



Organizing business ecosystems in emerging electric vehicle industry: Structure, mechanism, and integrated configuration



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ABSTRACT

The paper develops the structure of business ecosystems, operating mechanisms and integrated configuration models by examining multiple case studies of electric vehicle (EV) producers in China and the EU (Germany, France and Denmark). The EV ecosystem can be categorized into four paradigms using a target market (mainstream or niche innovation) and growth context (advanced economies or emerging economies). These four paradigms are advanced mainstream, advanced niche, emerging mainstream and emerging niche. This research also explores three key operating mechanisms with which to organize EV business ecosystems, namely vision developing, platform organizing and institution re-configuring. As a latecomer, compared with western paradigms, the development of Chinese EV industry is more openly engaged with vision development, platform organization and institution reconfiguration, such as government regulation.

1. Introduction

The concept of a business ecosystem has been highlighted in some real industrial phenomena, such as the electric vehicle (EV), iPhone online ecosystem and mobile internet industries (Kenney and Pon, 2011; Kley et al., 2011). The business ecosystem is considered to be an interdependent community that expands the traditional supply chain partners by involving more stakeholders like universities, government, and industry associations in the network. All of the stakeholders share a common vision and fate by contributing their complementary resources and capabilities in order to create a new business project or an emerging industry (Hu et al., 2014; Iansiti and Levien, 2004; Moore, 1993). Many scholars (Harland, 1996; Hayes and Wheelwright, 1984; Rong et al., 2015a; Zhang et al., 2008) have suggested that in order to fully understand a system in terms of its mission, strategy, function and mechanism, it is necessary to further explore the system construct.

We conducted a qualitative cross-case study in the emerging EV industry. The reason why the EV industry was selected was twofold. On the one hand, the emergence of the EV industry could illustrate some typical characteristics of a business ecosystem that consists of inter-organizational and cross-industry collaborations among the EV industry players. Different levels of organization are involved, such as

industrial participants (original equipment manufacturers (OEM), battery manufacturers, electronic control systems, electronic equipment and other auto component providers, as well as power generator and whole infrastructural network players), government agencies, industry associations, customers, and other relevant stakeholders. The OEMs in the EV industry are the ecosystem keystone players (Iansiti and Levien, 2004) or orchestrators (Dhanarag and Parkhe, 2006; Hacki and Lighton, 2001) to coordinate the other stakeholders in obtaining knowledge mobility (during the design of new EVs), innovation appropriability (sharing profits in the EV ecosystem) and network stability (selection of EV ecosystem partners). On the other hand, the growing EV industry, with rich diversification, was very suitable for the study of the variety of business ecosystem structures and configurations that different types of entrepreneurs and traditional car firms demonstrate. For example, some multinational firms like Renault and entrepreneurs like Tesla (originally a battery provider but now emerging as a high-end racing EV manufacturer, www.teslamotors.com/about) invest hugely and start to commercialize the products quickly, while other multinational firms like Daimler AG and BMW wait for the right moment to capture business opportunities with a more conservative mindset. Some large Chinese firms like BYD are sponsored by central and local government to implement the EV pilot project with a top-down innovation model; while in some areas

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of China, the grassroots entrepreneur specialized the market demand and conducted a modest innovation to successfully commercialize the economy version of EVs (specification as max speed 80 km/h, 120 km distance/charge) by using existing mature technologies.

Distinguishing from the classical supply chain structural model, the EV industry also demonstrates a value stream enabled by a business ecosystem (Shang and Shi, 2013). Firstly, the **supply side** will determine what kind and level of EV the ecosystem would provide; for example, they aim to replace the existing combustion engine or provide an economy version aiming to drive in a small area. Secondly, the **demand side** would indicate the driving force of the EV industry; for example, the Chinese EV industry is mostly driven by the government while the European EV industry is driven by market force. And thirdly, the **intermediaries** bridges demand and supply ends; for example, the infrastructure development for EV charging stations and networks, as well as adapted industrial policies, regulations/legislations and standards.

Hence, this paper will address the following research question:

In a comparison of Chinese and European EV industries, how do the focal companies manage their business ecosystems?

The paper is structured as follows. First, a literature review is presented of the current research on the organizational and business ecosystem theories. Then, a conceptual research framework is developed. The methodology specifies the research strategy, data collection and analysis methods. This is followed by a look at the case studies from four paradigms of EV ecosystem to demonstrate different types of ecosystem innovation scenarios through the proposed conceptual framework. The business ecosystem structures, mechanisms and configurations, as well as four propositions are identified. Finally, the theoretical, practical contributions and future research avenues are discussed.

2. Literature review and research framework

2.1. Literature review: mechanisms to organize a business ecosystem

The operational mechanisms play key roles in organizing those structural factors that make up the ecosystem as a whole. Three such operational mechanisms are highlighted to encourage the participation of ecosystem partners: vision developing (Chesbrough, 2003; Reid and Roberts, 2011), platform organizing (Gawer and Phillips, 2013; Iansiti and Levien, 2004) and institution reconfiguring (Howells, 2006; Lu et al., 2014).

2.1.1. Vision developing: vision initiation, vision diffusion

There are two stages to developing a vision for a firm: in the first stage, firms have to initiate the vision to engage staff within the firm through such means as a firm vision, market vision and technology vision. Those visions are regarded as the firm's values, mission, goal or, specifically for product environments, what kind of product the firm could provide. Then, in the second stage, these visions are shared in the process of inter-firm new product development. For example, in the open innovation system, visions are shared between external and internal resources and partners (Chesbrough, 2003). Furthermore, Moore (1996) proposes that the co-evolution of ecosystem partners is also driven by a shared vision to involve direct or non-direct business partners. The firm's vision is a way to encourage the potential partners to help commercialize the focal firm's ideas. Thus, vision sharing could facilitate and strengthen the collaborative innovation by integrating customer value, product specification and the supply chain system (Swink, 2006). Thus, this part could be referred to as 'vision diffusion'.

2.1.2. Platform organizing: network governance, core business process

A platform is an interface through which the keystone firm manages different partners and enables ecosystem partners to work collaboratively to identify and form a core business process, which breaks down the barriers and improves productivity (Cacciatori and Jacobides, 2005; Gawer and Phillips, 2013). For example, Adner and Kapoor (2010) propose the structure of technology interdependence which describes the relationship between the keystone/focal firm owning the technology platform in conjunction with suppliers and customers. Without this cooperation, the commercialization process of focal firms' products would be slowing down. However, in emerging ecosystems, the platform is normally not established as a multi-sided platform (Rochet and Tirole, 2003); instead the platform is fragmented and does not formally connect the stakeholders. Therefore, previous studies have failed to address how keystone firms encourage the non-direct partners, such as complementors, to work together. As a result, the way to manage those partners with a different role is highlighted in the network governance mechanism.

Keystone firms take the time to consider their core business process and business model (Chesbrough, 2010; Guo et al., 2017), which are to deliver their products and formulate the relationship between partners (Iansiti and Levien, 2004). A solution platform forms the model of partners' interactions and enables product solution diversity in order to better approach the dominant design (Rong et al., 2015a). In other words, the core business process is the process relating to the keystone firm's new product development and commercialization, which governs a platform-based flexible network along the path towards industry maturity.

2.1.3. Institution reconfiguring: policy flexibility, social adaptation

The emerging industries require more policy and regulation support than mature industries (Li and Garnsey, 2014; Rong et al., 2015a), because the individual stakeholder cannot distinguish a clear industrial development direction (Kley et al., 2011). In terms of the emerging EV industry, new policies cover various rules about the establishment of the charging infrastructure, the value distribution of business models and the implementation of industry standards (San Román et al., 2011; Chen et al., 2014). However, only some policies can facilitate EV industry development while others fail. For example, in China's Shandong province, the local entrepreneurs had already produced economy EVs and successfully commercialized them. However, this product was banned from sale in other provinces because elements of the specification of the product, such as speed and distance per charge, did not meet China's minimum national standards. Luckily enough for the entrepreneurs, the products survived due to the flexibility of local policies.

The emerging industries also have to satisfy cultural expectations, like social norms and lifestyle choices. Most car users were reluctant to use the EV since the EV industry is not yet a mature one (San Román et al., 2011). How to educate the customers to use new products is also a challenging task. The EV should be adaptable to social norms and cultures. Taking the Chinese *Shanzhai* mobile as an example, a local mobile phone manufacturer produced an affordable and customized mobile phone with a large speaker to meet the demands of farmers working in the fields. This came about as a result of research conducted on the ground, which showed a demand for this kind of niche product (Rong et al., 2011). Beside customer influence, other intermediaries like the standardization organization and service agency are also important in reshaping products (Howells, 2006).

2.2. The research framework

The conceptual research framework is developed as shown in Fig. 1. The horizontal dimensions are regarded as structural parts containing the partners of supply side, intermediaries and demand side (Shang

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