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Market orientation and innovation behaviour: how do service employees benefit from their uniplex and multiplex intrafirm network centrality?

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\textbf{ABSTRACT}
Intrafirm networks enable service employees to transform market orientation behaviours into innovation behaviours. Few studies, however, have investigated how network centrality in intrafirm networks can moderate this relationship. This paper investigates how service employees can leverage their intrafirm network popularity in three types of social networks: advice, friendship, and multiplex networks. The findings of a multi-source, multilevel study among 1175 service employees embedded in 60 firms demonstrate the important role of multiplex-network centrality. Employees who have a central position in multiplex networks (with overlapping friendship and advice ties) can tap into the complementarity of the assets rooted in friendship and advice networks, allowing them to more effectively convert market orientation into innovation behaviours. Our study demonstrates the importance of investigating multiplex relationships next to uniplex relationships in order to better understand the relative effects of different network types. Direct implications are given to encourage employees’ MO and innovation efforts.

\textbf{KEYWORDS}
Network centrality; friendship network; advice network; multiplex network; popularity; market orientation

\textbf{1. Introduction}
Market orientation (MO) steers firm efforts to innovate and create business success (Evanschitzky et al. 2012; Hurley and Hult 1998; Kirca, Jayachandran, and Bearden 2005). MO – the ability to generate, share and respond to market and customer need information (Kohli and Jaworski 1990) – reflects inherently a learning orientation (Slater and Narver 1995) that strongly relies on individual employees generating and using such information through their social interactions within organisations (Homburg et al. 2009; Narver and Slater 1990). Scholars suggest that well ‘developed and circulated’ customer- and market-related information flows among employees create ‘open communication channels’ (Kohli and Jaworski 1990, p. 9) that are needed for innovation to emerge from MO (Han, Namwoon, and Srivastava 1998). Such social interactions enable information exchanges and provide employees with insights that individually and cumulatively can create innovative solutions.

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Individual employees form the foundation of innovation by developing, carrying, reacting to, and modifying ideas (Van De Ven 1986, p. 592). To realise innovation, individual service employees can engage in market-orientation (MO) activities by, for example, collecting self-generated or available industry information, interacting with customers and co-workers to find out about customers’ current and future needs, and deciding on how to turn new ideas into marketable products and services. Still, the degree to which they can come up with novel ideas and gain support to convert them into innovation depends on their social network embeddedness and popularity. The social interactions or relationships that employees have and maintain with their co-workers represent a relational resource (Coleman 1988), which can be deployed by the employee and constitutes a certain value – often defined as social capital (Burt 1992). Employees may leverage their social capital for the attainment of certain creativity and innovation goals (Fleming, Mingo, and Chen 2007; Perry-Smith and Shalley 2003; Sosa 2011), and can potentially enhance the ability to realise innovation from their MO behaviours. For instance, by being a passage point for information flows that improve alertness towards extant opportunities and a richer pool of alternatives to choose from (Ferriani, Cattani, and Baden-Fuller 2009), and/or by accelerating development times through greater internal acceptance, co-worker support and resource sharing (Shane and Venkataraman 2000). Hence, social capital is considered to be central to understanding how MO behaviours translate into innovation outcomes (Ibarra, Martin, and Tsai 2005). But despite the importance of these social interactions and employees’ embeddedness within intrafirm networks, the overwhelming majority of research on MO has adopted an activity-based perspective by focusing on the innovation benefits that MO behaviours create for individuals and groups – independently from their related intrafirm networks (Han, Namwoon, and Srivastava 1998; Kirca, Jayachandran, and Bearden 2005; Ozkaya et al. 2015). There is a clear gap on how individual employees’ embeddedness within intrafirm networks influences their ability to do so. Consequently, a question such as ‘How can individual employees benefit from their intrafirm networks to convert MO behaviour into innovation behaviour?’ remains largely unanswered. This question is especially relevant to service employees who strongly rely on co-workers for information and support to realise innovation (Grinstein 2008).

In response, the purpose of this study is to investigate how an employee’s position in such intrafirm networks, helps to explain an employee’s ability to convert MO behaviours in innovation behaviours (see Figure 1). Consistent with social network theory (e.g. Burt 1992; Coleman 1988; Granovetter 1973), we argue that employees can leverage their social capital, as determined by their position within intrafirm networks (structural dimension), as well as the assets that are rooted in these relationships (relational dimension) to increase their effectiveness of transforming their MO behaviour into innovation behaviour. We examine the structural dimension as indicated the employee’s in-degree network centrality, because one’s connectedness and concomitant popularity may determine the ability of individual employees to receive and exchange information needed to recognise innovation opportunities and to summon support to realise them (Wong and Boh 2014). To further understand the relational dimension, we explore how the strength of the MO–innovation behaviour relationship is moderated by the employee’s network centrality in two distinct intrafirm uniplex networks – namely workplace friendship (affective ties) and advice (instrumental ties) – as well as in the overlapping multiplex
network. While social network literature acknowledges that network types differ in the relational content exchanged (Shah, Parker, and Waldstrøm 2017; Zagenczyk et al. 2015) and the type of support given (Levin and Cross 2004), much less is known about the distinct roles and effects of taking on central positions in uniplex relationships relative to multiplex relationships in shaping workplace behaviours. Using a sample of 1175 individual-level observations nested within 60 service firms, we seek to deepen our understanding of how service employees’ centrality in workplace friendship, advice and multiplex networks moderate the relationship between MO-Innovation behaviour.

This study contributes to the current literature in two ways. First, it shows how the structural position of service employees within intrafirm networks influence their ability to transform their MO behaviours into innovation behaviours. By taking a network perspective and demonstrating the important role of in-degree network centrality, this study explains how popularity within intrafirm networks helps an employee’s ability to convert MO behaviours into innovative behaviour. Second, this study investigates whether the degree to which employees can learn and benefit from the knowledge and support of their colleagues depends on different types of intrafirm networks, and the overlapping of such networks. The tie content (i.e., what is exchanged between two nodes) differs across affective and instrumental networks in terms of informational content (Shah, Parker, and Waldstrøm 2017; Zagenczyk et al. 2015) and the type of support given (Levin and Cross 2004). The distinctive social network exchanges can provide service employees with unique and complementary information and support. Prefiguring our results, we demonstrate the importance of investigating multiplex relationships (next to uniplex relationships), as the ties from uniplex networks seem to complement each other, such that having a central role in multiplex networks yield strong benefits. At the same time, and in line with previous research highlighting the constraints of multiplexity (Marineau, Hood, and Labianca 2017; Shah, Parker, and Waldstrøm 2017), this study finds that maintaining multiple ties with other employees may require substantive resource endowments, and when multiplex central employees do not maintain high levels of MO, it seriously harms their innovative behaviour.

This study is organised as follows: We first describe the theoretical background and then, in the methodology section, explain our research design and data collection.

**Figure 1.** Conceptual model.
procedures. To test the conceptual model, we present the model estimation analysis and results. We conclude with a discussion of the managerial and theoretical implications.

2. Social networks, social capital and the MO-innovation behaviour link

Employees who must execute MO and generate innovative solutions are embedded in intrafirm (within firms) networks of social interactions. MO literature has shown the importance of intrafirm social interaction for diffusing MO among employees for a firm’s business success (Kohli and Jaworski 1990; Lam, Kraus, and Ahearne 2010).

Yet, the literature has not yet investigated the degree to which individual employees can benefit from their popularity within intrafirm networks and more effectively convert MO behaviour into innovation behaviour.

Service employees can learn about customers and competitors (Day 1994; Homburg et al. 2009) through interacting with colleagues. Such information is often tacit or ‘sticky’ and cannot be easily codified and spread (Pérez-Luño, Saparito, and Gopalakrishnan 2016). Because it often resides within individuals, social interactions facilitate information exchanges among employees (Tsai 2001). Employees cannot easily obtain this information via non-social public sources and need interactions (Q&A sessions, demonstrations, and personal feedback) with their colleagues to gain an in-depth understanding of how to move forward and offer new services and solutions. In fact, the identification of valuable opportunities hinges on access to social networks that play a vital role in providing conduits through which this information flows (Coleman 1988; Granovetter 1973). In addition, because customers’ needs are heterogeneous and in flux, service employees need to constantly update the information or knowledge about their customers. Hence, being well-embedded in social networks may provide employees with advantages to generate and share such timely information with their colleagues on a continuous basis (Homburg et al. 2009) to combine, update, and transform market information into new opportunities for innovation.

Service employees do not randomly connect to others when seeking advice on customer and competitor information; they may look to those who are popular or trusted by others in the organisation (Rank, Robins, and Pattison 2010). Service employees who are popular and well embedded in their social relations (i.e., who take on a more central position within the intrafirm network), can benefit from their advantageous information position. They can see and hear things that others do not (Ferriani, Cattani, and Baden-Fuller 2009). For instance, central employees may be updated more frequently with interesting customer stories, such that they can more readily access accurate customer information and paint a fuller picture of customer needs. This increases the likelihood that they find lucrative opportunities that others cannot yet see. Their central position may also summon greater support for the acceptance and development of their ideas into new products and services (cf. Ibarra 1993; Klein et al. 2004). Thus, these centrally positioned employees can deploy their network of contacts as a relational resource to their advantage, as it provides greater access to information and support (Tsai and Ghoshal 1998). They can – by means of their social capital – learn more effectively and receive enhanced support from their peers that enhance their ability to better exploit their MO activities and transform it into innovative behaviour.
Social network theory has frequently linked social capital with innovation (cf. Leenders and Dolfsma 2016; Michelfelder and Kratzer 2013). An ongoing debate exists of how to measure social capital (Adler & Kwon 2002), and which type of social capital (structural versus relational dimensions) is most conducive to innovation (Perry-Smith and Mannucci 2017; Sosa 2011; Tsai and Ghoshal 1998). Our research follows recent research that takes a more nuanced view, and that highlights the possible complementarity of having strong ties (closed network structures) and weak ties (weak network structures), such that the ability to combine both is most conducive to realising innovation (Michelfelder and Kratzer 2013; Rost 2011).

Our study’s focus is on how individual employees can leverage their social capital to improve their ability to transform their MO behaviour into innovation behaviour. In defining an employee’s social capital, we incorporate the structural dimension by looking at their network centrality and investigate the relational dimension by looking at the relational content of exchange that differs across workplace friendship, advice and multiplex networks.

From a structural network perspective, we choose in-degree centrality as structural dimension, assuming that service employees’ popularity or importance as perceived by co-workers (i.e., the extent to which other co-workers in the network consider the focal employee to be a work-related friend, advisor, or both) can facilitate service employees to access better information and summon greater support from others to realise greater innovation returns on their MO behaviour. Using in-degree centrality for all three types of networks, we are able to compare the relative effect sizes of network centrality.

To incorporate the relational dimension of social capital, we consider the types of content that are exchanged via different types of networks, including workplace friendship, advice and multiplex relationships. To maintain a popularity perspective, we do not investigate tie strength from the focal actor (ego perspective) or that exists between employees (dyadic perspective). Instead, we take the perspective of alters and assess the instrumental (advice) and/or affective (friendship) role of the focal service employee (ego) as perceived by co-workers (cf. Brennecke 2020).

Finally, to contribute to the burgeoning literature on multiplexity, we also explore how the multiplex network centrality may (relative to the uniplex centralities) moderate the employee MO-Innovation behaviour relationship. While multiplex relationships may provide several benefits by providing complementarity, research also suggests that they may lead to dysfunctions and conflicts. Accordingly, we investigate the relationship of multiplex-centrality on the MO-Innovation behaviour relationship. This analysis contributes to the debate on whether employees who are central in multiplex networks enjoy benefits over those who are central in uniplex networks (Shah, Parker, and Waldström 2017), and whether playing the overlapping role of being an advisor and a workplace friend provides complementary benefits.

### 2.1. The effect of employee-level MO on innovative behaviour

As a behavioural construct, MO creates innovative outcomes for business (Han, Namwoon, and Srivastava 1998; Kirca, Jayachandran, and Bearden 2005) by encouraging “doing something new or different in response to market conditions” (Kohli and Jaworski 1990, p. 12). Embedded in intrafirm networks, service employees can deliver
superior customer value through the generation and sharing of market information with other employees, and by responding to it with innovative solutions (Narver and Slater 1990).

In service settings, employees are direct participants in the implementation of MO (Brown et al. 2002). They need to engage in intrafirm as well as employee–customer interactions to retrieve relevant and accurate market and customer information to adapt business offerings to customer needs (Cadwallader et al. 2010; Gwinner et al. 2005). Thus, it is logical that the more employees engage in MO activities, the more they will generate, share, and respond to customer needs and market information, and the more innovative they will become, because of their enhanced understanding and anticipation of current and future customer needs, and know-how to appropriately respond to diverse market demands and competitor reactions (Lukas & Ferrell 2000). Although previous research has established the relationship between MO and innovation at the firm or team level (Gatignon & Xuereb 1997; Han, Namwoon, and Srivastava 1998; Kirca, Jayachandran, and Bearden 2005), this study is one of the first to assess it at the individual employee level. Hence:

2.1.1. H1: A service employee’s level of MO has a positive impact on the employee’s innovation behaviour

2.2. Moderating effects of network popularity

Service employees may capitalise on their network centrality such that those with more central positions are more effective in transforming their MO into innovation behaviour. Popular employees may increase their effectiveness because of two main reasons. First, employees in central network positions receive information from more sources, and are, hence, capable of getting more, and more frequently updated information about customers and competitors from their colleagues through these networks which help them to capture a better sense of customer needs and competitor actions. Having access to information from more sources with greater updating frequency stimulates innovation, as new information more quickly reaches the focal employee. Although a greater access to multiple co-workers may not automatically lead to more diverse, nonredundant information (cf. Burt 1992), still popular employees benefit as they can more easily verify or disconfirm the information received (Lee, Cotte, and Noseworthy 2010). Conversely, those employees that engage in MO to obtain this knowledge from other employees, but who are in less central network positions (i.e. thus have fewer connections), may not be able to acquire or verify the quality of this information or receive the same piece of information at the wrong time or wrong place to be fully exploited (Koput 1997).

Second, employees with a central position are often ascribed a certain status, which gives them greater source credibility (Ibarra 1993). To put innovative ideas into action, it is critical to be convincing and trustworthy in the eyes of one’s colleagues for the sake of getting support from them and garner the resources needed to bring new ideas to fruition (Shane and Venkataraman 2000). Central service employees, who engage in MO behaviours, can more easily convince fellow colleagues to share resources, as they can leverage their knowledge advantage and stimulate reciprocity when exchanging valuable information with them (Klein et al. 2004). Central employees tend to act as opinion leaders (Lee,
2.2.1. Two types of intrafirm networks: advice and friendship networks

Intrafirm networks may have different relational purposes – either instrumental or affective (Balkundi and Harrison 2006; Capone and Lazzeretti 2018; Klein et al. 2004). This difference has important implications, as the outcomes of network centrality tends to differ across the diverse contents of interactions. For this study, we distinguish between influences from advice (instrumental) and workplace friendship (affective) network embeddedness on the link between service employees’ MO behaviour to innovation behaviour. Advice network ties arise in the course of work-role performance and involve the exchange of job-related information and assistance, while workplace friendship network ties involve exchanges between employees in terms of friendship and social support within the work environment (Gibbons 2004).

Although advice and friendship networks both provide service employees with resources to stimulate innovation and, they operate differently given the nature of information and support. An advice network particularly supports task-related information exchange from colleagues and helps co-workers to share resources such as ‘information, assistance and guidance’ (Sparrowe, Liden, Wayne, & Kraimer 2001) that can be readily applied to the business context. A large body of research has empirically proven that advice networks provide employees with the needed information and support to enhance their innovation and performance outcomes (Ibarra 1993; Sparrowe et al. 2001; Zhang & Peterson 2011). Nonetheless, compared to friendship networks, advice networks generally promote less changes that may challenge the status quo (Gibbons 2004). In comparison to an advice network, communication within a friendship network tends to more often involve non-task related information. Friendships rest on affect-based

Table 1. Differences in advice and friendship networks.

<table>
<thead>
<tr>
<th>Nature of relationship: Information exchange</th>
<th>Advice networks</th>
<th>Friendship networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrumental</td>
<td>Affective</td>
<td></td>
</tr>
<tr>
<td>Task-related information</td>
<td>Non-task related information</td>
<td></td>
</tr>
<tr>
<td>Authority, cognition-based trust, competence and reliability, active backing of ideas and assistance</td>
<td>Intimacy, affect-based trust, concern about welfare of other, social and emotional support</td>
<td></td>
</tr>
</tbody>
</table>

Note: Differences between advice and friendship ties are based on Chua, Morris, and Ingram (2010), Gibbons (2004), Ibarra (1993) and Lincoln and Miller (1979).
trust, intimacy, shared interests, and reciprocal liking (Berman, West, and Richter, Jr. 2002), and provide a safe venue for mutually exploring unproven thoughts (Gibbons 2004) and open discussions of sensitive issues that people would not share with non-friends (Sias and Cahill 1998). Communication between friends tends to be broader, less cautious and more intimate than between non-friends (Sias and Cahill 1998). Such friendship interactions tend to go beyond the mere exchange of market and customer information, and can – if applied well to a business context – still provide useful insights for the development of creative ideas. Such information exchanges allow for the development of radically new solutions to improve customer value. Sosa, (2011) found empirical proof that strong ties are effective catalysts for the generation of creative ideas.

Advice and friendship networks also differ in how they summon support. Advice networks stimulate the active backing and assistance via providing advice and convincing fellow employees with arguments that induce cognition-based trust towards a colleague's reliability and competence (Holste & Fields 2010; McAllister 1995). Friendship networks encourage this support via affect-based trust (Chua, Ingram, and Morris 2008; McAllister 1995) to forge emotional bonds, companionship and camaraderie among colleagues (Gibbons 2004).

### 2.2.2. Moderating effects of advice- and friendship-network centrality

A central position in advice networks can increase the strength of an individual-level MO-to-innovation link, because it ensures a wider access to accurate information that increase the capacity for recombining existing knowledge for innovation (Ahuja and Lampert 2002). Service employees constantly need to generate adaptive solutions to changing market and customer demands (Schepers, Nijssen, and Van der Heijden 2016), and ready access to information can help them to better address current customer needs and anticipate future needs (Slater and Narver 1995). Popular employees may well benefit from access to customer and market information through existing network ties, obtaining a more accurate view of ever-changing customer needs and effectively adapting to these by including innovation in their offerings (Cadwallader et al. 2010; Menguc, Auh, and Uslu 2013). Higher centrality in an advice network tends to also attract more specialised, task-related information flow (Sparrowe et al. 2001), which allows individuals to increase the effectiveness of their MO behaviours to generate innovation. Service employees with a central position in an advice network can do so, because they can leverage their information advantage (better access to task-related knowledge) and enjoy more authority in task-related issues among colleagues. Their accumulated status results in greater perceptions of freedom and power (Krackhardt 1990), which provides the assurance and personal discretion needed for calculated risk taking (Perry-Smith and Shalley 2003). Due to their greater social reach and expertise, they can signal the quality of their ideas that increase the likelihood of receiving organisational support and the needed resources from colleagues (Sparrowe and Liden 2005; Wong and Boh 2014), leading to easier implementation of innovation.

Service employees may benefit but also suffer from their central position in a friendship network (Perry-Smith and Mannucci 2017). On the positive side, being central in friendship networks may stimulate creativity and innovation via more frequent and intensive knowledge exchanges with, and greater support and acceptance from others. In terms of information exchange, central employees in friendship relationships
benefit from the higher affect-based trust that leads to a greater willingness of co-workers to share new information with the focal actor (Chiaburu and Harrison 2008). Affect-based trust is essential (rather than cognition-based trust) before individuals discuss novel and challenging ideas with colleagues (Chua, Morris, and Ingram 2010). Friendships provide psychologically safe environments, shared ownership and mutual understanding (Fleming, Mingo, and Chen 2007), which all facilitate the exchange of (radically) new and risky ideas (Gibbons 2004), which may result in radical innovations. In terms of support, being central in friendship networks also increases the emotional support by strong ties that help to motivate them to pursue a generated idea (Sosa 2011). The acceptance and implementation of new solutions within organisations is facilitated as central employees, by virtue of their popularity, can more easily gain support from their ‘friends,’ as they have a greater risk tolerance and willingness to accept novel ideas from friends.

On the negative side, friendship ties reduce an employee’s ability during the self-generation of new ideas of central employees because of the greater overlap and sharing of redundant information between strong ties (Granovetter 1973). Friends increasingly align their goals with each other, thereby limiting ‘out-of-the box’ thinking (Mom et al. 2015). In this respect, the ‘too-good friends’ problem (Souder, 1988) suggests that workplace friendship relationships become complacent and harmonious, such that co-workers become reluctant to challenge ideas from (popular) befriended employees. While the central position in friendship networks may stimulate co-workers to share information via a greater willingness, the greater similarity among friends and the greater likelihood of exchanging redundant knowledge may also limit the popular service employee’s opportunity to recombine knowledge into creative ideas (cf. Perry-Smith and Shalley 2003), thereby attenuating his or her ability to convert MO behaviour into innovative behaviour. Despite the greater likelihood of information redundancy and complacency, we hypothesise that central network positions in workplace friendship networks offer greater information and supportive advantages to employees that outweigh these costs. Thus, we posit the following:

H2a: The relationship between an individual-level MO and innovation behaviour is strengthened by advice-network centrality;

H2b: The relationship between an individual-level MO and innovation behaviour is strengthened by workplace friendship-network centrality.

2.2.3. Moderating effect of multiplex-network centrality

Service employees can maintain different types of ties with their colleagues, and, hence, possible overlap exists in advice (instrumental) and workplace friendship (affective) connections (Borgatti and Foster 2003). Multiplexity represents the overlap of roles, exchanges, or affiliations in a social relationship (Verbrugge 1979). Multiplex relationships exist when multiple types of ties exist between partners (Tuli, Bharadwaj, and Kohli 2010). In the context of our study, multiplex relationships carry both workplace friendship and advice dimensions: thus, form a multiplex tie through which another colleague considers a focal employee to be a friend and advisor. Such multiplex relationships
provide several benefits, yet may involve challenges that hinder the service employee’s ability to convert MO behaviour into innovation behaviour.

Multiplex relationships provide exchange partners with additional benefits. Multiplex relationships possess both affect-based (via friendship network) and cognition-based trust (via advice network). They constitute strong ties, due to the more frequent and richer information exchange. The sharing of both personal and work-related information may increase affective-based and cognition-based trust and promote cooperation and establish an environment that is conducive of knowledge sharing (Levin, Whitener, and Cross 2006; Shah, Parker, and Waldström 2017). Multiplex relationships, as compared to uniplex relationships, also provide access to a more diverse set of information, because co-workers are more likely to share higher quality or privileged information, even when they are better off concealing it (Albrecht and Adelman 1987). When employees are able to relate to each other via different social contexts, it makes relationships richer and stronger (Ibarra 1995), such that each partner can better understand each other. Multiplex relationships are also more stable because for each partner it is more difficult and costlier to terminate a relationship, as it comprises diverse ties in which each type of tie provides unique value for the partners (Tuli, Bharadwaj, and Kohli 2010). Relationships become more intimate, when employees know each other both ‘personally and professionally’ (Ibarra 1995; Sias and Cahill 1998). The intimacy of relationships promotes solidarity and stimulates the collaboration and identification of avenues for enhancing mutual benefits (Palmatier, Scheer, and Steenkamp 2007).

In our study, a greater multiplex network centrality means that a focal employee has a greater number of co-workers who perceive this employee to be a friend and an advisor. As such multiplex relationships imply both affective and instrumental exchanges, this may introduce diverse perspectives that are less likely to occur in uniplex relationships. An important reason for this lies in the challenging of assumptions and decisions. When individuals seek advice from befriended colleagues, they are more likely to question the focal employee’s assumptions and decisions, and stimulate divergent thinking, which is critical for creativity and innovation (Amabile et al., 1996). This cognitive process allows them to recognise opportunities that others cannot see. While the underlying friendship dimension increases the willingness to share information and fosters a safe and supportive climate for exchange, the underlying advice dimension helps to introduce novel information that service employees may not receive from friends-only colleagues. The added advice role helps to overcome the ‘too-good friends’ problem. Furthermore, while the underlying advice dimension helps to secure accurate task-related information for service employees popular in advice networks, those in a central position in multiplex networks may increase their effectiveness more as they simultaneously gain additional non-task related information and affect-based support that further stimulate creativity needed for idea generation and legitimacy needed for support. Multiplexity may thus bring complementary benefits that allow service employees central in multiplex relationships to find more novel solutions and attain more support.

Although most studies find positive effects of having overlapping roles, multiplexity also has a ‘dark side’ as there are constraints on maintaining (many) multiplex relationships. As all relationships are costly as people have a finite amount of time to communicate with colleagues (Krackhardt, 1994), maintaining many multiplex relationships can
lead to psychological strain, emotional exhaustion and maintenance difficulty (Methot et al. 2015; Shah, Parker, and Waldström 2017). Furthermore, being an advisor and friend can create relational conflicts due to possible conflicts when combining social and work roles that harm performance (Hood, Cruz, and Bachrach 2017). Hence, being central in multiplex networks may harm a service employee’s innovation output, and lower the returns on MO behaviour, as it may create fatigue and direct attention away from realising innovation. To address both viewpoints, we propose a null and alternative hypothesis:

H3o: The relationship between an individual-level MO and innovative behaviour is not affected by multiplex-network centrality.

H3a: The relationship between an individual-level MO and innovative behaviour is strengthened by multiplex-network centrality.

3. Methodology

3.1. Data collection and respondents

We adopted a multi-source, multi-informant approach by using a conventional survey instrument. We chose firms from an MBA club in China, the archive of which provided us a rich source of business contacts in the country. These MBA contacts helped us locate firms, which in most cases were their own employers. We mainly sampled businesses that operate in the retail and service industry. Because the intrafirm network data are key predictors in this research, a high response rate of more than 80% for each participating firm was necessary to ensure data validity (Sparrowe et al. 2001; Wasserman and Faust 1994). After approaching 224 service firms to request network data, we collected a net sample of 60 firms (response rate: 26.8%) that met a response rate of 80%. Our sample has a strong focus on retail and trade (30%) and healthcare and pharmaceuticals (23%). The respondent firms are mostly small firms with only 20 to 30 employees (only 5 of the 60 firms have fewer than 20 employees or more than 50 employees). Most firms (57%) are private enterprises.

The 60 firms provided data on intrafirm networks involving 1175 employees, all in clearly defined network matrices including both intrafirm advice-relationship and workplace friendship-network patterns. For non-network constructs, we asked the responding firms for an entire roster of employees who could answer the survey questions.

Respondents were classified according to five functional groups: senior management, HR managers, frontline managers, frontline employees and support staff. HR managers reported data on gender and tenure (i.e. length of employment). Senior-level managers and HR managers reported about MO-based reward systems within each firm. To study individual-level MO behaviours and innovative behaviour, we chose frontline employees and frontline managers as key informants. In total, 853 frontline managers and employees filled in the survey instrument. Finally, because of their supportive role, 172 staff members (e.g. HR employees, secretaries) were included for the network analysis, but
they were not asked to report on their MO and innovation behaviour. Table 2 provides an overview of the multi-informant setup, and what data were collected from each group.

3.2. Measures

We used established measures for both network and non-network data.

3.2.1. Independent variable: employee MO behaviour

We assessed this construct using Schlosser and McNaughton (2007) 20-Item Individual Market Orientation Scale (I-MARKOR) that originates from Kohli & Jaworski’s earliest MARKOR version. In line with previous literature, we present this construct to consist of three separate components: (i) the acquisition of market information, (ii) the sharing of market information, and (iii) the strategic response on the basis of this market information.

3.2.2. Dependent variable: employee innovation behaviour

We used an individual employee innovation behaviour performance measure developed by Janssen, (2004). The multi-item scale included statements such as ‘I created new ideas for difficult issues’, ‘I mobilised support for innovative ideas’, and ‘I transformed innovative ideas into useful applications’. Because both MO and Innovation consisted of highly inter-correlated items with high standardised loadings, we used a single, unweighted composite score for each of the constructs.

3.2.3. Moderating variables: network centralities

Taking a popularity perspective, we measured centrality in each network type so that it accounts for inward flow of interaction for a specific employee. Thus, we modelled network centrality as individual’s one step in-degree centrality (Brass et al. 2004), which indicates only direct relationships (also called ‘in-degree ties’) with co-workers within the network and not indirect ones. For each of the 60 firms, with a mean size of 20 employees for each network (SD = 12.25), we collected network data using Marsden’s name generator method (1990), providing our survey participants with a list of employees as identified by the HR department and senior managers. To measure advice network centrality, and acquire matrix data for advice networks, we asked respondents one simple
question, which is a common approach in network analyses (Ibarra 1993; Marsden 1990), ‘Generally who do you ask for advice when you have a work-related problem?’ This question was aimed at mapping out the participants’ workplace link for consumer- and market-related information on a daily basis. To measure workplace friendship network centrality, we asked respondents, ‘In the workplace, with whom do you usually have lunch and chat?’ This measure represents a relatively weak form of friendship (‘lunch friends’, cf. Dotan 2014) that is common in workplace settings. Our aim is to identify colleagues who are friends based on the level of closeness in terms of frequency, affection and reciprocal liking. In our research context, China, having lunch is considered a social activity in which colleagues usually select other close colleagues to go to food stalls for dining and drinking (Ma 2015).

Regarding both advice and friendship networks, we asked employees of each firm to check the list of names of co-workers they consider to be in their advice or friendship networks. By piecing the data together, we obtained two sets of 60 square matrices (directional network data set) for advice and friendship networks, respectively. We excluded all multiplex relationships from these matrices, such that advice-only and friendship-only network centrality measures are calculated. On average, a respondent has 2.17 friendship ties (2552/1175) of which 1.39 are friends-only (1639/1175), 2.07 advice ties (2433/1175) of which 1.29 are advice-only, and 0.78 multiplex ties (913/1175). Using UCINET 6 (Borgatti, Everett, and Freeman 2002), we computed in-degree centrality according to Wasserman and Faust (1994) method as the ratio of the number of relationships an employee has to the maximum possible relationships in that person’s network (Sparrowe et al. 2001).

To measure multiplex network centrality, we first summated the two raw data square matrices of advice and friendship networks to create a new multiplex matrix that records only the overlapping advice-friendship ties among the employees, then we use the same centrality measure as used above. To be consistent with the conceptual model, we again consider in-degree centrality.

3.2.4. Control variables
We measured firm-level reward systems to account for differences in MO outcomes caused by differences in firm-level MO-based reward systems (Wei and Atuahene-Gima 2009). We administered the six-item market-based reward system by Jaworski and Kohli, (1993) to HR (N = 16) and senior managers (N = 133). In addition, each firm’s HR respondents provided data on gender and employees’ tenure (i.e. how long they have worked for the firm). Gender has been shown to affect innovation outcomes (Ibarra, Martin, and Tsai 2005). We control for tenure as it can significantly impact individual-level behavioural consequences of MO (Ruekert 1992), such as employee innovation behaviour (Ibarra, 1993).

3.3. Measurement scale
We used AMOS 25.0, using a FIML approach for missing data⁴, to assess construct validity and reliability by first conducting confirmatory factor analysis with all five constructs (i.e. Employee MO behaviour (consisting of three components), employee innovation behaviour, and MO reward system). Table 3 displays the validity and
Table 3. Measurement items with validity and reliability analysis.

<table>
<thead>
<tr>
<th>Scale Items</th>
<th>Loading (t-value)</th>
<th>AVE</th>
<th>CR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Employee Market Orientation Behaviour</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Market Information Generating</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I ask people who used our product or service to assess the quality.</td>
<td>.52 (.)</td>
<td>.53</td>
<td>.91</td>
</tr>
<tr>
<td>I interact with people – either directly from customers or agencies (distributors) – to know what product or services customers will need in the future.</td>
<td>.69 (13.80)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In my communications with these people, I periodically review the likely effect of changes in our business environment (e.g. company mergers and acquisitions) on customers.</td>
<td>.69 (13.84)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I take responsibility to detect fundamental shifts in our business (e.g. competition, technology, regulation) in my communication with distributors.</td>
<td>.79 (14.84)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I talk to or survey those who can influence our customers' purchases (distributors).</td>
<td>.82 (15.08)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I review our product development efforts with distributors to ensure that they are in line with what customers want.</td>
<td>.81 (15.01)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I participate in informal 'hall talk' that concerns our competitors' tactics or strategies.</td>
<td>.71 (14.02)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I collect industry information through informal means (e.g. lunch with industry friends, talks with trade partners).</td>
<td>.69 (13.80)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Market Information Sharing Behaviour</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I participate in interdepartmental meetings to discuss market trends and developments.</td>
<td>.72 (.)</td>
<td>.55</td>
<td>.88</td>
</tr>
<tr>
<td>I let appropriate departments know when I find out that something important has happened to a major distributor, market, or customer base.</td>
<td>.77 (22.71)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I pass on information that could help company decision makers to review changes taking place in our business environment.</td>
<td>.51 (15.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I communicate market developments to departments other than marketing.</td>
<td>.79 (23.38)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I communicate with our marketing department concerning market developments.</td>
<td>.79 (23.47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I try to circulate documents (e.g. emails, reports, newsletters) that provide information on my distributor contacts and their customers to appropriate departments.</td>
<td>.84 (24.79)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I coordinate my activities with the activities of co-workers or departments in this organisation.</td>
<td>.74 (21.84)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Market Information Response</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If a customer has a problem with our product or service, I try to find some way or some person to solve the problem.</td>
<td>.73 (.)</td>
<td>.58</td>
<td>.87</td>
</tr>
<tr>
<td>I try to help customers/distributors achieve their goals.</td>
<td>.73 (21.40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I respond quickly if a customer/distributor has any problems with our offerings.</td>
<td>.84 (24.52)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I take action when I find out that customers are unhappy with the quality of the service or product.</td>
<td>.81 (23.64)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I jointly develop solutions for customers with members of our customer/adviser relationship team.</td>
<td>.70 (20.36)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Employee Innovation Behaviour</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generating new ideas for difficult issues (idea generation)</td>
<td>.77 (.)</td>
<td>.65</td>
<td>.96</td>
</tr>
<tr>
<td>Searching out new working methods, techniques, or instruments (idea generation)</td>
<td>.78 (25.65)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generating original solutions for problems (idea generation)</td>
<td>.79 (25.76)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobilising support for innovative ideas (idea promotion)</td>
<td>.80 (26.23)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquiring approval for innovative ideas (idea promotion)</td>
<td>.81 (26.73)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Making important organisational members enthusiastic about innovative ideas (idea promotion)</td>
<td>.82 (26.83)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transforming innovative ideas into useful applications (idea realisation)</td>
<td>.85 (28.25)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introducing innovative ideas into the work environment in a systematic way (idea realisation)</td>
<td>.84 (27.92)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluating the utility of innovative ideas (idea realisation)</td>
<td>.80 (26.19)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MO-Based Reward System</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No matter which department they are in, people in this business unit get recognised for being sensitive to competitive moves.</td>
<td>.65 (.)</td>
<td>.52</td>
<td>.84</td>
</tr>
<tr>
<td>Formal rewards (i.e. pay raise, promotion) are forthcoming to anyone who consistently provides good market intelligence.</td>
<td>.67 (14.83)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salespeople’s performance in this business unit is measured by the strength of relationships they build with customers.</td>
<td>.81 (17.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salespeople’s monetary compensation is almost entirely based on their sales volume.</td>
<td>.81 (17.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>We use customer polls for evaluating our employees.</td>
<td>.63 (14.25)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 1175; FIIM estimation in AMOS 25.0. Scale items range from 1 = completely disagree to 6 = completely agree.
reliability of the constructs, and their corresponding items. Only one item of MO reward system had to be dropped because of a low loading (<.50). Although we found the chi-square statistic for the confirmatory factor analysis to be significant ($\chi^2_{517} = 2582.81$, $p < .01$), the relevant overall fit measures indicate reasonable measurement fit (CFI = .89, TLI = .88; RMSEA = .058). We established convergent validity as the size and significance of the factor loadings ($p < .001$) was high. The average variance extracted (AVE) of all constructs was also higher than the recommended level of .50 (Fornell and Larcker 1981). We found evidence for discriminant validity as the square root of the AVE of the MO constructs on the one hand and the other constructs on the other hand was larger than the correlation of that construct with each of the other latent constructs (see Table 4). The discriminant tests did show that the underlying MO constructs had high correlations, but this is intuitive as the subconstructs pertain to one overall theoretical construct. The reliability of scales was also high, considering that the scales’ construct reliabilities (CR) were well above .60.

To assess the possible common method variance (CMV) of our survey instrument, we first conducted Harman’s single factor test that indicated that the single solution did not fit the data well. Second, we developed a new model in which a common methods factor was created (all items load on this newly created construct) (Podsakoff et al. 2003). This common methods factor was also linked to each item in order to assess the variance explained by the common factor and by the five corresponding constructs. We found that only 2% is explained the common method factor, while 80% of the item variance is explained by the five latent constructs. All of the 34 structural parameters of our model remain highly significant when introducing the common method factor. These tests suggest that CMV is not a major concern.

### Table 4. Correlations and discriminant validity.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Employee innovation behaviour</td>
<td>4.17</td>
<td>0.94</td>
<td>.65*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Employee MO behaviour</td>
<td>4.04</td>
<td>0.82</td>
<td>.47**</td>
<td>.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Information generating</td>
<td>4.05</td>
<td>1.02</td>
<td>.52**</td>
<td>.48**</td>
<td>.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Information sharing</td>
<td>4.08</td>
<td>1.04</td>
<td>.58**</td>
<td>.49**</td>
<td>.72**</td>
<td>.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Information response</td>
<td>4.04</td>
<td>0.81</td>
<td>.52**</td>
<td>.59**</td>
<td>.43**</td>
<td>.52**</td>
<td>.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Advice-network centrality*</td>
<td>0.00</td>
<td>1.00</td>
<td>.09**</td>
<td>.08*</td>
<td>.04</td>
<td>.10**</td>
<td>.09**</td>
<td>n.a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Friendship-network centrality*</td>
<td>0.00</td>
<td>1.00</td>
<td>.02</td>
<td>.06</td>
<td>.06</td>
<td>.08**</td>
<td>.10*</td>
<td>-.08**</td>
<td>n.a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Multiplex-network centrality*</td>
<td>0.00</td>
<td>1.00</td>
<td>.05</td>
<td>.10**</td>
<td>.03</td>
<td>.05</td>
<td>.08</td>
<td>.22**</td>
<td>.18**</td>
<td>n.a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>MO reward</td>
<td>4.05</td>
<td>0.85</td>
<td>.23**</td>
<td>.17**</td>
<td>.28**</td>
<td>.26**</td>
<td>.15**</td>
<td>.12**</td>
<td>.12**</td>
<td>.07*</td>
<td>.72</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Tenure*</td>
<td>0.00</td>
<td>1.00</td>
<td>.06</td>
<td>.02</td>
<td>.14**</td>
<td>.09**</td>
<td>-.07*</td>
<td>.14**</td>
<td>-.14**</td>
<td>-.05</td>
<td>.02</td>
<td>n.a</td>
</tr>
<tr>
<td>11</td>
<td>Gender*</td>
<td>0.50</td>
<td>0.50</td>
<td>.08*</td>
<td>.12**</td>
<td>.14**</td>
<td>.12**</td>
<td>.02</td>
<td>.11**</td>
<td>-.07*</td>
<td>.01</td>
<td>-.05</td>
<td>.15**</td>
</tr>
</tbody>
</table>

*Dummy variable: Men coded as 0, women coded as 1.
*Diagonally presented values are the square root of AVE based on FIML SEM estimations.

**Correlation is significant at the .01 level (2-tailed).

*Correlation is significant at the .05 level (2-tailed).
3.4. Data analysis

Our data set is composed of individual- and firm-level data. Our individual-level observations may, however, not be independent, because employees of the same firm tend to be more similar to one another than to employees of other firms. Group membership may influence the scores of our theoretical constructs, and violate the assumption of nonindependence of observations. To account for potential nonindependence of the observations, we used HLM, a multi-level technique, to predict variances of dependent variables with restricted maximum likelihood estimations.

4. Results

4.1. Multilevel model estimation

We assessed within-group agreement ($r_{wg}$), intraclass correlation (ICC$_1$), and reliability of the group mean (ICC$_2$) for these constructs. The $r_{wg}$ is .80 for the MO components. Using a random intercept to capture the between-firm variance, the null model regression showed that the ICC$_1$ value for Innovation is .21, which indicates that 21% of the variability in employee innovation behaviour is explained by group membership. This fits well with recommendations in literature because values above .1 indicate validity of the multilevel modelling (Schneider, White, and Paul 1998). The ICC$_2$ provides an estimate of the reliability of group means (Kozlowski and Klein 2000) and is .80. We do not aggregate team level data, as we, with the exception for MO-rewards, use individual level data for our analysis.

Table 5 contains the results of our conceptual model, using a stepwise approach. The null model (intercept only) shows that differences across teams account for about 21% of the variability in employees’ innovation levels. Model 1 includes Employee MO behaviour (MO), the main effects of advice- and friendship network centrality, and the three control variables. Then, in Model 2 we entered the interaction terms of the uniplex network (advice- and friendship-network) centralities with the MO construct. To test the moderation effects on the MO-Innovation behaviour link, we first mean-centred the MO variable before computing the product terms (Aiken and West 1991). In Models 3, 4 and 5, we report the testing for multiplex centrality in isolation (Model 3), with the main effects of the uniplex and multiplex centralities (Model 4) and when inserting the moderating effects of the uniplex centralities of advice and friendship centrality (Model 5).

As predicted in H1 and shown in Model 1, we found that MO positively affects employee innovation behaviour ($\beta = .44$, $p < .001$). To test H2a and H2b, Model 2 adds the interaction terms of advice and friendship-network centrality with MO. The interaction term of advice-network centrality is significant ($\beta = .13$, $p = .077$) but only at the less restrictive 10% level, whereas that of friendship-network centrality is not ($\beta = -.02$, $p > .10$). The significant interaction effect of advice-network centrality with MO, however, disappears when including the interaction term of multiplex-network centrality (Model 5). Therefore, we do not find support for H2a and H2b.

In line, with our alternative hypothesis, H3a and as shown in Model 3 and Model 4, we find a significant and positive interaction term ($\beta = .18$, $p < .01$) for the centrality in the multiplex network effect. Hence, the effect of MO on innovation behaviour becomes...
stronger for higher multiplex centrality. The above-mentioned findings suggest that having a central position in advice and friendship networks simultaneously (rather than being central in its underlying uniplex networks) strongly increases the effect of MO on innovation behaviour. Yet, given the effort it takes for employees to maintain central positions in both networks (Adler & Kwon 2002), it is important to note that employees with a central position in multiplexity succeed in achieving high levels of MO; a low MO activity is particularly harmful to innovation for employees who maintain a central position in multiplex networks (see Figure 2).

Regarding the control variables, in Models 1–5, the MO-based reward has a consistent positive effect, which shows that it provides an important firm-level instrument that directly encourages higher-level employee innovation behaviour. Gender and tenure do not significantly influence innovation behaviour.

Table 5. Model estimation of uniplex and multiplex network centrality.

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Employee level</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(β)</td>
<td>(β)</td>
<td>(β)</td>
<td>(β)</td>
<td>(β)</td>
<td>(β)</td>
</tr>
<tr>
<td>Intercept</td>
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<td>−.05</td>
<td>−.05</td>
<td>−.08</td>
<td>−.07</td>
<td>−.08</td>
</tr>
<tr>
<td>H1</td>
<td>MO</td>
<td>.44***</td>
<td>.44***</td>
<td>.44***</td>
<td>.43***</td>
<td>.47***</td>
</tr>
<tr>
<td></td>
<td>(MO)</td>
<td>(MO)</td>
<td>(MO)</td>
<td>(MO)</td>
<td>(MO)</td>
<td>(MO)</td>
</tr>
<tr>
<td></td>
<td>Advice centrality (AC)</td>
<td>.06</td>
<td>.06</td>
<td>.05</td>
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<td></td>
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<tr>
<td></td>
<td>Friendship centrality (FC)</td>
<td>.00</td>
<td>.00</td>
<td>−.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H2a</td>
<td>MO×AC</td>
<td>.13*</td>
<td>(.08)</td>
<td>(.08)</td>
<td>(.08)</td>
<td>(.08)</td>
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<tr>
<td>H2b</td>
<td>MO×FC</td>
<td>.03</td>
<td>(.05)</td>
<td>(.05)</td>
<td>(.05)</td>
<td>(.05)</td>
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<tr>
<td>Multiplex centrality (MC)</td>
<td>.02</td>
<td>.01</td>
<td>.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H3</td>
<td>MO×MC</td>
<td>.18***</td>
<td>.18***</td>
<td>.17**</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(MC)</td>
<td>.05</td>
<td>(.05)</td>
<td>(.05)</td>
<td>(.05)</td>
<td>(.05)</td>
</tr>
<tr>
<td>Control: employee level</td>
<td>Gender</td>
<td>.09</td>
<td>.09</td>
<td>.11</td>
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<tr>
<td></td>
<td>Tenure</td>
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<td>.07</td>
<td>.07</td>
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</tr>
<tr>
<td>Control: firm level</td>
<td>MO-based reward</td>
<td>.17**</td>
<td>.17**</td>
<td>.17**</td>
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<td></td>
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<tr>
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<td>(MO)</td>
<td>.06</td>
<td>(.06)</td>
<td>(.06)</td>
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<tr>
<td>Model fit</td>
<td>ICC</td>
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<td>21905.90</td>
<td>1674.17</td>
<td>1674.17</td>
<td>1659.06</td>
</tr>
<tr>
<td></td>
<td>− 2*Log Likelihood (2LL)</td>
<td>1674.17</td>
<td>1674.17</td>
<td>1659.06</td>
<td>1666.63</td>
<td>1671.78</td>
</tr>
<tr>
<td></td>
<td>Pseudo $R^2$</td>
<td>0.26</td>
<td>0.26</td>
<td>0.27</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>(relative to previous model)</td>
<td>231.73</td>
<td>0.00</td>
<td>−7.56</td>
<td>−5.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>708</td>
<td>672</td>
<td>672</td>
<td>672</td>
<td>672</td>
</tr>
</tbody>
</table>

*a male = 0, female = 1
*b MO behaviour as one-factor construct at the individual level
*c Proportion of variance explained by firm-level predictors
***Significant at the .001 level (2-tailed)
**Significant at the .01 level (2-tailed)
*Significant at the .05 level (2-tailed)
Significant at the .10 level (2-tailed)
4.2. Robustness checks

4.2.1. Alternative centrality measures

A variety of centrality measures exist, each having its own underlying assumptions. To assess the underlying key mechanisms, we explored whether our findings hold when using alternative centrality specifications for friendship, advice and multiplex networks. For each network, we used out-degree (outward ties only), reach (both in- and outward direct ties), eigenvector (both in- and outward ties) and betweenness (in-betweenness of nodes) centrality (Freeman 1977; Marsden 1990). The analyses revealed that the interaction effect of MO and advice centrality is insignificant (as tested in Model 2) when using out-degree reach, out-degree centrality and in-degree eigenvector centrality, but is significant for in-degree reach and betweenness. These findings suggest that seeking out advice to much of the network does not strengthen the MO-Innovation link (out-degree reach), nor does connecting to many others (out-degree centrality) or central others (out-degree eigenvector centrality). It does make an employee more effective in the conversion of MO when much of the network (in-degree reach) seeks out the advice of this employee or when the focal employee (node) is on many of the shortest paths when analysing the links between two other employees (betweenness), providing some evidence for the benefits of brokerage roles. In sum, the findings suggest that it is better to receive than to ask for advice (cf. Zagenczyk and Murrell 2009). The interaction term of MO and friendship centrality (as tested in Model 2) remained insignificant when using alternative specifications. The analyses revealed that the interaction effect of MO and multiplex centrality (as tested in Model 4) is significant when using in-degree reach and in-degree eigenvector centrality, but not using the remaining alternative specifications. Overall, the additional tests support the robustness of our findings.

4.2.2. Uniplex measures for advice- and friendship network centrality

To allow for further comparison of the uniplex network centralities, we re-tested our H1–H2 based on ties in the two distinct uniplex networks (i.e., advice or friendship network),

![Figure 2. Moderation effect of multiplex-network centrality on MO–Innovation behaviour link.](image)
ignoring the presence of multiplex ties. To assess the moderation effect of advice- and friendship-network centrality, we ran an HLM model using all advice ties to measure advice-network centrality, and using all friendship ties to measure friendship-network centrality. Table 6 confirms the positive effect of MO on innovation behaviour, and show a strong positive moderation effect for advice-network centrality (β = .29, p < .001), but an insignificant effect for friendship-network centrality (β = .01, p > .10). The advice-network centrality thus strongly moderates the MO-Innovation behaviour link in the absence of multiplex relationships.

5. Discussion

This study introduces a network popularity perspective to shed light on how employees’ central position in three distinct intrafirm networks, advice, workplace friendship and multiplex networks, improves their ability to convert MO behaviours into innovation behaviour. Overall, our results subscribe earlier contentions that the MO-Innovation link is context-specific (Gotteland and Boulé 2006; Najafi-Tavani, Sharifi, and Najafi-Tavani 2016; Song, Wei, and Wang 2015), and strongly depends on co-worker interactions
(Lam, Kraus, and Ahearne 2010). Supported by multi-level modelling on a multi-source, multi-informant data set, this study empirically shows that central actors in multiplex networks benefit most strongly from their network popularity, and are able to significantly improve their conversion of MO into innovation behaviour. Centrality in uniplex (advice and workplace friendship) networks do not play a role. While research suggests that centrality in any network type may leverage informational advantages (Menguc, Auh, and Uslu 2013), and summon more support through greater authority or intimacy, we find that only employees who play a central role in multiplex networks (instead of uniplex networks) can leverage their network popularity. Employees who are an advisor as well as a befriended colleague to many colleagues receive more accurate information and diverse support, and can leverage the complementarities of each type of network and possibly switch roles. They are able to receive and recombine both task-related and non-task related information, benefit from emotional and instrumental support and assistance, and exploit their authority to legitimise ideas while benefitting from the greater willingness of befriended co-workers to accept new and challenging ideas.

This study contributes to the burgeoning multiplexity literature by showing that the multiplexity of relationships is particularly relevant to consider when understanding how MO behaviours translate into innovation. Our study supports earlier findings that multiplex centrality may increase employee performance (Shah, Parker, and Waldström 2017; Tuli, Bharadwaj, and Kohli 2010). In line with other network studies that highlight the complementarity of different network ties (Lee and Lee 2015; Michelfelder and Kratzer 2013; Rost 2011), we find that the combination of instrumental and affective ties is particularly beneficial in translating MO into innovation behaviours. While our data show support for the positive influence of multiplex-network centrality, our results also hint to the dark side of multiplexity (cf. Methot et al. 2015; Shah, Parker, and Waldström 2017). Employees who are central in multiplex networks may seriously harm their innovation output when they fail to establish high levels of MO (see Figure 2). Recent studies on multiplexity confirm the positive role of multiplexity, but also hint that having too many multiplex relationships can lead to emotional exhaustion and maintenance difficulty (Methot et al. 2015; Shah, Parker, and Waldström 2017), and relational conflicts that are bad for performance (Hood, Cruz, and Bachrach 2017). This is an apparent risk given that such employees deploy significant resources to develop and maintain multiple ties with a large number of other employees. Finally, our study stresses the importance of measuring multiplex (next to uniplex) networks to examine how overlapping ties from different networks simultaneously affect innovation outcomes. Ignoring the existence of multiplex relationships would lead, in our case (as shown in Table 6), to wrong interpretations and possible over-reliance on advice networks. Our results show that well-connected employees only marginally benefit from being a pure advisor, and more strongly reap the innovation benefits from their intrafirm network position when they simultaneously act as work-related friends.

This study also contributes to the network popularity literature. While previous research has contended that individual employees’ popularity in intrafirm networks helps to improve job performance and career success (e.g., Burt 1992), information exchange (Levin and Cross 2004) and innovative performance (Michelfelder and Kratzer 2013; Rost 2011), this study shows that it can also improve their effectiveness of transforming MO behaviour into innovation behaviour. Rather than hypothesising
and finding a strong direct effect of centrality on innovation outcomes (Fang et al. 2015; Ibarra 1993; Shah, Parker, and Waldstrøm 2017; Tsai 2001; Wong and Boh 2014), we find that multiplex network centrality mainly impact innovation indirectly via increasing the strength of association between MO and innovation behaviours. Thus, network embeddedness in multiplex networks does not make individuals more innovative per se, but leads to more innovation when used in conjunction with MO behaviours. This finding emphasises that social networks provide a context for action (Burt 2004), such that actions are needed to realise the potential resources offered by intrafirm networks (Wong and Boh 2014).

5.1. Managerial implications

This study offers managerial implications on how to enhance innovation behaviour of individual service employees by identifying those employees are most likely to contribute to innovation, namely service employees who are popular in multiplex networks.

Employees with high multiplex-network centrality should be carefully identified, motivated and supported. Managers can encourage those highly central in workplace friendship networks to take a similar central role in advice networks to increase their ability to convert MO efforts into innovation behaviour. For example, by formally appointing them to perform mentoring activities or expand their task-related knowledge via training that help boost their authority. At the same time, those that already have a high advice-network centrality may benefit from also becoming friends with these advice-seeking nodes. For example, by inducing them to engage in social (bonding) activities with advice seekers, and creating a supportive team climate (Herman, Dasborough, and Ashkanasy 2008). Managers who want to improve the returns on MO behaviours could promote the multiplexity of relationships among service employees, but they should be aware that maintaining many multiplex relationships also creates a liability; employees high in multiplex centrality should manage their time carefully to ensure that they maintain high levels of MO activity.

5.2. Limitations and further study

This study has several limitations that constitute interesting avenues for future research. First, the generalisability of our findings may be limited because of our non-representative sampling. Though the data gave us an advantage in network perspective, owing to the small size of the service firms being small enough for network predicting with the least possible bias, it is unclear whether intrafirm network centrality plays a similar role for larger firms. Furthermore, we collected data from firms operating in a highly collectivistic country, which may explain the limited innovation output of service employees who are central in friendship networks; given the importance attached to maintaining current friendships, collectivistic employees may be less prone to exchange information that challenges the status quo and propose change. In sum, future research should thus assess the generalisability of our findings to other firms and regions.

Second, this study focused on the role of intrafirm networks; future research should assess whether and how the structural positions of employees in interfirm networks produce (dis)similar innovation outcomes. Although evidence exists that inter-firm
market orientation may yield knowledge transfers and stimulate innovation at the firm-level (Cambra-Fierro, Perez, and Whitelock 2011), existing research has not yet explored how an individual employee’s structural position in intrafirm networks may interact with one’s linkages with representatives of other firms, and jointly strengthen or weaken an employee’s MO and innovation behaviours.

Third, in line with prior studies, our study uses simple survey questions to assess friendship, advice and multiplex ties. Our advice measure did not ask co-workers to report specifically on who they seek advice for MO-related advice, which may explain the limited effect of advice network centrality in our research context. Next, we relied on a relative weak friendship measure, namely: workplace friendships; instead of asking for more intense personal friendships that may exist between co-workers who socialise outside work. Future research should assess whether alternative social network measures lead to (dis)similar results. Next, our cross-sectional measurement of network centralities ignores the temporal dimension, such that we are unable to determine whether network centrality drives MO behaviours or vice versa. Continuous data (e.g., retrieved from email communications, social app messages, electronic wearables) may enable researchers to measure the emergent properties of networks and behaviours and establish cause and effect (cf. George et al. 2016), and explain how network centrality may result from employee characteristics, interactions, and (relational or task) conflicts (cf. Gibbons 2004). Examining how service employees’ centralities in uniplex and multiplex networks develop over time and impact MO and innovation behaviours is an important avenue for future research.

Fourth, this study neither measured realised innovation nor innovation success. Future research can assess whether the innovative output and performance of employees’ innovative behaviours is moderated by network centralities. In line with this argument, future research can distinguish between different types of innovation, and investigate whether the types of intrafirm networks may differ in their degree to which they result in different types of innovation output (e.g. incremental versus radical).

Notes

1 Based on the meta-analysis of Fang et al. (2015), we selected in-degree centrality rather than brokerage as source of social capital. Their results show that in-degree centrality is more strongly relate to job performance (and career success) than brokerage. We acknowledge that network structure (network density) may also determine the ability of service employees to convert MO behaviour into innovation behaviour, as both in-degree centrality and brokerage may provide employees with structural advantage (Grosser, Venkataramani, and Labianca 2017; Wong and Boh 2014). We will partially assess the role of such network structures in our robustness section. We thank an anonymous reviewer for highlighting this issue.

2 Advice networks are also based on shared interests and trust, but they tend to derive from the sharing of professional values and cognitive-based trust rather than from personal values and affect-based trust (Gibbons 2004).

3 The multi-informant setup allows to cross-validate some of the survey results. Both frontline managers and front-line employees filled in the same scales. The two groups showed no significant mean differences to the same statement for each item and showed a similar pattern, thereby providing evidence that the scales are consistent and valid across groups. We used structural equation modelling to assess the invariance of the relationships across
front-line employees (N = 701) and front-line managers (N = 153), and find compared with the full sample (N = 1175) similar fit indices for the combined model: CFI = .88/.87, TLI = .88/.85, RMSEA = .058/.047. After establishing full configural invariance (all lambdas are significant for each group), also the measurement weights (Δχ²(29) = 17.78, p = .95) as well as its intercepts (Δχ²(29) = 32.17, p = .56) of the items appeared to be invariant across the two groups. This provided additional evidence that the items measure the same thing and to the same degree across groups.

We applied a full-information maximum likelihood (FIML) approach since using a list-wise deletion approach would discard the bulk (48%) of our sample. The results of the sample with missing values (N = 1175) are compared with those of the list-wise deletion approach (N = 568) and demonstrate high similarity in terms of fit (CFI = .89/.89, TLI = .88/88, RMSEA = .058/.071) and for each corresponding standardised loading. In Table 3, we refer to the results of the larger sample.

**Disclosure of potential conflicts of interest**

No potential conflict of interest was reported by the author(s).

**References**


