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Controversy Corner

Strategies for managing power relationships in software ecosystems

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ABSTRACT

Building a software ecosystem provides companies with business benefits as well as share risks and costs with a network of partners. The ability to establish successful partnerships with other companies can influence the success or failure of the ecosystem. Companies use power to build alliances and strengthen their position in the ecosystem. However, the inappropriate use of power may create tensions that threaten partnerships. To explore the dynamics of power and dependence in software ecosystems, we conducted three case studies of ecosystems formed by small-to-medium enterprises. As a result, we present a set of hypotheses that explain the effects of power on software ecosystems. As theoretical contribution, we present a meta-model that integrates concepts from software ecosystems literature with constructs from classical power theories. Our practical contribution is a set of strategies that companies can employ to manage power relationships with partners, so that their ecosystems can evolve in a healthy and prosperous manner. By obtaining an understanding of the occurrence of power and dependence, companies can recognise how to exercise power and deal with the power from partners in order to leverage their relationships.

1. Introduction

Software ecosystems have become one of the key drivers of innovation and growth in the IT industry. A software ecosystem is a group of interconnected companies that work as a unit and interact with a shared market for software and services (Jansen et al., 2009). Google Android, Apple iOS and Amazon Web Services are examples of successful platform ecosystems. These platforms heavily rely on the active collaboration and expertise of a diverse developer community. Notably, ecosystems are shifting the rules of competition and collaboration in which companies must operate. To ensure sustainable performance, companies are shifting bilateral partnerships to create ecosystems with different players, such as suppliers, complementors, and clients. The survival and progress of companies depend not only on their own business results, but also on the performance of the companies and the entire ecosystem. The foundation of a software ecosystem is based on the notion of interfirm relationship, with companies that co-create value via technological (e.g. new features for an innovative system), commercial (e.g. relevant pool of customers from different segments) and/or intellectual (e.g. new software development skills) complementation. The participation in a software ecosystem enables firms to integrate activities, assets, and capabilities to deliver complex solutions demanded by the market.

To enable a healthy network, companies must strategically govern the software ecosystem by defining appropriate governance mechanisms that amplify the opportunities to attract new players, share benefits among partners, and align activities among participants with complementary assets (Williamson and De Meyer, 2012). The ability to manage relationships with partners can influence the success or failure of the ecosystem. Frequently, companies disregard the potential for conflict and disastrous effects resulting from misaligned strategic interests (Yoffie and Kwak, 2006). For example, companies may battle to access a profitable niche market or implement a strategic software module.

In this setting, the exercise of power allows companies to share benefits, become more attractive and lead partners in their relationships. Companies holding valuable resources, such as money or expertise, can exercise power over partners that depend on such resources. They can also use power as a means to build alliances and strength their position in the network. However, the excessive use of power may create tensions that threaten the evolution of the ecosystem.

In the last years, we have conducted multiple case studies to explore ecosystem partnerships from a power perspective. We are particularly interested in understanding the dynamics of power in ecosystems formed by Small-to-Medium Enterprises (SMEs). Researchers have extensively studied proprietary ecosystems orchestrated by big players

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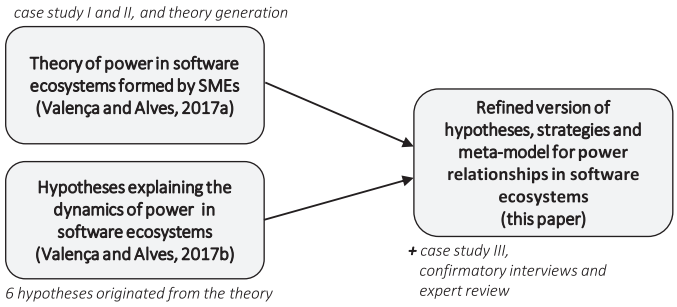

Fig. 1. The differences between previous works and this paper.

(Manikas, 2016). However, it is quite surprising that very limited research has analysed the relationships among SMEs forming an ecosystem, as this type of company accounts for around 95% of global business (Colomo-Palacios et al., 2015).

The current paper builds upon former studies, as described in Fig. 1. In Valença and Alves (2017a), we presented a substantive theory on the occurrence of power and dependence in ecosystem partnerships, together with illustrative power models from two exploratory cases studies (CSI and CSII). In another paper published at the 43rd Euromicro Conference on Software Engineering and Advanced Applications in 2017 (Valença and Alves, 2017b), we proposed six hypotheses about power relationships.

This paper is an extension of Valença and Alves (2017b). Here, we include a refined version of the hypotheses with new evidence gathered from confirmatory interviews. We also add a new case study (CSIII). As novel contributions, we propose a meta-model that integrates concepts of power and software ecosystems. Moreover, we present a set of strategies that companies can employ to establish successful power relationships in software ecosystems. The strategies are based on power-changing operations, which allow a company to adjust power advantage in a partnership. For example, a company may invest on establishing contact with potential partners who can provide it with new clients, reducing its dependence on the customer base of a dominant player. By implementing such power management strategies, companies may improve their own performance and promote the health of the entire software ecosystem. We developed these strategies based on results obtained from multiple case studies. The strategies were created from the analysis of interviews with studied companies and were assessed by means of an expert review. The proposed strategies aim to support companies to obtain a greater understanding on the occurrence of power and dependence, particularly recognising how to exercise power effectively and how to deal with the power from partners in a software ecosystem.

We structured this paper in six sections. Section 2 provides a conceptual background on software ecosystems and power theories. Section 3 details the research method to conduct the case studies. Section 4 illustrates the power model of a case company. In Section 5, we present the meta-model for power relationships in software ecosystems and an extended version of the hypotheses. In this section, we also propose practical strategies to manage power relationships in software ecosystems. Section 6 discusses the results of the expert review. It also analyses research limitations and related studies. Finally, Section 7 presents the contributions for research and practice and proposes directions for future works.

2. Theoretical foundation

In Section 2.1, we explain relevant concepts of software ecosystems field. In Section 2.2, we describe well-established works on power, which allowed us to examine the dynamics of power relationships among software companies in a comprehensive manner. The ideas introduced by the authors who proposed the classical power theories were widely adopted by researchers from several domains, such as, managerial sciences (e.g. Zhuang and Zhou, 2004; Gaski, 1986) and software engineering (e.g. Milne and Maiden, 2012; Hurni and Huber, 2014).

2.1. Key concepts in software ecosystems

The concept **software ecosystem** establishes a metaphor with natural ecosystems, in which species are part of a food chain and depend on each other. In this setting, a network of actors function as a unit and interact within a shared market for software and services. The relationships among ecosystem participants are generally underpinned by a common technological platform or business opportunities, through the exchange of information, resources and artefacts (Jansen and Cusumano, 2013). In the last decade, relevant players from the software industry created software ecosystems around their products by opening their platforms via interfaces, allowing external actors to integrate complementary solutions and develop new applications (Che and Perry, 2014). The interactions with external actors allow these players to complement the functionality of existing products as well as expand the offering of systems integration and services (Cusumano, 2004).

Companies in a software ecosystem collaborate and create larger software solutions via integrations of their products in **partnerships**. This intentional strategic relationship between companies enables them to join efforts to achieve goals they could not attain easily in isolation. On the one hand, companies gain access to a myriad of technologies to co-create innovations and enter new markets niches. On the other hand, they strive for common benefits and keep a high level of mutual interdependence.

The network of a software ecosystem is structured on top of business, technical, and social **dimensions** (Manikas and Hanssen, 2013b). The *business* dimension involves elements such as the marketplace, entry barriers and customer base. The *technical* dimension embraces technological and architectural aspects, such as the common software infrastructure and product line. Finally, the *social* dimension considers interfirm relationships, reputation and shared knowledge. In Valença and Alves (2017a), we synthesise the core elements of a software ecosystem, which we mapped after performing an exhaustive literature analysis of secondary studies (e.g. systematic literature reviews, mapping studies).

A community of interacting **actors** enables the software ecosystem to create and deliver new solutions (e.g. complete integrations, specific applications) to the market. Such mutually dependent participants often involve a keystone, niche players, value-added resellers, and customers. The *keystone* is a leading actor (in general, a company or independent entity) that guarantees the well-functioning of the network. This player is responsible for running a platform, creating and applying rules, processes and business procedures, setting and monitoring quality standards, and orchestrating actors' relationships. Examples of big keystones are Apple in the iOS ecosystem and Amazon in the Alexa ecosystem. *Niche players* use the central technological infrastructure to produce functionality to address demands from the market. They complement the keystone work and influence ecosystem management. The *value-added resellers* make profit from extending and selling ecosystem solutions to customers, end-users or other vendors. Finally, *users* purchase or obtain an ecosystem solution from a niche player or a vendor to carry out their businesses (Hanssen and Dyba, 2012).

The **health** of a software ecosystem indicates how the ecosystem is evolving and how effective the managerial strategies are to the sustainability of individual players as well as the whole ecosystem. The overall performance of software ecosystems depends on the actions and decisions taken by each individual player. An ecosystem is healthy when it provides mutual benefits for players (Manikas and Hansen, 2013a). The companies acting in the ecosystem are committed to their own health as well as their partners' health. It means that a win-