Technological Forecasting & Social Change 136 (2018) 331–338

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

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

Stefano Bresciani [a], Alberto Ferraris [a,b,*], Manlio Del Giudice [c,d]

[a] Department of Management, University of Torino, Corso Unione Sovietica, 218 bis, 10134 Torino, Italy
[b] Laboratory for International and Regional Economics, Graduate School of Economics and Management, Ural Federal University, Russia
[c] Department of Research, University of Rome "Link Campus", Via Nomentana, 335, 00162 Rome, Italy
[d] National Research University, Higher School of Economics, Moscow, Russia

ARTICLE INFO

Article history:
Received 12 August 2016
Received in revised form 13 January 2017
Accepted 1 March 2017
Available online 11 March 2017

Keywords:
Internet of Things
Smart City
Alliances
Ambidexterity
Knowledge management
ICT

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

* Corresponding author at: Department of Management, University of Torino, Corso Unione Sovietica, 218 bis, 10134 Torino, Italy.
E-mail addresses: stefano.bresciani@unito.it (S. Bresciani), alberto.ferraris@unito.it (A. Ferraris), m.delgiudice@unilink.it (M. Del Giudice).

http://dx.doi.org/10.1016/j.techfore.2017.03.002
0040-1625/

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 small-medium size enterprise, universities, research centers, etc.) may potentially contribute to both a firm's exploration and exploitation activities.

Inter-organizational connections are important because firms use exploration partnerships to focus on value creation in upstream activities, and exploitation partnerships to develop value creation in downstream activities (Lavie and Rosenkopf, 2006). In line with this, IoT Smart City partnerships may be balanced across function domains as proposed by Lavie et al. (2011). For example, companies engage in exploration alliances to pursue R&D initiatives that may lead to new technologies, services or products while engaging in exploitation alliance for their market application. However, when firms try to balance exploration and exploitation in their alliance portfolio, they face tension between these activities, shifting problems and conflicts from internal units to the organization of alliances (Lavie et al., 2011).

In general, Gupta et al. (2006) argued that strong effort in both activities is probably mutually exclusive. In a IoT Smart City context, companies may avoid this problem by following one of the approaches proposed by Gibson and Birkinshaw (2004), who argued that firms use temporal separation to solve some conflicts, leading to an improvement in their performance. This means that firms explore for a period of time, and then exploit, and then continue shifting from exploration to exploitation activities (Lavie et al., 2011). However, firms need specific mechanisms and capabilities in order to integrate and balance both activities within their organization (Chebbi et al., 2013).

Inexorably, in this complex context, we subsequently investigate the position wherein MNEs need to possess superior KM and ICT capabilities in order to achieve better alliance ambidexterity performances.

3. Hypothesis development

Knowledge management (KM) has been defined as the systematic and explicit management of key knowledge, along with its related processes of creation, organization, dissemination and utilization (Skyrme, 2001). Gloet and Terziovski (2004) proposed different interlocking terms such as knowledge creation, knowledge metrics, knowledge sharing, knowledge mapping, knowledge storage and distribution, which are understood within a KM “umbrella”.

Firms that want to begin a new IoT Smart city project need to use, access and integrate knowledge that resides inside and outside their boundaries (Scuotto et al., 2016). In these projects, which are usually very complex and utilize several kinds of less known technologies, different specialized knowledge must be applied with the aim of addressing project-specific problems (Tiwana, 2008). In order to successfully find solutions to multifaceted innovation problems and to accomplish a project, companies need to manage multiple specialized inputs and different sets of complementary knowledge. This is especially valid for these projects where knowledge resides within the city's several heterogeneous public and private stakeholders (Ferraris and Grieco, 2015; Sandulli et al., 2016). This requires novel re-combinations of ideas, resources, and knowledge at the project level, which improves the likelihood of finding innovative solutions (Obstfeld, 2005). In the first phases of these high risk projects it is difficult to easily understand: a) which new needs to satisfy; b) which new information is needed during the project that was not identified at the beginning; c) which solutions may be more effective; d) the project outcomes. This makes it inappropriate to use only traditional performance indicators such as efficiency and effectiveness (Tiwana, 2008). The possession of superior KM capabilities may allow firms to achieve greater levels of alliance ambidexterity performances, effectively managing, contemporaneously, both internal and external knowledge (Del Giudice and Maggioni, 2014).

Regarding the internal one, the bulk of a firm's internal knowledge is crucial for IoT smart cities projects. In fact, firms look for knowledge outside their boundaries that may complement their internal base of knowledge (Del Giudice et al., 2013; Almirall et al., 2014). KM helps the generation and exploration of new opportunities and the exploitation of the organization's knowledge base that feeds innovation (Darroch, 2005; Del Giudice et al., 2012). The more the firms develop the KM tools and practices that permit them to develop new knowledge, the more they can relocate knowledge to these projects according to their aim (Vaccaro et al., 2010).

Regarding the external one, companies may integrate knowledge mostly in two distinct ways: across employees dispersed in separate groups, and across different streams of knowledge (Carayannis, 1999; Tiwana, 2008). This is even compounded in alliances at the project level, where other external public and private stakeholders are involved in the discovery of new valid technologies or in the process of commercializing them within the city's ecosystem. According to previous studies (Grant, 1996; Tiwana, 2008), knowledge integration is a joint process carried on by various alliance partners that need to apply different and specific kinds of knowledge. From this perspective, the specialized knowledge of city partners needs to be integrated by solving project specific tasks and improving value creation. Firms may combine different sets of external knowledge, with internal ones, allowing the development of a new bulk of knowledge that can be used within the project or transferred to the whole organization (Laursen and Salter, 2006; Santoro et al., 2016). This may improve alliance ambidexterity performance and leads us to the development of the following hypothesis:

H1. *Knowledge Management (KM) capabilities enhance alliance ambidexterity in IoT Smart City projects.*

ICT capabilities refer to the extent to which firms strategically use a wide range of technologies for both explorative and exploitative business aims (Johannessen et al., 1999; Tippins and Sohi, 2003). IoT Smart Cities projects emphasize the need for firms to rely more than other projects on these kind of capabilities in order to cooperate with public and private partners to develop innovations which involve cutting edge technologies. Firms in Smart Cities can exploit ICT capabilities through the use of different technologies, from database programs to local area networks (Matlay and Addis, 2003). MNEs with high levels of ICT capabilities are also more able to “scan” the external city's environment (see, for example, the management and leverage of a crowdsourcing platform), which is fundamental for exploration projects in Smart Cities (Parida and Örtqvist, 2015). This provides additional knowledge about the market and citizen needs, which leads to positive benefits for future exploitation projects (Scuotto et al., 2016).

Based on a recent analysis carried out by Parida and Örtqvist (2015), there are three main issues beyond ICT capabilities that it would be very useful to address for IoT Smart City projects: a) the internal use; b) the use for collaboration; c) the use for communication. First, the ICT internal use dimension refers to the employment of technology to develop new services and products with a high technological impact on the society. Second, the ICT collaboration dimension refers to the use of ICT to establish and maintain relationships between the company and its city's partners, including public governments, suppliers, universities and other external actors (Almirall et al., 2014; Scuotto et al., 2016). Third, the use for communication refers to the application of several technologies to make the information and knowledge inflow and outflow effective (Lopez-Nicolas and Soto-Acosta, 2010), potentially resulting in better learning opportunities for the firms but also for the external “smart” ecosystem. In fact, these are in line with the objectives of mostly IoT Smart City projects, where companies need to possess high levels of internal ICT capabilities, combining them with their external stakeholders, and promoting and delivering new services to the citizens. This may, in turn, permit the companies to improve their performance both in explorative and exploitative alliances. We thus propose the following:

H2. *Information and communication technology (ICT) capabilities enhance alliance ambidexterity in IoT Smart City projects.*

Two of the main challenges in the Smart City context are: a) the collaborative design and development of new services and products for delivery to the citizens, involving knowledge that also resides in the firm and in the external city's stakeholders (explorative projects); and b) the collaborative exploitation of these technologies according to different stakeholder business models (exploitative projects). In both cases, firms have to manage multiple specialized inputs to successfully carry out a IoT Smart City project (Tiwana, 2008; Ferraris and Santoro, 2014; Scuotto et al., 2016). The management of knowledge is facilitated by ICT because that allow the firm to better use its technologies and comprehend technologies developed by the stakeholders of the city. ICT may favor collaboration within the projects, allowing a wide range of stakeholders, ranging from internal to external employees, to successfully cooperate (Soto-Acosta and Meroño-Cerdan, 2008). Finally, it favors the communication and transfer of critical information because knowledge created in one project needs to be transferred to other projects, including in other cities (Scuotto et al., 2016), thus improving overall firm ambidextrous performance.

KM is supported by ICT capabilities that help firms to make knowledge acquisition, knowledge transfer, knowledge conversion and knowledge application easy (Soto-Acosta and Cegarra-Navarro, 2016). The effective creation, recombination and integration of knowledge may be amplified through the possession of strong ICT capabilities (Lopez-Nicolas and Soto-Acosta, 2010), particularly when there are many complementarities and in the presence of co-specialization of knowledge resources, as in the Smart Cities (Powell and Dent-Micallef, 1997; Tippins and Sohi, 2003). A firm's superior ICT capabilities positively enhance the management of knowledge that may be within and outside corporate boundaries, KM, that in turn positively affects performance. This means that firms in IoT Smart Cities alliances may improve their ambidexterity performance by amplifying the effect of KM capabilities through superior ICT capabilities. This leads us to the following:

H3. *ICT capability acts as a mediating variable between a firm's KM capabilities and alliance ambidexterity in IoT Smart City projects.*

4. Research methods

4.1. Sample and data collection

We tested our hypotheses (Fig. 1) through a survey in the Smart City context. Empirical studies that focus on a single context indicate that a firm's knowledge practices and capabilities involved in the innovation processes are usually homogeneous and, may, therefore, be suitable for assessing performance (Alegre et al., 2013). We adopted four criteria to select the projects: a) to involve multinational firms that are active in both exploration and exploitation projects in a Smart City; b) to involve other private or public partners; c) to have a high technological content linked to the paradigm of the IoT; and d) to take place within Italy. Fifty one Smart City IoT projects were found that satisfied our selection criteria and a questionnaire was sent to all the 182 individual team participants in these project alliances spanning various organizations (as many as six, on average 3 organizations for each project). We received 80% (146/182) individual- and 78% (43/51) project-level response rates. We obtained data from diverse respondents for each project using a survey instrument (Tiwana, 2008). In this way we mitigated threats of bias that might have arisen if only one respondent was used to assess each project.

The questionnaire was comprised of 20 closed-end questions and was sent by email. A cover letter was provided in advance so as to explain the goal of the research. The questions proceeded according to the funneling technique (Breiman et al., 1984). In this way, we collected information about the projects, such as project size and length and partners involved. Consequently, specific questions were outlined and focused mainly on alliance ambidexterity performance at the project level. The respondents were questioned on the alliances in Smart City with a particular attention to the KM and ICT capabilities used for explorative and exploitative activities. Following Tiwana (2008), we gathered data for each project from different respondents while data for alliance ambidexterity performance was taken from the Smart City managers responsible for each project. The latter was mainly due to three reasons: a) they are directly involved in Smart City Projects and in direct contact with city partners; b) they have the decision making power in the firm; c) they personally manage each of their firm's projects in one city.

On average, we had four respondents for each project alliance. Individual-level answers for the items pertaining to KM and ICT capabilities were aggregated to project-level construct scores, because the unit of analysis in this study is the project. In line with previous project-level studies (Faraj and Sproull, 2000; Tiwana, 2008), we assessed the intraclass correlation coefficient (James et al., 1993). This allowed the risk of common methods bias to be reduced, and improved the trustworthiness of the project level constructs. The coefficient values ranged from 0.72 to 0.88, suggesting sufficient reliabilities of our assessments.

4.2. Validity and reliabilities

Following prior studies and accepted practices (Anderson and Gerbing, 1988; Tippins and Sohi, 2003), we evaluated the psychometric properties of the measurement scales. This included content validity,

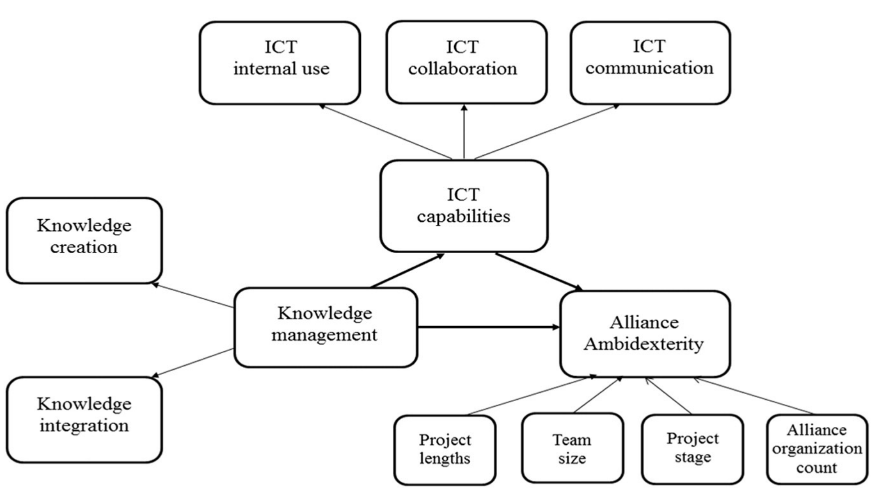

Fig. 1. The conceptual model.

reliability, discriminant and convergent validity. We assessed content validity relying on existing literature to build the scales. Following Alegre et al. (2013), we assessed reliability using: a) Cronbach's alpha coefficient reporting; and b) composite reliabilities. Table 1 shows that reliabilities are adequate. In order to deal with discriminant and convergent validity, we used confirmatory factor analysis (CFA). We thus compare the $\chi 2$ differences between a constrained confirmatory factor model (setting the correlation between two factors of the same construct to 1) and an unconstrained model (where the correlation was free). Because all the $\chi 2$ differences were significant, we can confirm discriminant validity (Anderson and Gerbing, 1988). Similarly, constraining the confirmatory factor model to 0, we provide evidence of convergent validity (Gatignon et al., 2002).

4.3. Variables

Scales used in past studies were adapted for measuring the constructs in this research. The relevant literature on which each set of items are based is provided in Appendix A. Each respondent selected a value for each statement based on a range between 1 (as 'disagree strongly') and 5 (as 'agree strongly') (Likert, 1932).

4.3.1. Alliance ambidexterity

Following Gibson and Birkinshaw (2004), we built this variable as the product of alignment and adaptation of organizational sub-unit ambidexterity. Regarding the first, we asked the respondents to evaluate whether the project: (1) is within budget, (2) is on schedule, (3) delivers all desirable features and functionality, (4) meets key project objectives and business needs, (5) overall, is very successful. Regarding the second, we asked the respondents about the ability of the project team to: (1) successfully manage changes in the scope of the project, (2) resolve unpredicted problems or solve new challenges that arise during the project, (3) carry on a relatively stable system for current requirements.

4.3.2. Knowledge management capabilities

This measure was composed of knowledge creation and knowledge integration measures. Based on Nonaka et al. (2000) and Schulze and Hoegl (2006), knowledge creation is the capacity of the internal members of a team to assess the: (1) frequent informal exchanges and interactions inside the team and between the team, and relevant organization departments (socialization); (2) formal knowledge collecting, such as interviews with knowledgeable individuals (externalization); (3) systematic gathering and assembling of explicit knowledge from diverse sources (combination); (4) tacit knowledge creation, such as trial-and-error experimentation (internalization). According to Tiwana (2008), knowledge integration refers to the ability of the internal members of the team to: (1) combine new knowledge coming from the project in a proper and effective way with that they already possessed, (2) develop shared project concepts combining knowledge from several different fields, (3) blend and join each individual member's knowledge at the project level.

4.3.3. ICT capabilities

These were measured based on the studies of Johannessen et al. (1999) and Parida and Örtqvist (2015). According to these scholars, ten items were identified in three dimensions: ICT use for internal purposes (four items), collaboration (three items), and communication (three items). Regarding the internal purposes, respondents were questioned on the degree to which their companies use ICT in this area to: a) access information (e.g. market and consumers); b) enable strategic planning; c) enable cost savings; d) stimulate the creation and upgrade of new employees competence and skills. Regarding collaboration, respondents were questioned on the degree to which their companies use ICT in this area to: a) maintain collaboration with business partners; b) establish new business collaborations; c) facilitate the flexibility of work within the project (e.g., work in different workplaces). Regarding communication, respondents were questioned on the degree to which their companies use ICT in this area to: a) manage communication flows within the company (e.g. intranet); b) manage communication flows outside firm boundaries with the stakeholders (e.g. extranet); c) promote marketing activities.

4.3.4. Control variables

We added controls for project length (Nidumolu, 1995), team size (Regans et al., 2004) and project stage (Tiwana, 2008). We measured control variables using single item measures. We also included controls for the alliance organization count, because the number of different partners within the projects affects the degree of shared knowledge on which the project draws (Powell et al., 1996; Tiwana, 2008).

4.4. Our analysis

The primary analyses of the dataset are based on structural equations modeling (SEM). We tested for the mediating effect of ICT capabilities. The first model (direct effect) examined the direct relationship between KM capabilities and alliance ambidexterity performance, testing Hypothesis 1. A second model (mediation) analyzed the same relationship with the ICT capabilities of firms acting as a mediator. The results are presented in Table 2. Following Tippins and Sohi (2003), the mediating effect of ICT capabilities is supported when: a) the variance explained in alliance ambidexterity performance by the mediated

Table 1
Descriptive statistics and reliabilities.

Factors	Composite reliability	Mean	S.D.	1	2	3	4	5	6
1. Knowledge creation	0.81	3.331	0.749	(0.81)					
2. Knowledge integration	0.79	3.442	0.781	0.572**	(0.80)				
3. ICT internal use	0.77	3.214	0.702	0.415**	0.432**	(0.83)			
4. ICT collaboration	0.86	3.254	0.754	0.514**	0.501**	0.702**	(0.78)		
5. ICT communication	0.81	3.296	0.741	0.302*	0.312**	0.599**	0.678**	(0.85)	
6. Alliance Ambidexterity	0.82	3.451	0.821	0.317*	0.389**	0.589**	0.496**	0.561**	(0.88)

Concepts	Mean	S.D.	1	2	3
1. KM capabilities	3.42	0.77			
2. ICT capabilities	3.25	0.72	0.51**		
3. Alliance Ambidexterity	3.45	0.82	0.34**	0.54**	

$N = 43$, alpha reliabilities are shown on the diagonal.
*$p < 0.05$; **$p < 0.01$.

model is higher than the direct model, b) a significant relationship between KM capabilities and ICT capabilities is confirmed, c) the significant relationship observed in the direct model between KM capabilities and alliance ambidexterity performance is reduced heavily or eliminated in the second model, and d) a significant relationship between ICT capabilities and alliance ambidexterity performance is confirmed.

5. Empirical findings

Table 2 shows the results of our research. The results are in favor of a mediation effect of ICT capabilities on the relationship between KM capabilities and alliance ambidexterity performance. First, the variance explained by the mediated model in alliance ambidexterity performance is higher than the first model (0.62 vs. 0.35). Second, the relationship between KM capabilities and ICT capabilities is significant (beta = 0.77, $t = 4.50$, $p < 0.01$), as the relationship between ICT capabilities and alliance ambidexterity performance (beta = 0.82, $t = 4.75$, $p < 0.01$). Third, the significant relationship in the direct model between KM capabilities and alliance ambidexterity performance (beta = 0.40, $t = 3.92$) becomes non-significant in the second model (beta = 0.23, $t = 1.12$). Together this evidence allows us to confirm the mediating effect of ICT capabilities on the relationship between KM capabilities and alliance ambidexterity performance.

We thus find strong support for our hypothesis, which emphasizes that KM and ICT capabilities improve alliance ambidexterity performance. In this regard, in the direct model we find that firms with superior KM capabilities achieve better alliance ambidexterity performance, however, when the indirect effects are included these prevail. Thus, KM capabilities enhance alliance ambidexterity indirectly through a firm's ICT capabilities. The achievement of ambidexterity through alliances in IoT Smart City projects does indeed require firm strategies to internally develop ICT capabilities. At the project level, this allows the company to take advantage of both internal and external knowledge. In our analysis, MNEs operating through alliances in Smart Cities benefit greatly from the interplay between KM and ICT capabilities, probably due to the peculiarities and characteristics of these innovative projects.

6. Discussion of the results and conclusions

6.1. Concluding discussion

Firms in Smart Cities confront multiple challenges, some of which are best met through exploratory activity and others with exploitative activity. Today, especially in a complex and innovative context such as a Smart City, MNEs must improve both dimensions simultaneously, and they may potentially exploit ambidextrous advantages through the development of alliances. In fact, companies that invest in discovering new technologies and business models for cities are also active in looking for profitable devices and services that will be useful to a self-sustaining city. This suggests that firms need to manage and integrate different kinds of knowledge.

Table 2
Results of the model[1].

Model	Hypothesis	St. coefficients	T-value
Direct model	KM → ICT	0.35	4.12*
	KM → AA	0.40	3.92**
Mediated model	KM → ICT	0.77	4.50**
	ICT → AA	0.82	4.75**
	KM → AA	0.23	1.12

[1] Overall relevant fit indices indicate a good fit (Tippins and Sohi, 2003; Alegre et al., 2013).
* $p < 0.05$.
** $p < 0.01$.

More specifically, this paper highlighted that the internal capabilities of firms, combined with external knowledge accessed through alliances with external partners, are closely intertwined. In fact, it emerged from the questionnaires that the internal KM and ICT capabilities of firms, are critical. This is because firms need to create and integrate knowledge using different sources that involve high technological contents and technology-based services to improve citizen life quality. KM brings several benefits to the innovation process and, particularly, to the creation and integration of knowledge that may be both within and outside a firm's boundaries, thus making it easier to use and more accessible. Following Du Plessis (2007), knowledge management capabilities also help the firm in highlighting the key role covered by the time in which knowledge is leveraged and used at the appropriate moment for sense making. This means that in times of need knowledge can be used, refined and made available. Organizations without an effective knowledge management orientation could thus be underutilizing knowledge, and thus being reduced to a lower level of knowledge sharing and integration, which reduces innovation performance (Darroch, 2005).

In this context, ICT capabilities make knowledge creation and integration easier, in combination with external actors, through alliances, capitalizing on internal bulk of knowledge. This is due to at least three mechanisms: a) ICT may enhance the internal use of knowledge, improving its efficiency and efficacy; b) ICT may facilitate collaboration among the project teams; and c) ICT may allow communication flows between and across the company and different teams. Companies have to build up these capabilities internally with the final aim being to transfer, manage and integrate structurally separate ambidextrous activities at different levels (Jansen et al., 2009; Chebbi et al., 2015). This will improve an MNE's alliance ambidexterity performance in IoT Smart Cities projects.

6.2. Contributions, implications and future research direction

This paper makes three major *theoretical contributions*. First, we add knowledge on the management of ambidexterity in a new context of analysis, the IoT and smart cities, which presents some peculiarities, such as the highly innovative technology contents of the projects and the heterogeneous range of employees involved (multi-actor projects) with diverse skills and capabilities (Lavie and Rosenkopf, 2006; Scuotto et al., 2016). Second, this paper extends the current resource-based view by suggesting empirical evidence for the direct and interactive effects of KM and ICT capabilities (Barney, 1991; Soto-Acosta and Meroño-Cerdan, 2008; Vrontis et al., 2016). In this regard, we highlight the importance not only of effectively managing knowledge, but of using ICT tools and competencies in order to increase the benefits of a firm's knowledge management orientation (Darroch, 2005). In fact, ICT should be conceived as a significant mechanism to enhance the positive effects of KM (Del Giudice and Della Peruta, 2016). Third, this paper complements other (prior) research on the positive effect of KM on a company's innovation performance. In fact, despite rich theoretical studies and argumentations, the empirical evidence of the effect of KM (also in combination with ICT capabilities) on performance was rather limited (Parida and Örtqvist, 2015).

Our study further has interesting *managerial implications*. It shows that managers have to comprehend that the effort and the resources invested in internally developing KM tools, platform and processes are not only useful for knowledge creation and sharing within the organization. In fact, KM internal capabilities may be also utilized in both exploration and exploitation alliances, directly affecting performances. Even more importantly, our study proposes that managers simultaneously develop ICT capabilities within the firms. In the IoT Smart City projects context, this amplifies the positive effects of KM on the ambidextrous performances of alliances. In particular, KM and ICT capabilities have to be aligned with the technology beyond IoT and Smart City projects and adapted to these heterogeneous alliances and to this new and peculiar context of analysis. In this way, MNEs may efficiently deal with Smart City projects, combining their exploration and exploitation activities.

Finally, this paper also has some *social implications*, because city governments are very interested in using the latest technologies to easily promote the best social climate for their citizens (Paskaleva, 2011; Bulu, 2014). In fact, cities benefit greatly from the higher citizen satisfaction that is brought by the pervasive use of technology in different aspects of their life (Paroutis et al., 2014). This also helps them to attract MNEs and promote the city, declaring events that allow public officials to achieve better support from the citizens (Lee et al., 2013).

Our research also has some limitations. First, the study of a single context of analysis may reduce and limit the generalizability of results. We think that there is a need for further research on this topic in order to determine whether KM and ICT capabilities play the same role in other high tech or low tech contexts. Second, our results should be treated with caution, despite our use of SEM which allowed us to augment the interpretation of causality between the constructs. Third, this research is limited due to the choice of the MNEs involved, so we encourage other quantitative, but also qualitative, examples to be documented, involving the experiences that new firms have of managing exploration and exploitation alliances with heterogeneous partners in a Smart City and the different capabilities useful in these projects.

Acknowledgement

The article was prepared within the framework of the Basic Research Program at the National Research University Higher School of Economics (HSE) and supported within the framework of the subsidy granted to the HSE by the Government of the Russian Federation for the implementation of the Global Competitiveness Program.

Appendix A. Dimensions and items

Dimensions	Items	Literature
KM capabilities	Knowledge creation	Nonaka et al., 2000; Schulze and Hoegl, 2006; Villar et al., 2014
	Knowledge integration	Pisano, 1994; Grant, 1996; Tiwana, 2008
ICT capabilities	ICT internal use	Johannessen et al., 1999; Merono-Cerdan et al., 2008; Parida and Örtqvist, 2015
	ICT collaboration	Johannessen et al., 1999; Merono-Cerdan et al., 2008; Lopez-Nicolas and Soto-Acosta, 2010; Parida and Örtqvist, 2015
	ICT communication	Johannessen et al., 1999; Soto-Acosta and Meroño-Cerdan, 2008; Lopez-Nicolas and Soto-Acosta, 2010; Parida and Örtqvist, 2015
Alliance ambidexterity	Alignment orientation	Gibson and Birkinshaw, 2004; Tiwana, 2008
	Adaptation orientation	Gibson and Birkinshaw, 2004; Tiwana, 2008
Control variables	Project lengths	Nidumolu, 1995; Tiwana, 2008
	Project size	Regans et al., 2004; Tiwana, 2008
	Alliance organization count	Powell et al., 1996; Tiwana, 2008

References

Adler, P., Heckscher, C., 2013. The collaborative, ambidextrous enterprise. Univ. Bus. Rev. 40, 34–51.
Ahammad, M.F., Lee, S.M., Malul, M., Shoham, A., 2015. Behavioral ambidexterity: the impact of incentive schemes on productivity, motivation, and performance of employees in commercial banks. Hum. Resour. Manag. 54 (S1), s45–s62.
Alegre, J., Sengupta, K., Lapiedra, R., 2013. Knowledge management and innovation performance in a high-tech SMEs industry. Int. Small Bus. J. 31 (4), 454–470.
Almirall, E., Lee, M., Majchrzak, A., 2014. Open innovation requires integrated competition-community ecosystems: lessons learned from civic open innovation. Bus. Horiz. 57 (3), 391–400.
Anderson, J.C., Gerbing, D.W., 1988. Structural equation modeling in practice: a review and recommended two-step approach. Psychol. Bull. 103 (3), 411.
Andriopoulos, C., Lewis, M.W., 2009. Exploitation–exploration tensions and organizational ambidexterity: managing paradoxes of innovation. Organ. Sci. 20 (4), 696–717.
Barney, J., 1991. Firm resources and sustained competitive advantage. J. Manag. 17 (1), 99–120.
Breiman, L., Friedman, J., Olshen, R., Stone, C., 1984. Classification and Regression Trees. Wadsworth International, Belmont.
Bresciani, S., Thrassou, A., Vrontis, D., 2015. Strategic R&D internationalisation in developing Asian countries-the Italian experience. World Rev. Entrep. Manag. Sustain. Dev. 11 (2–3), 200–216.
Bulu, M., 2014. Upgrading a city via technology. Technol. Forecast. Soc. Chang. 89, 63–67.
Carayannis, E.G., 1999. Fostering synergies between information technology and managerial and organizational cognition: the role of knowledge management. Technovation 19 (4), 219–231.
Chebbi, H., Yahiaoui, D., Thrassou, A., Vrontis, D., 2013. The exploration activity's added value into the innovation process. Glob. Bus. Econ. Rev. 15 (2/3), 265–278.
Chebbi, H., Yahiaoui, D., Vrontis, D., Thrassou, A., 2015. Building multiunit ambidextrous organizations: a transformative framework. Hum. Resour. Manag. 54 (S1), s155–s177.
Darroch, J., 2005. Knowledge management, innovation and firm performance. J. Knowl. Manag. 9 (3), 101–115.
Del Giudice, M., Della Peruta, M.R., 2016. The impact of IT-based knowledge management systems on internal venturing and innovation: a structural equation modeling approach to corporate performance. J. Knowl. Manag. 20 (3), 484–498.
Del Giudice, M., Maggioni, V., 2014. Managerial practices and operative directions of knowledge management within inter-firm networks: a global view. J. Knowl. Manag. 18 (5), 841–846.
Del Giudice, M., Carayannis, E.G., Della Peruta, M.R., 2012. Culture and cooperative strategies: knowledge management perspectives. Cross-cultural Knowledge Management. Springer, New York, pp. 49–62.
Del Giudice, M., Della Peruta, M.R., Maggioni, V., 2013. Collective knowledge and organizational routines within academic communities of practice: an empirical research on science–entrepreneurs. J. Knowl. Econ. 4 (3), 260–278.
Du Plessis, M., 2007. The role of knowledge management in innovation. J. Knowl. Manag. 11 (4), 20–29.
Faraj, S., Sproull, L., 2000. Coordinating expertise in software development teams. Manag. Sci. 46 (12), 1554–1568.
Ferraris, A., 2014. Rethinking the literature on multiple embeddedness and subsidiary specific advantages. Multinatl. Bus. Rev. 22 (1), 15–33.
Ferraris, A., Grieco, C., 2015. The role of the innovation catalyst in social innovation-an Italian case study. Sinergie Ital. J. Manag. 127–144.
Ferraris, A., Santoro, G., 2014. Come dovrebbero essere sviluppati i progetti di social innovation nelle Smart City? Un'analisi Comparativa. Impresa Progetto Electron. J. Manag. 4, 1–15.
Ferraris, A., Erhardt, N., Bresciani, S., 2017. "Ambidextrous Work in Smart City Project Alliances: Unpacking the Role of Human Resource Management Systems". International Journal of Human Resource Management http://dx.doi.org/10.1080/09585192.2017.1291530.
Gatignon, H., Tushman, M.L., Smith, W., Anderson, P., 2002. A structural approach to assessing innovation: construct development of innovation locus, type, and characteristics. Manag. Sci. 48, 1103–1122.
Giarratana, M.S., Fosfuri, A., 2007. Product strategies and survival in Schumpeterian environments: evidence from the US security software industry. Organ. Stud. 28 (6), 909–929.
Gibson, C.B., Birkinshaw, J., 2004. The antecedents, consequences, and mediating role of organizational ambidexterity. Acad. Manag. J. 47 (2), 209–226.
Gloet, M., Terziovski, M., 2004. Exploring the relationship between knowledge management practices and innovation performance. J. Manuf. Technol. Manag. 15 (5), 402–409.
Grant, R.M., 1996. Prospering in dynamically-competitive environments: organizational capability as knowledge integration. Organ. Sci. 7 (4), 375–387.
Gupta, A.K., Smith, K.G., Shalley, C.E., 2006. The interplay between exploration and exploitation. Acad. Manag. J. 49 (4), 693–706.
Hoffmann, W.H., 2007. Strategies for managing a portfolio of alliances. Strateg. Manag. J. 28, 827–856.
Hollands, R.G., 2008. Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? City 12 (3), 303–320.

James, L., Demaree, R., Wolf, G., 1993. Rwg: an assessment of within-group interrater agreement. J. Appl. Psychol. 78 (2), 306–309.
Jansen, J.J.P., Tempelaar, M.P., Van den Bosch, F.A.J., Volberda, H.W., 2009. Structural differentiation and ambidexterity: the mediating role of integration mechanisms. Organ. Sci. 20 (4), 797–811.
Johannessen, J.A., Olaisen, J., Olsen, B., 1999. Strategic use of information technology for increased innovation and performance. Inf. Manag. Comput. Secur. 7 (1), 5–22.
Kang, S.C., Morris, S.S., Snell, S.A., 2007. Relational archetypes, organizational learning, and value creation: extending the human resource architecture. Acad. Manag. Rev. 32 (1), 236–256.
Kauppila, O.P., 2010. Creating ambidexterity by integrating and balancing structurally separate interorganizational partnerships. Strateg. Organ. 8 (4), 283–312.
Komninos, N., 2008. Intelligent Cities and Globalisation of Innovation Networks. Routledge.
Laursen, K., Salter, A., 2006. Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms. Strateg. Manag. J. 27 (2), 131–150.
Lavie, D., Rosenkopf, L., 2006. Balancing exploration and exploitation in alliance formation. Acad. Manag. J. 49 (4), 797–818.
Lavie, D., Stettner, U., Tushman, M.L., 2010. Exploration and exploitation within and across organizations. Acad. Manag. Ann. 4 (1), 109–155.
Lavie, D., Kang, J., Rosenkopf, L., 2011. Balance within and across domains: the performance implications of exploration and exploitation in alliances. Organ. Sci. 22 (6), 1517–1538.
Lee, J.H., Phaal, R., Lee, S.H., 2013. An integrated service-device-technology roadmap for smart city development. Technol. Forecast. Soc. Chang. 80 (2), 286–306.
Lee, J.H., Hancock, M.G., Hu, M.C., 2014. Towards an effective framework for building smart cities: lessons from Seoul and San Francisco. Technol. Forecast. Soc. Chang. 89, 80–99.
Likert, R., 1932. A technique for the measurement of attitudes. Arch. Psychol.
Lopez-Nicolas, C., Soto-Acosta, P., 2010. Analyzing ICT adoption and use effects on knowledge creation: an empirical investigation in SMEs. Int. J. Inf. Manag. 30 (6), 521–528.
March, J.G., 1991. Exploration and exploitation in organizational learning. Organ. Sci. 2 (1), 71–87.
Matlay, H., Addis, M., 2003. Adoption of ICT and e-commerce in small businesses: an HEI-based consultancy perspective. J. Small Bus. Enterp. Dev. 10 (3), 321–335.
Merono-Cerdan, A.L., Soto-Acosta, P., López-Nicolás, C., 2008. Analyzing collaborative technologies' effect on performance through intranet use orientations. J. Enterp. Inf. Manag. 21 (1), 39–51.
Nidumolu, S., 1995. The effect of coordination and uncertainty on software project performance: residual performance risk as an intervening variable. Inf. Syst. Res. 6 (3), 191–219.
Nonaka, I., Toyama, R., Konno, N., 2000. SECI, Ba and leadership: a unified model of dynamic knowledge creation. Long Range Plan. 33 (1), 5–34.
Obstfeld, D., 2005. Social networks, the tertius iungens orientation, and involvement in innovation. Adm. Sci. Q. 50 (1), 100–130.
Parida, V., Örtqvist, D., 2015. Interactive effects of network capability, ICT capability, and financial slack on technology-based small firm innovation performance. J. Small Bus. Manag. 53 (S1), 278–298.
Paroutis, S., Bennett, M., Heracleous, L., 2014. A strategic view on smart city technology: the case of IBM smarter cities during a recession. Technol. Forecast. Soc. Chang. 89, 262–272.
Paskaleva, K.A., 2011. The smart city: a nexus for open innovation? Intell. Build. Int. 3 (3), 153–171.
Pisano, G.P., 1994. Knowledge, integration, and the locus of learning: an empirical analysis of process development. Strateg. Manag. J. 15 (S1), 85–100.
Powell, T.C., Dent-Micallef, A., 1997. Information technology as competitive advantage: the role of human, business, and technology resources. Strateg. Manag. J. 18 (5), 375–405.
Powell, W., Koput, K., Smith-Doerr, L., 1996. Interorganizational collaboration and the locus of innovation: networks of learning in biotechnology. Adm. Sci. Q. 41, 116–145.
Regans, R., Zuckerman, E., McEvily, B., 2004. How to make the team: social networks vs. demography as criteria for designing effective teams. Adm. Sci. Q. 49 (1), 101–133.
Sandulli, F., Ferraris, A., Bresciani, S., 2016. "How to select the right public partner in Smart City projects". R&D Management http://dx.doi.org/10.1111/radm.12250.
Santoro, G., Ferraris, A., Giacosa, E., Giovando, G., 2016. How SMEs engage in open innovation: a survey. J. Knowl. Econ. 1–14.
Schulze, A., Hoegl, M., 2006. Knowledge creation in new product development projects. J. Manag. 32 (2), 210–236.
Scuotto, V., Ferraris, A., Bresciani, S., 2016. Internet of things: applications and challenges in smart cities: a case study of IBM smart city projects. Bus. Process. Manag. J. 22 (2), 357–367.
Skyrme, D., 2001. Capitalizing on knowledge: from e-business to k-business. Butterworth-Heinemann, Oxford.
Soto-Acosta, P., Cegarra-Navarro, J.G., 2016. New ICTs for knowledge management in organizations. J. Knowl. Manag. 20 (3), 417–422.
Soto-Acosta, P., Meroño-Cerdan, A.L., 2008. Analyzing e-business value creation from a resource-based perspective. Int. J. Inf. Manag. 28 (1), 49–60.
Tippins, M.J., Sohi, R.S., 2003. IT competency and firm performance: is organizational learning a missing link? Strateg. Manag. J. 24 (8), 745–761.
Tiwana, A., 2008. Do bridging ties complement strong ties? An empirical examination of alliance ambidexterity. Strateg. Manag. J. 29 (3), 251–272.
Uckelmann, D., Harrison, M., Michahelles, F., 2011. An architectural approach towards the future internet of things. Architecting the Internet of Things. Springer, Berlin Heidelberg, pp. 1–24.
Vaccaro, A., Parente, R., Veloso, F.M., 2010. Knowledge management tools, inter-organizational relationships, innovation and firm performance. Technol. Forecast. Soc. Chang. 77 (7), 1076–1089.
Villar, C., Alegre, J., Pla-Barber, J., 2014. Exploring the role of knowledge management practices on exports: a dynamic capabilities view. Int. Bus. Rev. 23 (1), 38–44.
Vrontis, D., Thrassou, A., Santoro, G., Papa, A., 2016. Ambidexterity, external knowledge and performance in knowledge-intensive firms. J. Technol. Transf. 1–15.
Zanella, A., Bui, N., Castellani, A., Vangelista, L., Zorzi, M., 2014. Internet of things for smart cities. IEEE Internet Things J. 1 (1), 22–32.

Prof. Stefano Bresciani received his PhD in Business Administration in 2003 and he worked as a Research Scholar in the ESCP-EAP, London, in the California State Polytechnic of Pomona - Los Angeles, and in the Open University of Lisbon. He is currently a Professor in Business Management at the School of Management and Economics, University of Torino, where he teaches innovation management and leadership. He undertakes research integrated with the Department of Management of the University of Torino. His main areas of research include innovation and strategic management. Furthermore, he is visiting professor at the University of Nicosia – Cyprus. Stefano Bresciani is with EuroMed Research Business Institute (EMRBI) since 2009, reaching the Senior Fellow position in 2015. For EMRBI, he is the Vice President for Network Development and the Chairman of the Research Committee on 'Multinational enterprises and corporate governance'.

Dr. Alberto Ferraris received his Ph.D. in Business and Management at the Department of Management, University of Turin (Italy) in 2015. He is currently a Post Doc Researcher at the University of Turin - Department of Management. He is also Research Fellow of the Laboratory for International and Regional Economics, Graduate School of Economics and Management, Ural Federal University (Russia). He is an Associate Member (AM-EMAB) of the EuroMed Research Business Institute. He is author of several academic and scientific articles published on international journal. He is member of the EuroMed Research Business Institute Research Group on "Multinational enterprises and corporate governance". He is currently Adjunct Professor of "Business Management" at the Department of Management, University of Turin. He won the Best Student Paper Award at the 7th EuroMed Conference in Kristiansand (Norway) in 2014 and the "2015 Emerald/EMRBI Business Research Award for Emerging Researchers".

Prof. Manlio Del Giudice is Associate Professor of Management at the University of Rome "Link Campus". He holds a PhD in Marketing and Management at the University of Milano-Bicocca and he is affiliated as Professor of Management and Entrepreneurship at the Paris School of Business, in Paris (France), and as Principal Investigador, at the University of Murcia, in Murcia (Spain). He serves as Director for Research and Scholarly Relations within the Euromed Business Research Institute, where he is Senior Fellow as well. He is the author of about 100 international scientific publications (including 12 monographs); his researches have been published on flagship peer-reviewed journals like MIS Quarterly, Journal of Knowledge Management, International Journal of Technology Management, Journal of Intellectual Capital, Business Process Management Journal, International Studies on Management Organization, Journal of Organizational Change Management. He holds key positions (Editor, Senior Associate Editor, Associate Editor) in several international scientific journals on management and he served as Guest Editor for mainstream journal like Small Business Economics, Journal of Technology Transfer, Technological Forecasting and Social Change, Baltic Journal of Management, Management Decision, International Journal of Technology Management, Journal of Knowledge Management. He is Ad Hoc Reviewer for flagship journal ranked in the ABS List (3* and 4*) like Journal of Organizational Behavior, Entrepreneurship Theory and Practice, Scandinavian Journal of Management, International Marketing Review, Technovation, Family Business Review. He has active collaborations with over 60 universities around the world (including George Washington University, Stanford University, Harvard Business School, University of Cambridge, Vu University Amsterdam, Mississippi State University, Twente University, University of West Scotland, Waikato University New Zealand, King's College, United Arab Emirates University, Indian Institute of Technology, Federal University of Rio de Janeiro, and University of Beijing). He serves as Associate Editor for global relevant publishers such as Nature Publishing Group, Springer, Palgrave MacMillan. Professor Del Giudice is Contact Person within the University of Rome "Link Campus" for the Italian Society of Management SIMA, has developed over the years active collaboration on marketing, technology transfer and innovation with a number of institutions (Prime Minister's Office, Department of Youth, National Research Council, US Consulate General, Region Campania, Campania District Bioscience, Science and Technology Park of Sicily, etc.). He has held key roles on the boards of public and private consortiums and companies within the fields of avionics, advanced biotechnologies, nutraceuticals, bio-composting technologies, ICT, publishing. He has been a promoter / tutor of more than 30 spin offs in the fields of biotech, renewable energy and agribusiness. He is currently serving as Expert Evaluator for the Campania Region, for the National Research Council of Norway and for the European Commission in the areas of marketing, technological innovation and internationalization. (Google Scholar Profile: , https://scholar.google.it/citations?user=c_r6C48AAAAJ&hl=it&oi=ao)