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The Borders of Mobile Handset Ecosystems: Is Coopetition Inevitable?

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Abstract. Today, the mobile phone industry witnesses important changes, shifting from a value chain to a burgeoning business ecosystem. This paper deals with the relationships that are at the very core of mobile OS ecosystems for IMTs (smartphones and PDA): Microsoft-OS, Symbian-OS, Palm-OS and RIM-OS over the period 1998-2006. Our study confirms that an ecosystem's borders are unclear. More than half of our sample' relationships are shared by at least two different ecosystems. The ecosystems we studied do not differ in terms of exclusive relationship which suggests that coopetitive strategies are particularly relevant in mobile platforms war.

Keywords: Ecosystems, Mobile OS, co-opetition, keystone organization.

1 Introduction

When Microsoft launched a new version of Windows Mobile operating system in 2005, Bill Gates spoke in the following terms: "The idea is to create a real ecosystem, with operators, manufacturers and developers[1]". In 2007, Google revealed its broader mobile strategy and released Android, a Java-based operating system that runs on the Linux 2.6 kernel. Android was announced under the Open Handset Alliance, a group of around 30 technology and mobile industry leaders. Under Google's leadership, these companies will work together to create both a more open cellphone environment and a better customer experience, turning cellphones into powerful mobile computers. However, this strategy is far from new. Indeed, ten years earlier Nokia used the same strategy, partnering with major players such as Psion, Motorola, Matshushita-

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[1] La Tribune, 12 May 2005.

Panasonic, Siemens, Sony-Ericsson and Samsung in order to develop the Symbian operating system. Looking back, Microsoft, Nokia and Google with their respective operating systems for intelligent mobile terminals (IMT), were going down the same road. Their strategies have common features. Basically, they commit resources to get the leadership in the mobile phone landscape, offering a standardised technology (OS) thanks to a wide range of relationships between various players from different sectors, whether they are partners or competitors. Such value webs are an opportunity for different key players to promote their flagship OSs.

They are also known as 'business ecosystems" [1]. Teece [2] defines business ecosystems as "a community of organizations, institutions, and individuals that impact the enterprise and the enterprise's customers and suppliers". This paper will focus on the relationships that are at the very core of mobile OS ecosystems for IMTs (smartphones and PDA): Microsoft-OS, Symbian-OS, Palm-OS and RIM-OS over the period 1998-2006. Indeed, these four OSs were the most popular mobile platforms during the study period. In this paper, we analyze the main characteristics of these four business ecosystems. We will focus on "exclusiveness" i.e. the tendency to associate with only a select keystone organization. Given the existence of various players and a large number of potential relationships, the choices pertaining to this exclusiveness and their outcomes are particularly relevant.

1.1 It's all about Business Ecosystems

The key players in the ICT field (Apple, SAP, Cisco, IBM, Symbian, Microsoft, etc.) often use the concept of "business ecosystems" to define the loose networks of suppliers, distributors, outsourcing firms, complementors, technology providers, that affect, and are affected by, the creation and delivery of a company's own offerings. For a specific company, it is very important to join such a network in order to benefit from business opportunities [3]. The ecosystem-based view is a very exciting framework which provides an alternative interpretive lens for better understanding new forms of dynamic networked co-operative business processes [1], [4]. According to Moore [1] a business ecosystem is "a community of businesses and individuals that co-evolve, sharing one or more resources on the basis of a common strategic destiny". This concept relies on different theoretical approaches [5]. Shapiro and Varian [6] assert that because of the compatibility between certain technologies, businesses that sell complementary products or services have to develop relationships with their allies. Thus, forming alliances, cultivating partners, and ensuring compatibility (or lack of compatibility) are critical business decisions especially in the ICT sector where standards are an important issue.

Relationships between the firms of an ecosystem are complex and show a mix of cooperation and competition, illustrating situations of coopetition as analysed by Nalebuff & Branderburger [7]. Because of this, the frontiers of an ecosystem are unstable and keep changing depending on the interactions between member firms. An ecosystem is a business community which brings together firms from various industries which are interdependent. These business communities are usually structured around a leader, which strives to share its commercial philosophy or its technological standard [8]. Moore [9], [10] also stresses this dimension and the need

for the leader to develop the kind of vision to which the ecosystem's members can adhere. In this framework, the role of the leader is to encourage the convergence of all the other community members' vision and ensure that their efforts will enable the development of beneficial synergies for the customers. This shared vision is indeed a way of structuring innovation and ensuring coordination amongst actors within the ecosystem. The ICT sector is closely related to the concept of the business ecosystem because it is made up of very dynamic interdependent markets [11]. Indeed, in such dynamic markets, leaders or "would-be" leaders often try to introduce standards that will ensure market stability and their market dominance. But for such a stability to emerge, a standard must be introduced and widely accepted. As a consequence, we can observe a mix of competition and collaboration between companies which leads to great instability in the early phases of the ecosystem life-cycle. In the mobile phone sector, navigating business ecosystems is very important for those companies wishing to promote a standard mobile OS and achieve sustainable growth. For instance, a common strategy for mobile platform providers is to build a software marketplace, encouraging a large developer community that will increase the penetration rate of their OS. The success of a developer program not only depends on the software marketplace but also on the platform's health i.e. the OS ecosystem. Third-party developers are interested in making money and creating great applications. In the first place, they will choose the platform that lets them easily create these applications. However, if they can't make money from a platform, they will move away to another. At this stage, given the existence of cross network externalities, an important issue is how big is the user base?

1.2 Is Exclusivity in Relationships Possible?

In previous research, we suggested that coopetitive relationships have a great influence on smartphone and PDA ecosystems [12]. However, our research focussed on the direct relationships between focal firms or keystone organizations and did not lead to a quantitative analysis. In order to better understand the main differences between rival ecosystems, we are now going to focus on the relationships we identified in such ecosystems. For instance: does the number of relationships within a business ecosystem increase over time? Are these relationships based on the same incentives (commercial agreements, long-term partnerships etc.)? Do these ecosystems differentiate themselves through their members' activity? At this stage, we are mainly interested in the specificity of the relationships' evolution, the very nature of these relationships and the type of actors that are involved in these relationships. At the end, we hope the answers obtained could help us better understand how context-specific the exclusivity of such relationships is. Basically, we want to know if a specific business ecosystem can be made up of relationships between players that are not in touch with the keystone of a rival ecosystem. In other words, what is the degree of coopetition [7] between rival ecosystems? Coopetition refers to the collaborative arrangements of two or more competitors while at the same time these firms compete at the market [13]. Hence, coopetition builds on the idea that competitors should not just be considered as rivals for market dominance but also as valuable sources of innovation. We have to appreciate coopetition both within and

between ecosystems. For instance, Figure 1 below describes two different ecosystems (A and B) consisting of a group of relationships between firms X, Y and Z (1). Firms X are the "leaders" [1] or the "keystone organizations" [4] in their respective ecosystems. These firms are in competition (2a). The ecosystems A and B are also in competition in order to promote their mobile OSs as a dominant design (2b). However, keystone organizations X can build direct relationships (3), which refer to coopetition strategies. When different players belong simultaneously to both ecosystems (Z) there will be an indirect coopetition.
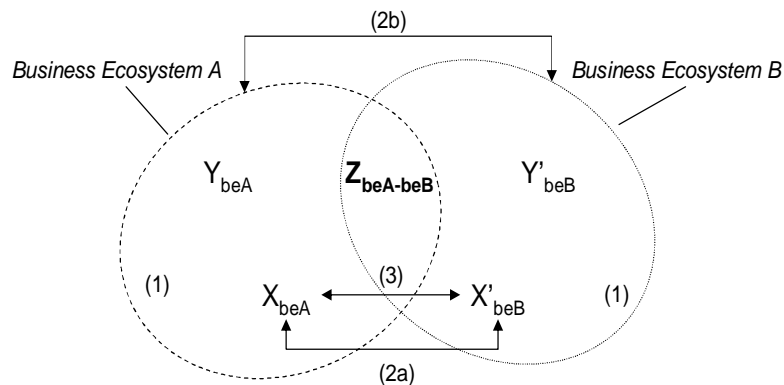
Fig. 1. Business ecosystems and keystone organizations

An examination of the academic literature in the field of business ecosystems reveals that the question of "exclusiveness" is still underdeveloped [1], [14], [4], [2]. Since firms can contribute in different ecosystems, these contributions can reduce resources specificity between ecosystems. In respect to this question, the number of non-exclusive relationships within business ecosystems is particularly relevant. In the same vein, are there differences in the appeal to forming relationships with exclusive actors?

2 Methodological Approach

First of all, we postulate that:
- Two firms that initiate a partnership belong to the same ecosystem; their respective interests in this partnership will converge meaning that their destinies are partially linked. Thus, a firm in connection with a player that works on a specific mobile platform belongs to this mobile OS ecosystem. Of course, it's about a wide approach of ecosystems and some of these relationships may be more important than others.

- Based on secondary data we extracted from professional journals, we listed various relationships between players in the mobile landscape in order to build an exhaustive sample. This sample can be used in order to describe (characteristics) the spectrum of relationships making inferences from sample data to the population.

We reviewed three main French journals (Les Echos, La Tribune and 01.Net) over the period 1998-2006 in order to extract each article dealing with mobile OS platforms we were interesting in. We only selected articles that included the names of the key players associated with these platforms. We collected about a thousand articles. Once filtered, we retained 738 articles that were closely related to our topic. At the end, we identified 237 collaborative relationships between 96 companies (OEM, ODM, ISV, Content providers, MNO etc.) and 4 keystone organizations.

Then, we built an adjacence matrix in order to map possible cooperative links with key players. These links were selected according to their importance. After this stage, we used social network software (Ucinet / NetDraw) in order to draw from the adjacence matrix different sociograms depending on the nature of the relationships. Analysing the multiple cooperative [15] and coopetitive [16] relationships with social network tools has become increasingly commonplace in research.

Such a methodological approach makes it possible to analyse complex relationships and to appreciate "degree centrality" i.e. the degree of proximity between key players. This approach allowed us to evaluate cooperation both inside and outside the business ecosystems we focused on. In this context, we were only interested in the links that relate players with keystones organizations in charge of promoting their respective platforms: Microsoft, Symbian, Palm and RIM. Of course, various OSs were available when we conducted our study. However, in order to simplify reality we focussed on the most popular OSs and the major players. The relationships we identified during our study can be sorted as follows:

- *Agreements*: it's a one-off relationship in which players are weakly implicated (EADS and RIM joined forces to deliver security certification of the BlackBerry for governmental organizations in Europe),

- *Customer-supplier relationships*: here it's mainly about licensing (for instance, Sony and other OEMs joined the PALM OS licensee family),

- *Partnerships /Alliances*: these long-term agreements are designed to manage cooperative efforts in creating or exploiting technology (for instance Nokia and Symbian Ltd before the creation of the Symbian Foundation).

Among the 237 relationships we identified (dyadic relationships), there can be redundant relationships especially if a new specific agreement was noticed over the period. In respect to "exclusiveness", there won't be multiple counting. We tried to know if there was at least one relationship between a firm and a keystone organization during the study period. Thus, we identified 160 relationships -among 92 companies- with one of the four keystone organizations.

3 Findings

First of all, we analyzed constitutive relationships within the four ecosystems in order to appreciate how these relationships evolve year after year. As suggested below (Fig 2), there are variations in the number of relationships. We observed an increase then a decrease of the number of relationships. Whatever the ecosystem, there was no progressive increase in the number of relationships as is the case in a life-cycle curve (Bass Curve). A khi² adjustment test for the relative part of the relationships for each year is not significant (khi² = 1.60 ; DDL : 24).
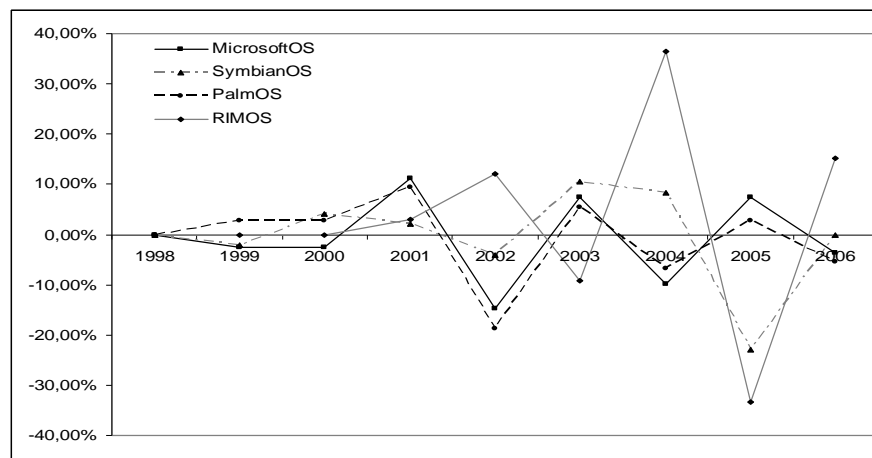

Fig. 2. Ecosystems' evolution over the study period.

Then, we tried to analyze if membership of a mobile ecosystem generated specific kinds of relationships. For each ecosystem, we identified a particular form of relationship (Table 1), either based on customer-supplier relationships, alliances or basic partnerships. We run a khi² test that reveals a significant difference (khi² = 46.07 ; DDL : 6 ; $p < 0.001$). For instance, the Windows Mobile ecosystem mainly relies on customer-supplier relationships based on licensing agreements. The RIM OS ecosystem is also based on the same type of relationships. In the case of Symbian, the ecosystem is based on numerous customer-supplier relationships and very few short-term basic agreements. Here, it's all about long-term. The Palm-OS ecosystem is a little bit different from the previous ecosystems since it uses the three types of relationships with relatively equal distribution.

Table 1. Three types of relationships.

Type of Relationship (237)	Microsoft	Symbian	Palm	RIM	Total
Simple Agreement	30.86%	3.45%	41.33%	48.48%	33.49%

Customer-Supplier	55.56%	41.38%	21.33%	45.45%	40.37%
Alliances	13.58%	55.17%	37.33%	6.06%	26.15%
Total	1	1	1	1	1

Now, we are interested in the species within these ecosystems, *i.e.* members' 'core business' in order to appreciate functional diversity. Indeed, functional diversity affects ecosystem properties and consequently, its sustainability. As suggested in Table 2, we identified 7 different types of players which are quite different from each other (khi² = 52.78 ; DDL = 18 ; p < 0.001).

For instance, players within the Windows Mobile ecosystem are mostly mobile handset OEMs and electronic manufacturers and suppliers. However, even if the part of the relationships with these players is the largest within Windows Mobile ecosystem, it is, compared with the other ecosystems, one of the weakest (quite similar to Palm-OS). On the contrary, the part of the relationships with mobile handset OEMs within the Symbian ecosystem is the biggest one (41.67%). This point is consistent with Symbian's history since the company's founders are mainly mobile OEMs. The distribution in the case of Symbian and Palm are quite similar except for the section "Others". Indeed, with Palm we identified a set of relationships with "niche players" that focus on very specific fields in the mobile landscape. In the RIM-OS, the business ecosystem relies on relationships with mobile OEMs and MNOs.

Table 2. Functional diversity.

Activities (237)	Microsoft	Symbian	Palm	RIM	Total
OS	6.17%	12.50%	13.33%	12.12%	10.55%
Mobile OEMs	23.46%	41.67%	24.00%	27.27%	27.85%
PC OEMs	18.52%	8.33%	4.00%	3.03%	9.70%
Electronic OEMs & Suppliers	18.52%	8.33%	6.67%	3.03%	10.55%
MNO	18.52%	10.42%	8.00%	24.24%	14.35%
Software / Internet Services	11.11%	14.58%	16.00%	12.12%	13.50%
Others	3.70%	4.17%	28.00%	18.18%	13.50%
Total	1	1	1	1	1

Table 3 indicates for each ecosystem if the relationships take place only within a specific ecosystem or if these relationships are shared, at least with one rival ecosystem. Here, a khi² test indicates that there are no significant differences for a fixed significance level of 0.05 (khi² = 6.60 ; DDL = 3 ; p < 0.09). Thus, it seems that all the ecosystems studied have the same share of non-exclusive relationships. Symbian OS share about three quarter of its relationships with at least one other rival ecosystem. RIM-OS follows the same trend. For both Microsoft and Palm OSs, relationships are divided up in a more equal way between unique and shared relationships.

At the end, about 60% of the relationships identified for the four ecosystems are shared relationships. Table 3 is also interesting since it makes it possible to identify the number of rival ecosystems concerned with these sharing relationships. For

instance, RIM-OS shares 27.27% of its whole relationships with the three other rival ecosystems.

Table 3. Shared or common relationships.

| Ecosystem (160) | Unique Relationship | Shared relation with at least 1 rival OS | Total | Shared or Common relations with at least 1 rival OS | | | |
				Shared relation with 1 rival OS	Shared relation with 2 rival OSs	Shared relation with 3 rival OSs	Total
Microsoft	49.02%	50.98%	1	15.69%	23.53%	11.76%	50.98%
Symbian	23.33%	76.67%	1	20.00%	36.67%	20.00%	76.67%
Palm	46.67%	53.33%	1	20.00%	20.00%	13.33%	53.33%
RIM	31.82%	68.18%	1	22.73%	18.18%	27.27%	68.18%
Total	40.54%	59.46%	1	18.92%	24.32%	16.22%	59.46%

Basically, it seems that shared relationships between rival ecosystems are a rule or a common feature. From this point of view, it seems interesting to visualize the relationships between rival ecosystems (Fig 3). For instance, Table 4 reveals that 38.89% of Microsoft ecosystem members are engaged in relationships with the Symbian ecosystem. Figure 3 summarizes all the dyadic relationships between rival ecosystems. In such a context, the Microsoft case is interesting, since the Windows Mobile ecosystem is connected with its rivals in the same proportion, turning the platform into a real hub. Basically, figures in Table 4 indicate that the frontiers of an ecosystem are quite unclear.

Table 4. Relationships between rival ecosystems.

Ecosystem (160)	Microsoft	Symbian	Palm	RIM
Microsoft	-	38.89%	38.89%	25.93%
Symbian	63.64%	-	57.58%	36.36%
Palm	43.75%	39.58%	-	22.92%
RIM	56.00%	48.00%	44.00%	-

In Figure (3) below, we mapped relationships between business ecosystems. One can see players that are in touch with the four ecosystems (square), with three ecosystems (triangle), with two ecosystems (circle) and those which are with only one mobile OS ecosystem.
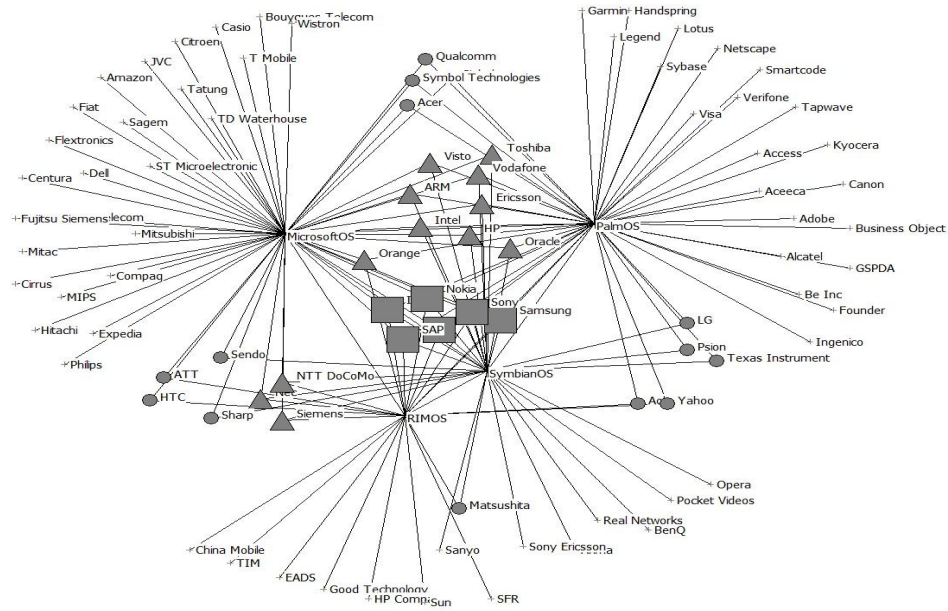
Fig. 3. Ecosystems' map

4 Conclusion

In this study, we were interested in mobile OS ecosystems. Figure 4 presents these ecosystems given two quantitative parameters: the part of customers (as opposed to the part of agreements, alliances and customer-supplier deals) and the part of unique relationships (as opposed to shared or common relationships with at least one OS). Data are related to relationships within a specific ecosystem. The matrix below illustrates the importance of commercial relationships (the part of customers *i.e.* OS licensees) for a specific ecosystem (Y) and the specificity of its memberships (X). We notice that the Windows Mobile ecosystem is made of more commercial connections and unique players than the Symbian OS.

Our study confirms that an ecosystem's borders are unclear. More than half of our sample' relationships are shared by at least two different ecosystems. For instance, 76.67% of Symbian ecosystem members are members of a rival ecosystem. The ecosystems we studied do not differ in terms of exclusive relationship which suggests that coopetitive strategies are particularly relevant in the ecosystem-based view. Beyond the analysis of exclusive relationships between keystone organizations, we suggest that indirect coopetition also characterizes business ecosystems.
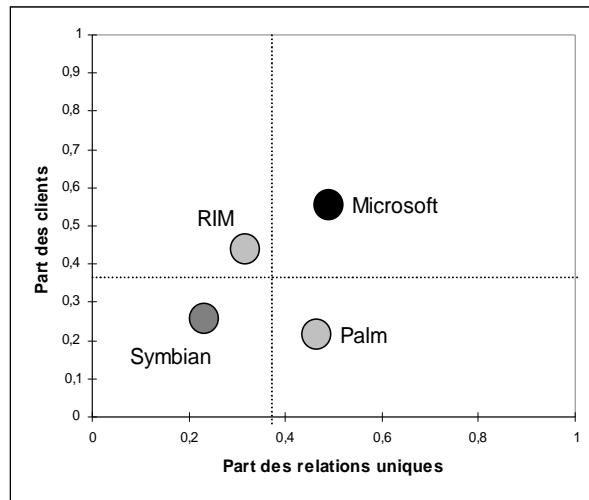
However, there are several limits to our study:

- We considered that the relationships between players had the same value;

- We did not study relationships between players that were not in the central position (keystones),

- We did not analyze the other ecosystems present over the study period, such as Linux (LiMo);

- We did not identify relationships with regard to their year of appearance to determine if the membership of two ecosystems was simultaneous or not.

In order to go further in the analysis of business ecosystems in the mobile landscape, longitudinal studies should be carried out in order to better appreciate the relationships' evolution across time. Nevertheless, our results confirm the need to develop external relationships between business ecosystems. From this point of view, it seems clear that both the Android ecosystem and the Apple iPhone ecosystem will have to open their doors to external players, whether they are already members of rival ecosystems or not. At the end, the emergence of new forms of hybrid competition that includes competition and co-operation drives the need for relational strategies. The ability to create and manage relationship with a network of collaborators will be a key success factor in the mobile ecosystem war.

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