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The management of organizational ambidexterity through alliances in a new context of analysis: Internet of Things (IoT) smart city projects

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ABSTRACT

In the last decade, the Internet of Things (IoT) has affected the approach of organizations to innovation and how they create and capture value in everyday business activities. This is compounded in the so-called Smart Cities, where the objective of the IoT is to exploit information and communication technologies (ICTs) to support added-value services for citizens, giving companies more opportunities to innovate through the use of the latest technologies. In this context, multinational enterprises (MNEs) are building alliances, starting several projects with public and private city stakeholders aimed at exploring new technologies for cities but also at exploiting new IoT-based devices and services in order to profit from them. This implies that companies need to manage and integrate different types of knowledge to efficiently and effectively support the simultaneous pressure of exploration and exploitation, at a project portfolio level. Using structural equations modeling with data collected from 43 IoT smart city project alliances in Italy, this paper tests and finds evidence that MNEs need to develop knowledge management (KM) capabilities combined with ICT capabilities if they want to obtain greater ambidexterity performance at the project portfolio level. More specifically, we highlight that KM capabilities enhance alliance ambidexterity indirectly through firms' ICT capabilities, suggesting that MNE managers should design KM tools and develop new ICT skills. Implications for academics, managers and future lines of research are proposed.

1. Introduction

The tension of exploration and exploitation is a prominent and as yet unresolved matter for multinational firms, in particular with regards to their management (Andriopoulos and Lewis, 2009). For several scholars, organizational ambidexterity provides an useful solution in order to perform this orchestration successfully ('Gibson and Birkinshaw, 2004) and to improve firm performance (Vrontis et al., 2016). According to Giarratana and Fosfuri (2007), the typical separation of organizational ambidexterity is essential because companies that pursue either exploration or exploitation usually outperform the others (Kauppila, 2010) and maximize the different benefits of both strategies (Andriopoulos and Lewis, 2009). Ambidexterity may also be achieved through networks, however, within and across the boundaries of the company (Kang et al., 2007, Ferraris et al., 2017). In this context, the alliance literature supports the idea that inter-organizational connections may improve and complement exploration and exploitation activities that companies take in action (Hoffmann, 2007; Vaccaro et al., 2010). Companies may thus compose their portfolios of exploration and exploitation alliances through a combination of different inter-organizational connections (Lavie et al., 2010).

In general, achieving ambidexterity is not very easy (Adler and Heckscher, 2013). This is more complex if we analyze ambidexterity in new and less orthodox contexts, such as the IoT in Smart City projects, in which firms have started operating recently (Zanella et al., 2014), and in the case of innovation resulting from the cooperation of different private and public stakeholders within the city's ecosystem (Lee et al., 2014). In fact, nowadays, firms are increasing the number and the relevance of their alliances within smart cities because modern cities are very important sources of innovation (Paskaleva, 2011; Paroutis et al., 2014). The "IoT smart city" context has, thus, become a hot topic among academics, practitioners and policy makers. According to Komninos (2008), Smart Cities are the consequence of a dense innovation ecosystem that creates value through the use and re-use of information that may come from many different social connections and highly skilled human capital. Thus, multinational firms that operate in

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this new and complex context need to adapt and rethink their explorative and exploitative strategies in order to be successful, because IoT Smart City alliances are different from classical alliances for at least three reasons: a) firms face triangular (or network) relationships rather than dyadic ones; b) firm innovation activities involve the latest technologies that often involve the war and the development of a new technological standard; c) firms create many projects that are based on temporary (short term) rather than long term cooperation.

Companies are exploring and testing new solutions in the IoT Smart City context, aiming to discover new technologies that permit cities to upgrade and to be more innovative. Together, firms are looking for the exploitation of business opportunities that comes from the application of these new technologies to new markets (Scuotto et al., 2016). Thus, they are discovering new technologies for cities but also searching for new profitable business models to commercialize, and to profit from new products and services introduced in the cities (Ferraris and Santoro, 2014; Sandulli et al., 2016). These companies are thus investing many more resources (Bulu, 2014) and they are developing new or superior capabilities (Ferraris, 2014; Bresciani et al., 2015) with the aim of managing exploration and exploitation in these high risk projects (Ferraris et al., 2017).

With this regard, the resource-based view (RBV) of firms argued that firms which develop superior resources or capabilities compared with competitors have better results and improve the potential to achieve competitive advantage (Barney, 1991). In the Smart City context, where the new devices and services that are discovered involve strong technological and knowledge skills, we propose two critical capabilities that may allow a firm to overcome the tradeoff between exploration and exploitation while being engaged in inter-organizational connections, thus attaining better performance (Lavie et al., 2011). In fact, our belief is that knowledge management (KM) and information and communication technology (ICT) capabilities are two distinct and important capabilities that are critical for the enhancement of firm ambidexterity performance in IoT in Smart Cities. This has also been highlighted by several studies, as recently noted by Soto-Acosta and Cegarra-Navarro (2016).

The aim of the present study is to add new knowledge to the IoT and Smart City alliance research, measuring and clarifying the effect of KM and ICT capabilities on ambidexterity performance at a specific level of analysis (the project). Specifically, we tested our hypothesis using structural equations modeling (SEM), with our findings strongly supporting the idea that KM capabilities indirectly enhance ambidexterity performance thanks to the exploitation of ICT capabilities (which mediate the direct positive effect).

The particular characteristics of these partnerships and the peculiarities of IoT Smart City projects strongly affect the contribution and the originality of this work, and in particular this contributes to the exploration versus exploitation debate and to its connection with the RBV theory of firms. In fact, as highlighted by Zanella et al. (2014), it is very interesting to investigate the deployment of the IoT in an urban context, an important research gap that this paper has filled. We did not offer insights from the perspective of cities that use the technology - as most of previous studies have done - but, instead we offer an empirical examination from the perspective of the stakeholders that create and develop these technologies, the firms.

This research is structured into the following sections: Section 2 proposes the theoretical background of the paper regarding the context of analysis, the IoT and Smart City contexts and the achievement of ambidexterity through alliances. In Section 3, we develop hypotheses regarding the relationships between KM and ICT capabilities and ambidexterity performance. We then (Section 4) present the methods and the analysis used to test our hypotheses (with the structural modeling technique). Finally, Section 5 describes and discusses the results, suggesting implications and future research recommendations, and draws conclusions.

2. Theoretical background

2.1. The IoT and smart cities

Urbanization and competitive pressures encourage the growth of cities that are more economically, environmentally and socially sustainable. In fact, cities grow to be smart by designing local areas using new ICTs such as the semantic web, cloud computing, devices and the internet of things. The IoT is a concept that refers to the use of new technologies and sensors to make the virtual world of IT integrated and strictly connected with the real world of things (Uckelmann et al., 2011; Scuotto et al., 2016). IoT is one of the pillars of the knowledge-based society and digital economy, and its effect is assumed as disruptive in the everyday life of citizens, with 16 billion connected devices in the next years opening interesting business opportunities for firms, especially for MNEs. Moreover, with access to more and higher quality information thanks to the use of the IoT, firms may be able to evaluate and take more fine-grained decisions about the management of business processes (Uckelmann et al., 2011). In summary, a city that is "smart" provides new services for its citizens thanks to an intensive use of new technologies. This highlights the need to identify and plan the development of future technologies that may match city demands (Lee et al., 2013).

A Smart City is a city that aims at connecting the physical, IT, social and business infrastructures in order to leverage the intelligence of the city's community (Hollands, 2008). In fact, cities are assuming a relevant role as innovation drivers for firms in a wide variety of industries such as health, the environment, and information and communication technology, among others (Zanella et al., 2014; Scuotto et al., 2016). In particular, firms may exploit the IoT in smart cities with the aim of testing new business models or new technologies (exploration) and commercializing and providing new services to citizens (exploitation) (Sandulli et al., 2016). Usually, firms involved in smart cities projects primarily follow a business model experimentation approach, because of the high technological risk. In fact, cities may be a great source of smart innovation, but successful experiments need the cooperation and support of local governments. Firms also pursue exploitation activities in Smart Cities to commercialize and to profit from previous exploration activities. In this context, firms pursue both exploration and exploitation activities (Scuotto et al., 2016). To that end, firms may develop or extend cooperation networks with several partners and city stakeholders with different goals, interests and resources; such as other established firms, citizens, start-ups, key users or universities and research centers. In this particular and complex context, an urban IoT may allow synergies and a better management of public services (Zanella et al., 2014).

2.2. Achieving ambidexterity through alliances in IoT Smart City projects

March (1991, p. 71) argued that "*maintaining an appropriate balance between exploration and exploitation is a primary factor in system survival and prosperity*". In this context, many studies found a positive relationship between organizational ambidexterity and several organizational outcomes (Kauppila, 2010; Ahammad et al., 2015), however, firms face many challenges that in some cases prevent them achieving optimal performance (Adler and Heckscher, 2013). Kauppila (2010) clearly demonstrated that alliances may be crucial for the management of ambidexterity. In fact, the development of networks within and across the boundaries of a company (Kang et al., 2007) may increase the potential to improve ambidextrous performance (Vrontis et al., 2016). In this sense, alliance researchers, such as Hoffmann (2007) and others, have said that external partners play a key role in strengthening a firm's exploration and exploitation agendas and in complementing them with new and valuable resources. Looking at ambidexterity from the perspective of inter-organizational alliance, we note that the external partners involved in these projects (local governments, other MNEs or

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