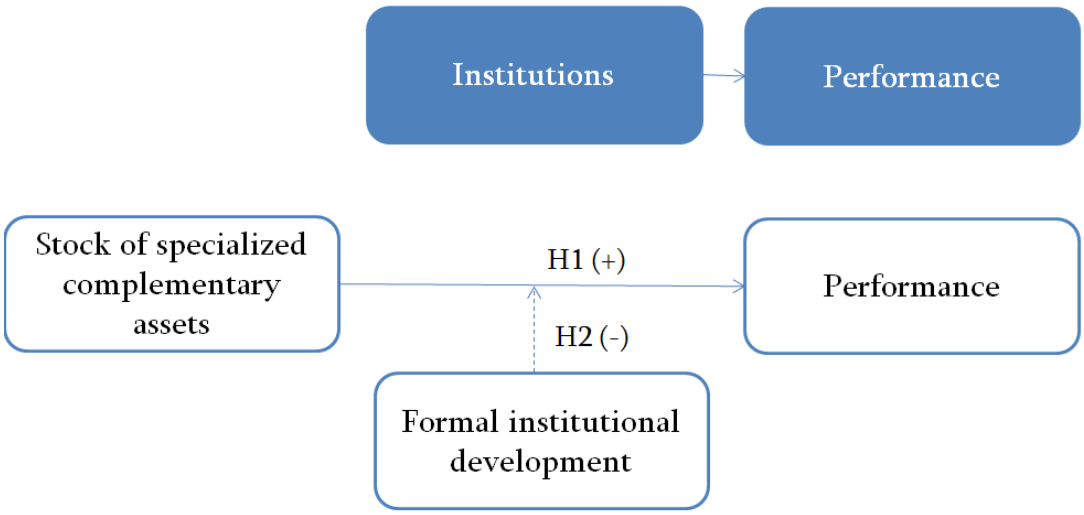
systems, and regulatory quality (Cuervo-Cazurra and Genc, 2008; Peng et al., 2005; Chan et al., 2008). Contracting with unknown parties is less risky and, thus, newcomers are less damaged by the institutional environment.

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.*

Previous hypotheses are summarized in Figure 5.1.

Figure 5.1. Incumbency, Institutions and Performance



5.3. DATA AND VARIABLES

5.3.1. 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 20th 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).[2] 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

[2] 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.

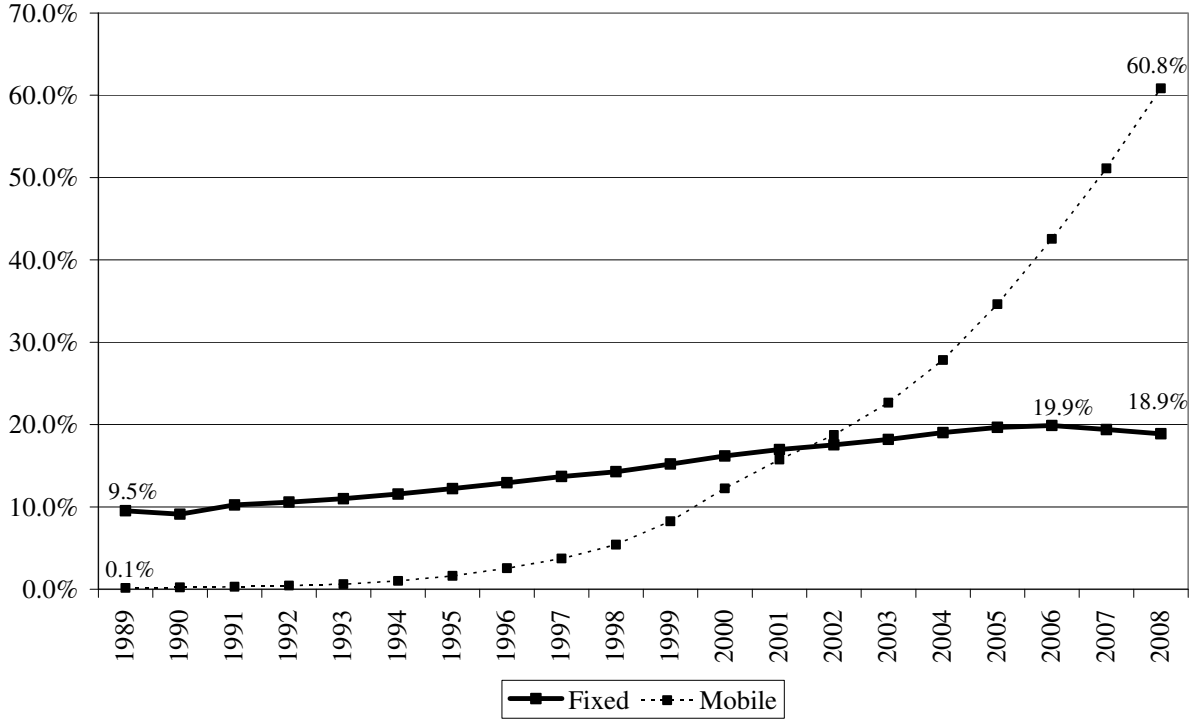
accumulate valuable assets such as reputation, brand value or users' relationships (Dierickx and Cool, 1989).

A new technology based on radio waves was developed in the second half of the 20th 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 20th century and the first decade of 21st century have not substantially increased around the world in comparison with mobile communications (Figure 5.2), whose diffusion rate has been proved to dramatically increase during the last decade. As a result of this evolution, the absolute 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 5.2. 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.

5.3.2. 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.[3] 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.

[3] 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).

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, 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 complementarily 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 chapter 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) or the Corruption Perceptions Index (r = 0.76) published by the Transparency International society.

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.

5.3.3. Descriptive Statistics

Descriptive statistics and correlations are shown in Table 5.1 both referred to 3,923 observations. As can be seen in Table 5.1, 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 5.1. 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.

5.4. RESULTS

The model we estimate is the following:

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

Table 5.2 shows random effect estimates[4] 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

[4] 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).

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.

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 5.2. COMPLEMENTARY ASSETS, INSTITUTIONS AND PERFORMANCE

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

t statistics in parentheses

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

5.5. DISCUSSION AND CONCLUSIONS

This chapter 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 chapter 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-á-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 chapter 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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RESUMEN Y

CONCLUSIONES

De acuerdo con el artículo 13.4 del RD 99/2011, de 28 de enero, que regula las enseñanzas oficiales de doctorado, la tesis puede ser desarrollada en el idioma habitual para la comunicación científica. El artículo 2.2 del Acuerdo de 17 de diciembre de 2008 del Consejo de Gobierno de la Universidad de Zaragoza, que aprueba el Reglamento sobre Tesis Doctorales, determina que en caso de que dicho idioma no sea el español la tesis deberá incluir en el momento de su depósito el resumen y conclusiones en español.

Con el fin de cumplir con el requisito anterior, al final de los cinco capítulos que conforman esta tesis doctoral, escrita en inglés, se han añadido dos secciones en español. La primera de ellas, *Resumen*, sintetiza el contenido de cada uno de los capítulos, con especial atención a sus objetivos, hipótesis, resultados y contribuciones. La segunda sección, *Conclusiones*, destaca las principales implicaciones académicas y empresariales de la tesis doctoral a partir de los resultados obtenidos.

RESUMEN

La tesis se compone de cinco capítulos. Los dos primeros capítulos tienen un propósito descriptivo. Así, el Capítulo 1 determina los dos grandes objetivos de investigación de la tesis y el Capítulo 2 describe la industria donde se van a realizar los análisis empíricos. Los tres capítulos restantes son los encargados de desarrollar el marco teórico, hipótesis, análisis empírico y resultados de las dos líneas de investigación que plantea la tesis. Así, el análisis de la estrategia en industrias de red se ha desarrollado en el Capítulo 3, mientras que la vertiente institucional de

la estrategia empresarial ha sido el hilo conductor en el Capítulo 4 (que analiza el impacto del marco institucional sobre la toma de decisiones estratégicas) y en el Capítulo 5 (que analiza la influencia del marco institucional sobre el resultado empresarial). A continuación, se detalla el contenido de cada uno de los capítulos.

El **Capítulo 1,** ***"Introducción"***, describe el objetivo de investigación de la tesis. Éste ha sido el de analizar en mayor profundidad la influencia que tanto la competencia bajo efectos de red como el marco institucional tienen en la determinación de la estrategia empresarial y los resultados de la misma. La tesis ha pretendido otorgar protagonismo a dos elementos importantes que caracterizan las condiciones bajo las que compiten las empresas, como son efectos de red y las instituciones del mercado, y que tradicionalmente han sido relegadas a un papel secundario en el estudio de la dirección estratégica (McIntyre y Subramaniam, 2009; Peng, Sun, Pinkham y Chen, 2009).

El éxito que en los últimos años han tenido empresas multinacionales que operan en industrias de red, tales como Apple, Facebook, Vodafone o Google, ha atraído la atención de los investigadores. Ha surgido un creciente interés por analizar en qué medida la existencia de efectos de red y los diferentes marcos institucionales a los que se enfrentan pueden condicionar su estrategia y sus resultados.

En primer lugar, el rápido crecimiento que muchas de estas empresas han experimentado se ha venido explicado por la existencia de efectos de red (Gruber, 2005). Éstos hacen que las "reglas de juego" para competir en este tipo de industrias difieran de las tradicionales. El valor deja de

estar el producto para descansar en la red de usuarios que lo consumen. Ello implica que variables claves como el precio o la calidad hayan perdido protagonismo frente al tamaño de la red (McIntyre y Subramaniam, 2009). Uno de los principales objetivos de la tesis es analizar en qué medida las decisiones estratégicas de las empresas en las industrias de red pueden conseguir incrementar el valor de la red – en vez del valor del producto – a través de la gestión de la base instalada de usuarios.

En segundo lugar, dada la presencia a nivel mundial de las industrias de red, las empresas tienen que competir en mercados que difieren enormemente en términos de cultura, lenguaje, códigos de conducta, legislación o protección de los derechos individuales. El impacto que dichas diferencias pueda tener sobre la toma de decisiones estratégicas ha atraído el interés de la literatura, sobre todo la referente a la dirección estratégica de grupos internacionales (Brouthers, Brouthers y Werner, 2008; Chan, Isobe y Makino, 2008; Cuervo-Cazurra y Genc, 2008; Meyer, Estrin, Bhaumik y Peng, 2009). Pero incluso las empresas que operan en un mercado deben ser conscientes de que decisiones estratégicas que otras empresas de perfil similar están tomando en otros mercados geográficos pueden no tener las mismas consecuencias en su propio mercado debido a las diferencias en el marco institucional (Peng et al., 2009). Por todo ello, el segundo gran objetivo de la tesis es avanzar en la comprensión de la influencia que el entorno institucional tiene tanto sobre la toma de decisiones estratégicas como sobre el resultado.

El **Capítulo 2**, ***"El marco de investigación: la industria de la telefonía móvil",*** ha sido el encargado de justificar por qué se ha escogido el sector de la telefonía móvil como industria de referencia a la hora de testar empíricamente las hipótesis de la tesis. La industria de la telefonía móvil ha sido elegida por considerarse un caso paradigmático de industria con efectos de red, con presencia mundial y cuyas empresas se encuentran altamente internacionalizadas.

El sector de la telefonía móvil ha experimentado un crecimiento exponencial que no conoce precedente anterior, ni siquiera en el caso de otras exitosas plataformas tecnológicas como Internet o la telefonía fija. Ello ha sido debido, en gran parte, a la alta intensidad de los efectos de red (Gruber, 2005). Asimismo, se trata de una industria que se encuentra presente en todas las regiones del mundo debido a la importancia política, económica y social que tradicionalmente siempre ha tenido el sector de las comunicaciones (Fuentelsaz, Maicas y Polo, 2008). Por ello, es posible observar diferencias institucionales entre los mercados en los que está presente esta industria.

También es importante destacar que, desde mediados de los noventa del siglo pasado, las empresas que operan en esta industria han tendido a internacionalizarse (Curwen y Walley, 2008). El Capítulo 2 muestra que en dicho proceso de internacionalización las empresas multinacionales no sólo han entrado en países próximos geográfica y culturalmente, sino que también se han expandido hacia países muy diferentes en términos institucionales.

Por tanto, tanto la existencia de efectos de red como la diversidad institucional de los mercados en los que está presente la industria de la telefonía móvil y los grupos internacionales que operan en ella justifican la selección de este sector de actividad como contexto de investigación de los análisis empíricos de la tesis.

El Capítulo 3, *"Decisiones estratégicas, efectos de red y resultados: El valor de la red en las industrias de red"*, analiza cómo la estrategia consigue potenciar los efectos de red en beneficio de la empresa cuando consigue incrementar el valor de su red de usuarios. El modelo teórico que plantea el capítulo determina que las decisiones estratégicas de las empresas incrementarán el valor de la red si incrementan las expectativas de los usuarios acerca del mayor tamaño de la red en el futuro, lanzan señales a los usuarios para coordinarlos hacia la selección de la red y aumentan la compatibilidad percibida de la red de la empresa con la red de las empresas rivales. Cuando se cumplan estas tres condiciones, los usuarios potenciales sentirán incentivos para unirse a la red de usuarios de esa empresa y eso, al final, determinará el crecimiento de la misma. Ello redundará en una mayor utilidad de los usuarios y en mayor beneficio para la empresa.

Partiendo del anterior modelo teórico, el Capítulo 3 formula tres hipótesis referentes a tres decisiones estratégicas y el efecto esperado que deben tener sobre el valor de la red según su influencia sobre los tres antecedentes de los efectos de red, es decir, expectativas, coordinación y compatibilidad. Las tres decisiones estratégicas que se analizan son las referentes al momento de entrada de la empresa en el mercado, el grado

de internacionalización y la gestión de los costes de cambio. Además, se añade una última hipótesis que pretende confirmar el efecto positivo del valor de la red sobre el beneficio en industrias con efectos de red.

El análisis empírico, que se desarrolla sobre un panel de datos de telefonía móvil de 20 países europeos desde 1998 a 2008, confirma el efecto positivo del tiempo de entrada sobre el valor de la red y el negativo de los costes de cambio sobre dicho valor. Asimismo, se observa que el valor de la red tiene un efecto positivo sobre el beneficio empresarial. Únicamente el grado de internacionalización no resulta significativo.

El Capítulo 3 tiene dos contribuciones importantes. En primer lugar, plantea un modelo teórico que busca su aplicación empresarial con carácter generalizado. Estudios anteriores han centrado su atención en algunas decisiones estratégicas, tales como el tiempo de entrada, la variedad de productos complementarios, etc. Sin embargo, el modelo planteado en este capítulo busca predecir el efecto positivo o negativo de cualquier decisión estratégica sobre el valor de la red y los resultados. Será positivo cuando la decisión sirva para incrementar las expectativas de los usuarios acerca del mayor tamaño de la red en el futuro, les ayude a coordinarse hacia la selección de esa red e incremente la compatibilidad percibida de la red de la empresa con otras redes.

En segundo lugar, y quizá más importante, el Capítulo 3 tiene una contribución básica para el análisis estratégico de las industrias de red. A la hora de medir el valor de la red, este capítulo propone una medida alternativa a las propuestas con anterioridad. La nueva medida tiene un

marcado carácter estratégico al tomar en consideración no sólo el tamaño de la red, sino también la intensidad de los efectos de red a partir del tamaño relativo de la red de una empresa con respecto al tamaño de las redes de los rivales.

El Capítulo 4, *"Decisiones estratégicas e instituciones en el proceso de inversión extranjera directa: ¿Dónde entrar?"*, pretende determinar cuál es la influencia que las instituciones, formales (leyes, regulación, contratos, etc.) e informales (cultura, religión, códigos de conducta, etc.), tienen en la toma de decisiones estratégicas. Para ello este capítulo toma en consideración una decisión estratégica clave en el proceso de internacionalización, objeto tradicional de análisis desde la perspectiva institucional de la estrategia. En concreto, el Capítulo 4 analiza la influencia que las instituciones formales e informales de cada mercado tienen sobre la decisión de entrada de una empresa multinacional en ese país.

Cuando un grupo internacional entra en un país espera poder explotar capacidades y recursos de la matriz, tanto tangibles como intangibles, en el país de destino de la inversión (ventajas de la propiedad). Asimismo, espera poder aprovechar los recursos de ese mercado, tales como una localización estratégica, existencia de fuentes de recursos exclusivas o mano de obra cualificada (ventajas de localización) (Dunning y Lundan, 2008). Si bien, la perspectiva institucional de la estrategia internacional que se aborda en el capítulo plantea que la obtención de dichas ventajas, tanto de propiedad como de localización, depende del marco institucional, formal e informal, del país de destino de la inversión.

La aproximación a las instituciones informales y formales se realiza sobre la base de dos conceptos claves. El primero de ellos se refiere a la *distancia cultural*, considerada como el conjunto de factores, como la diferencia en lenguaje, tradiciones, educación y códigos de conducta, que dificulta el flujo de información entre el mercado de origen y destino de la inversión (Johanson y Vahlne, 1977). El segundo concepto clave se refiere al *desarrollo de las instituciones formales*, es decir, al grado en el que las normas explícitas de un mercado – tales como la ley, los contratos, las sentencias, etc. – reducen las asimetrías de información y ayudan a una mayor protección de los derechos de propiedad entre las partes contratantes en una transacción económica (Meyer et al., 2008).

Las hipótesis del Capítulo 4 plantean en qué medida la distancia cultural entre el país de origen y destino de la inversión y el grado de desarrollo de las instituciones formales del país de destino influyen sobre la probabilidad de que un grupo internacional entre en ese país. Así, la primera hipótesis del Capítulo 4 es que una mayor distancia cultural entre un país y el país de origen de un grupo internacional reduce la probabilidad de que dicho grupo entre en ese país. La segunda hipótesis del Capítulo 4 es que un mayor desarrollo de las instituciones formales de un mercado incrementa la probabilidad de que un grupo internacional entre en él. Finalmente, y como hipótesis clave en este Capítulo, se propone la consideración conjunta de las instituciones formales e informales a la hora de decidir la entrada de un grupo en un país. Cuando el país de destino de la inversión tiene instituciones formales más desarrolladas, el impacto negativo de la distancia cultural sobre la probabilidad de entrada del grupo en ese país pasa a ser menor.

Esto es así porque cuando las instituciones formales de un país apoyan la realización de intercambios económicos protegiendo los derechos de propiedad de las partes, el desconocimiento de las reglas informales derivado de la distancia cultural pierde importancia de cara a dificultar la consecución de las ventajas de internacionalización.

El apartado empírico del Capítulo 4 incluye la totalidad de decisiones de entrada que todos grupos internacionales de telefonía móvil realizaron entre 2000 y 2010 en todos los países del mundo para los que existen índices institucionales formales e informales. Se confirma que la distancia cultural influye negativamente en la probabilidad de que una multinacional entre en un mercado. Asimismo, se observa que el desarrollo de las instituciones formales no tiene un efecto directo significativo. Pero sí que lo tiene de forma indirecta, en la medida que un mayor desarrollo de las instituciones formales incrementa la probabilidad de que un grupo internacional entre en un país que guarda una mayor distancia cultural con su país de origen. Se confirma, por tanto, ese efecto moderador de las instituciones formales sobre la relación entre las instituciones informales y la decisión de entrada.

El análisis conjunto de las instituciones formales e informales es una de las principales contribuciones del Capítulo 4 puesto que la literatura anterior ha tendido a considerar separadamente el papel de las instituciones formales e informales sobre las decisiones de entrada de los grupos. Como segunda contribución del capítulo 4 cabría destacar el propio análisis empírico que se realiza, al tener en consideración la totalidad de países a nivel mundial en los que se han producido entradas

de todos los grupos internacionales de una misma industria durante un periodo de 11 años.

El Capítulo 4 ha tomado en consideración la perspectiva institucional de la estrategia empresarial en su contexto de aplicación tradicional, como es el del proceso de internacionalización. Sin embargo, la perspectiva institucional de la estrategia empresarial aboga por determinar el impacto del marco institucional en otros ámbitos de investigación, y no sólo en el análisis del proceso de internacionalización por parte de los grupos internacionales. Por esa razón, el Capítulo 5, *"Instituciones y resultados después de un cambio tecnológico radical: Cómo el valor de los recursos complementarios especializados varía entre mercados"*, ha tratado de integrar la literatura sobre la perspectiva institucional de la estrategia con la referente a discontinuidades tecnológicas.

El Capítulo 5 se sitúa en el contexto posterior a un cambio tecnológico radical en el que las empresas establecidas en la tecnología anterior han invertido en la nueva tecnología. Bajo este contexto, se analiza cómo los recursos de la cadena de valor de las empresas establecidas que sirven para la comercialización de la tecnología anterior continúan siendo valiosos para la comercialización de la nueva tecnología. Recursos tales como la reputación, los canales de ventas y distribución, el servicio postventa, los vínculos con los usuarios o el conocimiento de la industria conservan su valor y, en la medida que resultan difícilmente imitables por los nuevos entrantes, son capaces de conferir un mayor beneficio a las empresas establecidas sobre los nuevos competidores (Mitchell, 1991; Tripsas, 1997; Rothaermel, 2001). Esa relación positiva entre la posesión

de estos recursos complementarios y el beneficio de la empresa tras un cambio tecnológico radical es la primera hipótesis de este capítulo.

La contribución principal de este Capítulo 5 descansa en la segunda hipótesis que propone el efecto moderador del marco institucional sobre la intensidad de la ventaja de las establecidas. Dado que las empresas establecidas mantienen el valor de los activos complementarios en la nueva etapa tecnológica, también mantienen las relaciones de confianza establecidas con los agentes del mercado con los que han de interactuar para hacer uso de esos activos, tales como usuarios, proveedores, inversores, empleados o autoridades públicas. El capítulo propone que el valor de los recursos complementarios, al garantizar el mantenimiento de la red informal de relaciones de la empresa, es mayor en contextos de menor desarrollo de las instituciones formales. Esta afirmación se sustenta sobre la base de que, a falta de organismos que faciliten el intercambio de información y garanticen los derechos de propiedad derivados de la ley y los contratos, los agentes del mercado preferirán realizar intercambios económicos con empresas que ya conocen con anterioridad. Así podrán reducir las asimetrías de información y los posibles comportamientos oportunistas. Los nuevos entrantes, por tanto, se encontrarán en una mayor desventaja con respecto a las empresas establecidas en estos entornos de instituciones formales débiles al carecer de esa red previa de relaciones informales.

El análisis empírico desarrollado sobre 46 mercados de todas las regiones mundiales confirma el efecto positivo que los recursos complementarios tienen sobre el beneficio empresarial. Asimismo, se observa que a mayor

desarrollo de las instituciones formales de un mercado, menor es el impacto positivo de esos recursos sobre la obtención de resultados. Por tanto, los mismos recursos estratégicos en dos contextos institucionales diferentes no conllevan la consecución de una misma ventaja competitiva.

El Capítulo 5 tiene tres contribuciones clave. En primer lugar, aplica la perspectiva institucional de la estrategia en un contexto de investigación novedoso, como es el de las discontinuidades tecnológicas. En segundo lugar, ofrece una evidencia adicional acerca de la importancia de los recursos complementarios en la consecución de una ventaja competitiva por parte de las empresas establecidas tras un cambio tecnológico radical. Finalmente, tal y como ocurría en el Capítulo 4, se ofrece un análisis empírico basado en una muestra de mercados que cubre todas las regiones mundiales, lo que permite un mayor grado de generalización de los resultados.

CONCLUSIONES

A continuación se detallan las principales conclusiones de los capítulos que abordan los objetivos de investigación propuestos en el Capítulo 1 y que analizan empíricamente las hipótesis planteadas en el sector de la telefonía móvil, descrito en el Capítulo 2.

Conclusiones del Capítulo 3:
El papel de la estrategia en mercados con efectos de red

La estrategia en industrias con efectos de red debe de estar enfocada a la gestión del valor de la red, que se convierte en un determinante clave del beneficio frente a otro tipo de industrias en las que el valor reside en el producto. Las empresas pueden intensificar los efectos de red en su propio beneficio para así generar un mayor valor de red a través de decisiones estratégicas que influyan sobre las expectativas y coordinación de los usuarios y la compatibilidad percibida de su red con la de empresas rivales. En concreto, se observa que el tiempo que una empresa lleva operando en el mercado incrementa el valor de su red. Por el contrario, altos costes de cambio reducen el valor de la red al desincentivar la selección de la red por parte de los usuarios potenciales.

La dimensión estratégica del valor de la red se plasma en la medición alternativa que propone la presente tesis doctoral. Mientras medidas anteriores equiparaban el valor de la red al tamaño de la misma, la medida alternativa que se propone en la tesis resulta una función no sólo

del tamaño de la red sino también de la intensidad de los efectos de red. Dicha intensidad se hace depender del tamaño relativo de la red de la empresa con respecto al de sus rivales en un mercado específico. La consideración de la existencia de competidores en la medida del valor de la red permite otorgar a ésta un marcado carácter estratégico.

La tesis avanza en el análisis del papel de la estrategia en industrias de red. Primero, a través de la construcción de un modelo que explica el impacto de cualquier decisión estratégica sobre el valor de la red y el beneficio. Segundo, mediante la construcción de una medida alternativa a la tradicional del valor de la red que incorpora la dimensión estratégica del mismo.

Conclusiones del Capítulo 4:
El carácter complementario de las instituciones formales e informales

Las decisiones estratégicas de las empresas son entendidas como el resultado de la interacción dinámica entre la organización y su entorno institucional. En el marco del proceso de internacionalización, las multinacionales tienen que tomar una decisión estratégica clave como es la selección del país destino de la inversión extranjera directa. La tesis observa que la distancia cultural y el desarrollo de las instituciones formales determinan, de forma simultánea, la probabilidad de que un grupo internacional entre en un país o no.

Las diferencias en cultura, religión, códigos de conducta o lenguaje entre el mercado de origen de una multinacional y otro mercado dificultan la

obtención de las ventajas esperadas de la internacionalización. Por ejemplo, la transferencia de capacidades y know-how de la matriz a la subsidiara es más difícil cuando descansan en rutinas que no son comprendidas por los trabajadores de la subsidiaria. La multinacional también tiene problemas para entrar en la red de negocios de otro país dada la dificultad para desarrollar vínculos con los inversores, trabajadores o proveedores de ese mercado. Ello dificulta la adquisición de recursos financieros y humanos valiosos. Por tanto, los grupos internacionales prefieren entrar en países cuyas instituciones informales son más semejantes a las de su país de origen.

No obstante, las instituciones formales del país de destino de la inversión (p.ej., sistema legal, administrativo y judicial) pueden garantizar el cumplimiento de los contratos entre la multinacional y los otros agentes del mercado (trabajadores, proveedores, inversores, etc.) y facilitar la entrada de la multinacional en la red de negocios del mercado (por ejemplo, a través de la creación de intermediarios tales como bancos, cámaras de comercio, etc.). En tal caso, la distancia cultural pierde importancia como elemento restrictivo de la decisión de entrada en un país por parte de las empresas multinacionales. Por tanto, el regulador que desee fomentar la entrada de capital extranjero para incrementar la competitividad del mercado debe de reforzar los sistemas legales, administrativos y judiciales para que sean capaces de garantizar el cumplimiento de los contratos y la apertura del mercado a la competencia.

La tesis avanza en la aplicación de la perspectiva institucional de la estrategia a través de la consideración conjunta del papel de las instituciones formales e informales en una decisión estratégica clave, tal y como es la selección del país de destino de la inversión por parte de una multinacional.

Conclusiones del Capítulo 5:
La perspectiva institucional aplicada a la dirección estratégica de innovaciones radicales

El desarrollo de las instituciones formales facilita la entrada de nuevos competidores en un mercado que ha sufrido un cambio tecnológico radical puesto que proporciona una mayor comprensión del funcionamiento del mercado, aumenta la información disponible y garantiza la protección de los derechos de propiedad derivados de los contratos. Se observa que cuando las instituciones formales fallan a la hora de reducir los riesgos contractuales, los nuevos entrantes se encuentran en desventaja con respecto a las empresas que proceden de la etapa tecnológica anterior y deciden invertir en la innovación radical.

La posesión de recursos complementarios que ayudan a la comercialización de la innovación radical se convierte en una fuente de ventaja competitiva para las empresas establecidas en la tecnología anterior. Dichos recursos, situados en la parte inferior de la cadena de valor, ayudan a estas empresas a conservar las relaciones con los agentes del entorno tales como usuarios, proveedores, inversores, trabajadores y

gobiernos. Estos lazos informales son capaces de reducir las asimetrías de información y el riesgo contractual a falta de instituciones formales que se encarguen de ello. En consecuencia, los recursos de las empresas establecidas en la tecnología anterior tienen un mayor valor en entornos con bajo desarrollo de las instituciones formales en la medida que ayudan a la comercialización de la innovación y a mantener las relaciones con los agentes del entorno que reducen los riesgos contractuales.

La tesis avanza en la aplicación de la perspectiva institucional de la estrategia empresarial considerando el carácter moderador de las instituciones formales de un mercado sobre la intensidad de la ventaja competitiva de las empresas establecidas.

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