The emerging role of Lead Users in the mobile industry

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Abstract The purpose of this paper is to provide a formal conceptualization of emerging mobile ecosystems as value-creation networks and characterize the role played by external developers, conceptualized as Lead Users (VonHippel 1986), in the evolution of these networks in the mobile industry. Based on quantitative data from a survey conducted between seasoned developers mediation models for panel data are built. The results are triangulated with semi-structured interviews and corporate data as reported by companies. The empirical study confirms that external developers are paramount to absorb external knowledge and transform it into knowledge of explicit nature and therefore of high value for other participants in the network. This paper finds evidence on the influence that external developers, conceptualized as Lead Users (VonHippel 1986), exert on firms' ability to compete in the mobile industry.

Keywords: Networks for value creation, tacit knowledge, lead user theory, dynamic capabilities, mobile ecosystems.

1.1 Introduction

Technological convergence between computing and telecommunications is fostering the emergence of new players as competitors to incumbent telcos (West, 2010). More important however is that traditional revenue sources for established telcos are reaching their maximum capacity therefore limiting growth potential, at least in developed regions such as Europe or USA (Economist, 2009).

Being developing countries the next stop in terms of potential growth notwithstanding, these markets offer much lower marginal profits per user compared to traditional European or American consumers as well as increasing pressure from new vendors and local carriers able to compete with equivalent products and services.

Therefore, firms in this sector are experiencing: (1) increasing levels of competition, (2) technological changes, (3) long-tail demand and (4) variety of suppliers.

Classical theories of strategic analysis rely on the ability to optimize internal resources and achieve economies of scale to determine the success of a company. This thinking paradigm, however, fails to identify how to proceed in dynamic markets characterized

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by (1) open international commerce, (2) rapid technological change, (3) systemic technologies, and (4) well-developed global markets for the exchange of goods and services (Teece, 2009).

In dynamic markets, precisely the ones in which telecommunications firms operate nowadays, long-term successful business models need to find and develop new opportunities, combine internal knowledge with external abilities as well as strive for continuous process improvement and new knowledge generation (Nonaka and Takeuchi 1995; Chilton 2010).

Under the dynamic capabilities paradigm as proposed in (Teece, 2009; Helfat, 2007), sustainable advantages require more than the ownership of difficult-to-replicate assets such as large customer's base, installed infrastructure or favourable access to capital. Being able to adapt to changing customer and technological opportunities, shape the surrounding ecosystem, develop new products and processes and implement viable business models are a must-have for firms.

Telecommunication firms, in spite of their huge market capitalization and technological resources cannot expect to accomplish all required changes with their own resources and remain competitive at the same time in such a turbulent scenario. As a result both incumbent companies firmly established in the market as well as incoming ones are rearranging their structures in order to absorb external knowledge.

In relation to this several challenging issues emerge such as (1) the incorporation of external knowledge, oftentimes of tacit nature, into the firms' business processes and (2) how to articulate dynamic capabilities in a strongly networked context dominated by economies of substitution rather than economies of scale (Garud, 1995).

This paper contributes to address some of these questions in the context of the dramatic changes taking place in the mobile business in which incumbent telecommunication firms face the pre-eminence of internet companies such as Apple, Amazon or Google.

1.2 Theory and hypotheses formulation

1.2.1 Value-creating networks

Networks are a mode of organization in which independent parties establish flexible ties and share resources in order to strengthen their competitive position (Dilk, 2008, Gulati et al., 2000). In these types of network arrangements, firms constantly interact mobilizing the best combination or resources for a particular situation. In this sense the capacity of the network to adapt according to time, space and actor determines the potential value the network is able to provide (Normann, 1993).

Under this new paradigm, successful inter-firms networks would be those with the ability to conceive the entire value-creating system and subsequently integrate required resources into a single and coherent entity.

However in value-creating networks the purposes of the collaboration are somewhat unstructured in the sense that (1) the concept of value generation is not known in advance and (2) the mechanisms by which value is effectively produced are not explicit. As a result value-creating networks behave much more fluidly with many partners, oftentimes thousands, interacting and testing new ideas and business models (Chesbrough, 2006; 2007).

As far as this paper is concerned, mobile marketplaces as implemented by Apple,

Google, Nokia and RIM (Blackberry) among others can be formally conceptualized as value-creating networks in which highly specialized and explicit knowledge, such as hardware and operating system's software, is combined with tacit knowledge, in the form of downloadable applications or services in the cloud. Moreover this paper contends that mobile ecosystems are key in articulating dynamic capabilities of market sensing, economic profit and reconfiguration.

As far as value-creating networks in the mobile industry are concerned there exist a clear separation between networks sponsored by incumbent telecommunication companies such as Nokia, Ericsson, Vodafone or Telefónica and the so-called Internet firms represented by Apple, Amazon or Google.

As for the first case, this is value-creating networks sponsored by telecommunication companies, value emerges from the successful integration of complementary resources into a set of well defined telecommunication services, following business models which are formally agreed in advance and involving a moderate amount of partners. Given the large capital investments required, business models are long-term oriented and risk averse.

Internet-sponsored ecosystems, however, do exhibit different attributes; in this case value creation does follow from a constellation of resources, which may complement or supplement others. What is novel in the case of internet-sponsored networks is the paramount role played by external developers. Contrary to other networks, mobile ecosystems involve thousands of firms and individual developers that continuously iterate creating new applications which in turn are made commercially available for others to replicate or improve. There exists theoretical evidence arguing in favour of these extreme modes of collaboration in terms of innovation (Baldwin, 2000; VonHippel, 2006) in industrial regimes which are technology intensive.

1.2.3 Lead User induced generation of knowledge in value networks

Formally speaking an external developer of software corresponds to the concept of Lead User as defined in the literature. Lead Users (VonHippel, 1986) present two characteristics: (1) they face needs that will become general in a marketplace, and (2) they have incentives to benefit significantly by obtaining a solution to those needs.

As far as firms engaged in lead user modes of innovation are concerned, Franke et al. (2006) finds that (1) the intensity of lead users engaged is positively correlated with the emergence of commercial innovations, (2) lead-users do expect some benefit –albeit inmaterial- out of their involvement and that (3) the "ahead on an important marketplace trend" component of the lead user construct has a positive impact on innovation attractiveness.

This paper contends that external developers are critical in these value-creating networks in a mobile industry context as they (1) absorb tacit knowledge and (2) make it explicit in the form of software applications (Nonaka, 1995), moreover Lead Users effectively contribute to the organizational knowing (Orlikowski, 2002). In order to test this, the following hypothesis is formulated:

   H1. Lead Users positively influence the ability to transform tacit knowledge into new knowledge of explicit nature.

1.2.4 Lead User induced dynamic capabilities in value networks

Delivering telecommunication services is highly systemic due to strong interdependencies between hardware components, related software and even regulation (i.e. radio spectrum allocation). As a result technical architectures in this sector present high levels of modularity and are subject to strong economies of substitution (Garud and Kumaraswamy, 1995).

As put forward in (Sanchez and Mahoney, 1996), Modular organizations are better able to respond to a changing environment. Modular organizations, characterized as learning organizations that continuously change and solve problems through interconnected and self-organizing processes, call for new strategies to absorb and integrate knowledge which in this modular paradigm is distributed among different entities (Garud and Kumaraswamy, 1995, Langlois, 2002).

Modular regimes are thus challenging as they require constant reconfiguration and intensive testing to achieve sustainable rates of innovation (Baldwin 2000).

At this point this paper contends that external developers are critical in value networks in the mobile sector as they expand resources available to conduct testing and as result facilitate faster rates of innovation and products/services which are better adapted to market's expectations.

Formally speaking the role played by lead users as far as innovation is concerned admits the following conceptualization:

H2.1 Lead Users positively influence the ability of the sponsoring firm to extract economic value.

H2.2 Lead Users positively influence the ability of the sponsoring firm to sense the market.

This is, lead users are paramount to enact dynamic capabilities in technological regimes of modular nature.

1.3 Methodology

In order to provide some insights on the role played by external developers in mobile ecosystems an empirical study was conducted among a set of software developers already engaged in mobile application development at the main mobile marketplaces sponsored by Apple (IOS), Google (Android), RIM (Blackberry) and Nokia (Symbian). In total 822 developers participated in the survey, conducted on-line, further one-to-one interviews were carried out with over 40 people ranging from hobbyists to CEOs of game companies. To ensure that results are representative the results report on at least 50 developers for each mobile ecosystem considered. The majority of the respondents came from Europe, North America and Asia (90%) and the rest from LatAm, Africa and Oceania (Visionmobile, 2011).

Respondents included both novice and seasoned developers with an average experience of three years in mobile application development. This data has been triangulated (Yin 1994, Myers, 1997) with qualitative information provided by managers working in the industry (Ericsson and O2) as well as market data publicly available concerning platform utilization (Gartner, 2011; Distimo, 2011).

1.3.1. Model variables

To provide a quantitative measure for the Lead user involvement construct, a new variable "LeadUserIntensity" is defined corresponding to the responses of developers surveyed. Responses are aggregated into different categories according to their present engagement in mobile platforms (iOS, Android, Symbian and Blackberry).

The construct "Explicit Knowledge Generation" is made operational by a new variable "NumberMobileApplications" which takes into account the total number of software applications present in mobile platforms as declared by the firms. We believe this variable provides an adequate proxy variable to measure the rate of explicit knowledge which is being created in value networks in the mobile business.

As far as the construct related to dynamic capability "Value Extraction" is concerned, this paper considers economic profits of the sponsoring firms (Apple, Google, Nokia, RIM) a valid indicator of their ability to extract value out of their involvement, hence the variable "OperatingProfits".

With regards to the dynamic capability to sense the market, this paper considers that the rate of mobile applications downloaded by consumers on a monthly basis serves as a proxy variable to quantify how the sponsoring firm is doing in terms of providing applications and services which are of interest to final consumers. Arguably higher download rates signify more appealing products to customers as well as increasing levels of interest for the value network (in the sense of increasing activation of smartphones purchased). Hence the variable "ApplicationDownloadRate".

1.3.2. Model building

To test the hypotheses formulated in section 2, mediation models are suggested (Preacher, 2007). Mediation models allow for testing causality among variables as well as the mechanisms through which variables influence outcomes.

In this paper however mediation models for multilevel data, (Krull and MacKinnon, 2001), are required in order to take into account panel data in which mediation may vary across level two units, i.e across mobile ecosystems.

Given the relative scarcity of available data, mostly due the novelty of value networks, mediation models are supplemented with non-parametric bootstrapping (Bollen and Stine, 1990; Shrout and Bolger, 2002) to infer the statistical significance of mediation effects. Bootstrapping is oftentimes preferable to Sobel tests.

1.4 Results and discussion

1.4.1 Relation between Lead Users and Operating Profits

For a panel data corresponding to main firms sponsoring value networks in the mobile industry, table 1.1 shows the beta coefficients (and standard errors) corresponding to a multilevel mediated model in which the independent variable "LeadUserIntensity" affects the dependent variable "OperatingProfits" mediated by the variable "NumberMobileApplications".

Table 1.1 Mediation model: LeadUsers & OperatingProfits

Heading	LeadUserIntensity	log(NumberMobileApplications)	Prob>Chi2
log(OperatingProfits)	2.86 (0.45)		0.0000
log(NumberMobileApplications)	1.97 (0.67)		0.0035
log(OperatingProfits)	1.64 (0.051)	0.67 (0.014)	0.0000

Note: coefficient in parentheses are standard errors

As revealed in previous table the independent variable "LeadUserIntensity" predicts both the mediating variable "NumberMobileApplications" (beta: 1.97, p-value: 0.003) and the dependent variable "OperatingProfits" (beta: 2.86, p-value: 0.000).

Moreover the beta coefficient between "LeadUserIntensity" and "OperatingProfits" controlling for the mediating variable "NumberMobileApplications" is in this case smaller (beta: 1.64, p-value: 0.000) thus indicating partial mediation effect.

In order to test whether this mediation effect is significant, a bootstrapping analysis is conducted Bollen and Stine, 1990; Shrout and Bolger, 2002); non-parametric bootstrapping is preferred to Sobel tests in the case of small samples.

Results based on 1000 bootstrapped samples confirm the mediation effect.

The results presented in table 1.1 provide evidence on the relevant role played by Lead Users in developing new knowledge (beta: 1.97, p-value: 0.003) as well as in creating economic value for the sponsoring firms (Total effect=2.96). Therefore supporting hypothesis H1 and H2.1.

1.4.2 Relationship between Lead Users and Application Download Rate

With regards to the relationship between Lead Users involvement in value networks and the ability to sense the market, table 1.2 shows the beta coefficients, along with standard errors, corresponding to a mediated model with independent variable "LeadUserIntensity", dependent variable "ApplicationDownloadRate" and mediating variable "NumberofMobileApplications".

Table 1.2 Mediation model: LeadUsers & AppDownloadRate

	LeadUserIntensity	Log(NumberMobileApplications)	Prob>Chi2
log(ApplicationDownloadRate)	6.06(1.6)		0.0002
log(NumberMobileApplications)	1.97(0.67)		0.0035
log(ApplicationDownloadRate)	1.66(0.86)	2.22(0.23)	0.0000

Note: coefficient in parentheses are standard errors

Previous table indicates that the independent variable "LeadUserIntensity" predicts both the mediating variable "NumberMobileApplications" (beta: 1.97, p-value: 0.003) and the dependent variable "ApplicationDownloadRate" (beta: 1.66, p-value: 0.000). In this case, the mediation effect is even stronger than before according to beta coefficient of the independent variable which controlling for the mediating variable is (beta: 1.66, p-value: 0.000). The results of a bootstrapping analysis confirm a partial mediation effect.

The results presented in table 1.2 find evidence on the effect of Lead Users participation in the value network and the ability of the sponsoring firm to sense the market (Total effect=6.04); hence supporting hypothesis H2.2.

The importance of Lead Users in mobile ecosystems has been also strongly advocated by several managers interviewed who are involved in similar value networks as sponsored by Telefónica and Ericsson. According to a manager "our firm engaged systematically in open collaboration with external users in 2007, initially as a test at the Beijing University of Post and Telecommunications. Over 700 students signed up for a novel service combining mobile communications, social networks and user-generated context"…; "the purpose of the test was to engage external, technically savvy, users into early development stages in order to receive feedback regarding functionality and usability which, in the end, could help our firm to provide attractive and well-functioning services to consumers. Given the early success of this preliminary initiative it was further scaled up at the corporate level to a worldwide reach". This confirms the importance of engaging with external developers to tap local knowledge such as students' preferences or specific business opportunities in local markets.

According to mediation models (tables 1.1, 1.2) the number of software applications existing already determines the total effect level played by Lead Users in the value network (Total effect 95% confidence intervals [2.76-3.38] and [4.75-8.14]). This justifies the observed interest of sponsoring firms in sustaining their value networks with internal business units developing applications and software components to facilitate the entrance of external developers.

1.5 Conclusions

The telecommunication industry is experiencing a paradigm shift as competition is based on dynamic capabilities to (1) sense and shape the market, (2) extract value and (3) reconfigure. In this new context economies of substitution dominate over economies of scale.

Articulating previous abilities, however, requires profound transformations either of technical or organizational nature. In this sense, this paper reports on an emerging form of inter-firm collaboration in the telecommunication industry, value-creating networks.

Value-creating networks present some specific characteristics in contrast to their counterparts in the manufacturing sector: (1) they need to implement mechanisms to absorb external knowledge of highly tacit nature and (2) they incorporate large sets of lead users into the network.

The results of the empirical study conducted support the important role played by Lead Users in these networks. Lead Users by developing software applications contribute to make explicit knowledge regarding customers' preferences and expectations. In this sense, this paper contributes to identify what factors contribute toward appropriate use and integration of knowledge resources (Chilton, 2010).

Given the strong effects between Lead Users and the ability of firms to sense the market and profit from it then, it is only natural that firms sponsoring mobile ecosystems are doing their best to attract best external resources into their value-creating networks, to ensure high rates of innovation and market development.

The results of this paper confirm extant literature on the importance of Leadusers for innovation and knowledge transformation (VonHippel 2006, Franke 2006). This paper however finds that as far as value networks in the mobile industry are concerned firms must provide economic incentives to attract external developers who according to our

interviews exhibit profit-oriented behaviour.

1.7 References

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