

# The influence of the physical work environment of business centres on social networking and knowledge sharing in the Netherlands

**Citation for published version (APA):**

Weijs - Perrée, M., Appel - Meulenbroek, R., Arentze, T., & Romme, A. G. L. (2019). The influence of the physical work environment of business centres on social networking and knowledge sharing in the Netherlands. *Intelligent Buildings International*, 11(2), 105-125. <https://doi.org/10.1080/17508975.2019.1574705>

**DOI:**

[10.1080/17508975.2019.1574705](https://doi.org/10.1080/17508975.2019.1574705)

**Document status and date:**

Published: 03/04/2019

**Document Version:**

Accepted manuscript including changes made at the peer-review stage

**Please check the document version of this publication:**

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

**General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

[www.tue.nl/taverne](http://www.tue.nl/taverne)

**Take down policy**

If you believe that this document breaches copyright please contact us at:

[openaccess@tue.nl](mailto:openaccess@tue.nl)

providing details and we will investigate your claim.

# **The influence of the physical work environment on social networking and knowledge sharing in business centres**

Office design has been demonstrated to influence knowledge sharing within (large) organizations located in single-tenant buildings. For business centres, where organizations share spaces, facilities and services, it is often assumed that social networking and knowledge sharing between organizations occur even more frequently. However, empirical research with regard to the effects of the physical design of business centre offices on social networking and knowledge sharing behaviour is still limited, despite the growing number of business centres. Therefore, the purpose of this research is to analyse the effects of the physical work environment on perceived social networking and knowledge sharing behaviour within and between organizations in business centres. Data collected among 268 users of 53 business centres in the Netherlands was analysed using path analysis. Results showed that using a lounge room is most effective for knowledge sharing between organizations. Moreover, meeting spaces and flexibly used workspaces appear to be important for knowledge sharing within organizations.

Keywords: knowledge sharing, social networking, physical work environment, office design, business centre

## **Introduction**

Knowledge and innovation activities drive regional growth, employment and economic competitiveness (e.g. Huggins, Izushi, and Thompson 2013). Moreover, knowledge sharing behaviour has become increasingly important for organizations (Israilidis et al. 2015) because knowledge is a vital source for organizational performance, innovation capabilities and sustainable competitive advantage (Haas and Hansen 2007; Wang and Noe 2010).

Specifically for small or medium enterprises (SMEs) and freelancers, networking and knowledge sharing with other organizations is highly important (Vajjhala 2013), because of their small size (Asheim, Coenen, and Svensson-Henning 2003). Interactions and the use of

network ties (i.e. relations) are needed to increase knowledge sharing behaviour among individuals and groups (Marouf and Doreian, 2010).

The role of the office has been changing due to several developments in work processes, such as working at home/remotely, virtual teams and global working. More than before, networking has become one of the main office activities, which is highly important for sharing knowledge and generating new ideas (Johns and Gratton 2013). Sharing knowledge and engaging in creative or innovative work are most effective by means of spontaneous face-to-face interactions (Ngah and Jusoff 2009; Wang and Noe 2010). Therefore, organizations increasingly re-evaluate their physical work environment and choose to locate in more interactive work environments (Ives, Torrey, and Gordon 2000; Sykes 2014). More and more, the office building has become a setting for social interactions, collaboration and idea generation (Johns and Gratton 2013; Sykes 2014). In addition, the demand for spaces other than regular workspaces is increasing, for example in the form of event spaces, informal meeting spaces and project spaces (Harris 2015).

Over the past decades, business centres have become an important sector of the property market, due to the decreasing need for conventional workspaces, the increasing need for flexible workspaces, the demand for high-level facilities and services, and the need for network opportunities (e.g. Gibson 2003). Many organizations are rethinking their work processes and are therefore renting office space in a business centre, which is an office building where spaces and shared facilities and/or services are offered to multiple organizations (Weijs-Perrée et al. 2016). The business centre market is growing and new concepts such as incubators and co-working spaces that focus specifically on networking and knowledge sharing (Sykes 2014; Moriset 2014) have been emerging. The number of co-working spaces, for example, has increased worldwide from 310 co-working spaces in 2009

to 7.800 co-working spaces in 2015 (Deskmag 2015). However, especially in business centres it remains a major challenge to create an effective workplace design that stimulates interactions and knowledge sharing (Kastelein 2014).

In this respect, there is hardly any empirical research on business centres and even less with regard to networking and knowledge sharing behaviour. A few studies on business centres focused mainly on user satisfaction (Hartog, Weijs-Perrée, and Appel-Meulenbroek 2017) or on one specific business centre concept, such as on networking behaviour among tenants in incubators (a specific type of business centre focusing on high-tech start-up companies) (e.g. Bøllingtoft and Ulhøi 2005). Other studies have mainly focused on social networking and knowledge sharing within (large) organizations in single-tenant buildings. These studies have demonstrated that the physical work environment influences patterns of social interactions and knowledge sharing behavior within an organization (e.g. Rashid, Wineman and Zimring 2009; Wineman et al. 2009; Kastelein, 2014; Kabo et al. 2015; Appel-Meulenbroek, De Vries, and Weggeman 2017). Research has also shown that interactions often occur in or near workspaces (e.g. Rashid, Wineman, and Zimring 2009), which underlines the importance of workspace as a mechanism for knowledge sharing behavior. Furthermore, shared facilities and open common workplaces have been shown to stimulate networking and knowledge sharing behavior between colleagues (Peponis et al. 2007; Staplehurst and Ragsdell 2010; Kastelein 2014). In addition, informal spaces allow people to relax and connect with other colleagues, which could lead to more trust among them, which in turn may eventually lead to more willingness to share knowledge (Chevez and Aznavoorian 2014). However, it is still unknown whether such mechanisms also take place within and between organizations located in business centres. Evidently, knowledge sharing behaviour between organizations is more complex because of different boundaries, cultures

and processes (Easterby-Smith et al. 2008).

Business centres are increasingly positioned in the market as innovative office locations where different organizations can interact and share knowledge with each other. This raises the question whether the physical work environment of business centres also affects knowledge sharing between people from different organizations that happen to be sharing workspaces and facilities/services in the same building. In addition, knowledge sharing between SME's and self-employed workers, which are the main target groups of business centres, is likely to be different than knowledge sharing within large organizations, which is mainly studied in previous research. Therefore, the aim of this study is to analyse the (direct and indirect) effects of facilities and workspace type and use (i.e. physical work environment) on perceived knowledge sharing behaviour within and between organizations in business centres controlling for demographic variables and organizational size. This study adds to previous research in single-tenant offices by analysing social networking and knowledge sharing between office workers within as well as between organizations (i.e. mostly SME's or self-employed workers) in the context of an increasingly popular office concept.. Data was collected among 268 tenants/users of 53 business centres in the Netherlands and analysed with path analysis.

The remainder of this paper is divided into five sections. First, a literature review serves to identify possible relations between facilities, workspace, networking (i.e. interaction frequency) and knowledge sharing behaviour. Next, Section 3 describes the data collection procedure, the sample and some descriptive statistics. In Section 4, the analyses and results are addressed. Last, Section 5 contains a discussion and conclusion.

## **Theoretical framework**

### ***Networking and knowledge sharing behaviour***

Based on an extensive review of literature, Yi (2009, 68) described *knowledge sharing behaviour* as a ‘set of individual behaviours involving sharing one’s work-related knowledge and expertise with other members within one’s organization, which can contribute to the ultimate effectiveness of the organization’. However, this definition is focused on sharing knowledge within an organization. In this study, knowledge sharing behaviour is described as ‘a process through which individuals mutually exchange knowledge to create new knowledge (e.g. Van Den Hooff and De Ridder 2004). Knowledge sharing behaviour can be inter-organizational (between organizations) or intra-organizational (within an organization) (e.g. Van Wijk, Jansen, and Lyles 2008). Knowledge sharing behaviour between organizations is more complex than knowledge sharing behaviour within an organization, because of different boundaries, cultures and processes (Easterby-Smith, Lyles, and Tsang 2008). However, organizations can improve their knowledge and innovation capabilities by sharing knowledge across organizations (Easterby-Smith et al. 2008).

Knowledge sharing behaviour is often studied from a social network perspective (e.g. Tsai 2002; Borgatti and Halgin 2011), since organizations are social communities. Networks are, therefore, important for organizations to gain access to knowledge and resources (Marouf 2007). A *social network* can be defined as (cf. Seufert, Van Krogh, and Back 1999) ‘a specific set of linkages among a defined set of actors (individuals, groups, organizations or communities), with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behaviour of the actors involved’ (Mitchell 1969, 2).

These linkages between actors are important for knowledge sharing behaviour

(Wasserman and Faust 2008). Many researchers argued that the strength of these linkages (network ties) could affect knowledge sharing behaviour (e.g. Reagans and McEvily 2003; Levin and Cross 2004). For example, Xerri and Brunetto (2010) described strong ties as relationships with a high level of interaction, emotional intensity, and reciprocity, such as relationships with family members, close friends or close colleagues. In addition, weak ties were described as relationships with a low level of interaction, emotional attachment and reciprocity, such as acquaintances, friends of friends and distant colleagues. Granovetter (1973) suggested that weak ties are more important for sharing new information because weak ties provide access to new information and resources beyond the social circle. Reagans and McEvily (2003), however, suggested that relations with close ties increase the possibility that knowledge is shared. Frequently interacting with others is needed for developing stronger ties and eventually for more knowledge sharing behaviour among individuals (Marouf and Doreian 2010; Van Wijk, Jansen, and Lyles 2008). Thus, social networking is instrumental in getting access to (new) knowledge (Suckley and Dobson 2014). Knowledge is mostly shared through social or business interactions (Marouf 2007). Although most knowledge appears to be shared via social interactions between individuals (strong ties) (Wang and Noe 2010), business interactions occur the most at work (Marouf 2007). It is important that the physical work environment of business centres facilitates social interactions, because these interactions may soften cultural differences and create trust between organizations and eventually the willingness to share knowledge with others (Easterby-Smith et al. 2008).

### ***The physical work environment***

Previous research showed the importance of the physical work environment as a mechanism that stimulates knowledge sharing within organizations (e.g. Chevez and Aznavoorian 2014).

The physical infrastructure (i.e. design of the building, spaces and facilities) is also determined as one of the main dimensions of knowledge management infrastructure (Becerra-Fernandez and Sabherwal 2010). Networking and knowledge sharing behaviour between organizations probably takes place more often in business centres because of the shared office space, facilities and services. However, research into the influence of characteristics of business centres (facilities and workspaces) on knowledge sharing behaviour and social networking is limited. Previous studies focused mainly on the influence of the physical work environment (workspace type, use and facilities) of single tenant buildings on knowledge sharing behaviour within an (large) organization.

Open-plan offices, for example, stimulate the number of interactions and, therefore, enhance knowledge sharing behaviour (e.g. Blakstad, Hatling, and Bygdås 2009; Chigot 2003). On the other hand, open-place offices can result in more noise, reduced privacy, and difficulties performing work that needs concentration (Van der Voordt and Van Meel 2000). Moreover, other studies showed that the relocation to an open-plan office even decreases the number of interactions through the higher visual connectivity (i.e. efficiency in the interaction of workers) and the fear of disturbing others (Brennan, 2002; Suckley and Dobson 2014).

Moreover, research has showed that interactions often occur in or near workspaces (e.g. Rashid, Wineman and Zimring 2009). Therefore, the use and type of workspaces are also highly important for social networking and knowledge sharing behaviour. For example, a flexible workspace (i.e. a workspace used by employees who do not have an assigned workspace) can lead to problems for interactions because people cannot find each other or a workspace (Van der Voordt and Van Meel 2000).

Shared facilities and space tend to stimulate interactions and knowledge sharing

behavior as well. For example, Staplehurst and Ragsdell (2010) analysed facilities (meeting rooms, desk, deliberate knowledge sharing behaviour facility, canteen, drinks machine, corridor/reception, stairs and car park) used for knowledge sharing behaviour activities in SME's and compared two case studies in the UK. Respondents in both companies ranked meeting rooms in addition to desks, as the most important knowledge sharing behaviour facility. Results of the study by Kastelein (2014) showed that open and common workspaces, common shared areas (e.g. kitchen, play/game rooms, lounges, and library) as well as sufficient and available meeting facilities are the most important facilities for easy interaction. Hua et al. (2011) studied preferred spaces for collaboration and interaction. Findings showed that for casual conversations, individual workstations, kitchen or coffee areas and meeting rooms were used the most. With regard to collaborative work, most respondents used closed meeting rooms, individual workstations and open meeting areas. Shared print/copy areas, kitchen or coffee areas and circulation areas were used less frequently for collaborative work. In addition, informal spaces allow people to relax and connect with other individuals, which can create more trust among individuals, eventually leading to more willingness to share knowledge (Chevez and Aznavoorian 2014). Another study showed that people share more knowledge during informal interactions (e.g. around coffee rooms or cafeterias) than during formal meetings (Wensley 1998).

### ***Demographics and organizational type***

Individuals serve as receptors and they generate knowledge in organizations (Okoyere-Kwakye and Nor 2011). Therefore, demographics of individuals (e.g. age, gender, work experience, education level) are also potentially important for explaining knowledge sharing behaviour. For example, previous research showed that male entrepreneurs more often discuss their work (share tacit knowledge) during interactions and have a larger business

network than female entrepreneurs (Klyver and Grant 2010; Pangil and Nadurdin 2008; Zengyu Huang et al. 2013). On the other hand, other studies did not find any relation between gender and knowledge sharing behaviour (Alhammad, Al Faori and Hussan 2009). In addition, Zengyu Huang et al. (2013) analysed the influence of demographic factors on the usage of advice-seeking networks. Findings of their study suggest that people who are higher educated are more likely to use a professional network for advice, women are more likely to use personal networks than men and early stage entrepreneurs are more likely to use advice-seeking networks than later stage entrepreneurs.

Besides demographics, the type of organization (i.e. size) is also important. For example, Van Wijk, Jansen, and Lyles (2008) found a positive effect of organizational size on knowledge sharing and suggested that larger firms have more diverse resources to share knowledge. Chevez and Aznavoorian (2014) found that larger organizations rely more on technology to share knowledge and that individuals in smaller companies are more willing to share knowledge.

### ***Identification of predictor variables***

In summary, the reviewed literature indicates that demographics (e.g. age, gender, work experience and education level), organizational size, facilities (e.g. meeting spaces, reception, canteen/restaurant, kitchen, lounge and coffee area) as well as workspace type (i.e. alone in a closed space, together with others in a closed space or in an open space) and its use (i.e. personal office, shared office and the flexible used office) influence networking and knowledge sharing behaviour in single-tenant buildings. However, these studies have not considered these factors simultaneously in a single model or analysed these relations in business centres, where organizations share facilities and office space. Although little is

known about knowledge sharing behaviour in business centres, some hypotheses can be formed based on the existing literature in single-tenant offices.

In the conceptual model proposed here (see Figure 1), based on previous research in single-tenant offices, it is assumed that the physical work environment (i.e. workspace type or use and the use of offered shared facilities) in business centres may have a direct or indirect effect (mediated by social networking) on knowledge sharing behaviour with colleagues and with people from other organizations (e.g. Van der Voordt and Van Meel 2000; Peponis et al. 2007; Staplehurst and Ragsdell 2010; Kastelein 2014). Furthermore, it is hypothesized that social networking behaviour is critical for knowledge sharing behaviour. Finally, previous research showed that social networking behaviour (i.e. frequency of interacting) could affect knowledge sharing behaviour. When people interact more frequently, it is also more likely that they share knowledge with each other more frequently. Therefore, it is also expected that social networking behaviour affects knowledge sharing behaviour and is a mediator for explaining the effects of physical characteristics, demographics and organizational type on knowledge sharing behaviour.

It is recognized that people who are members of the same group (e.g. colleagues) are more likely to interact and eventually more likely to share knowledge with each other (e.g. Agneessens and Wittek 2012; Kabo 2017). Therefore, differences are expected with regard to the effects of the physical work environment on knowledge sharing behaviour with colleagues and with people from other organizations. Furthermore, demographics (e.g. age, gender, education level) and organizational type may affect social networking and knowledge sharing behavior and, therefore, are included in the proposed path model as control variables. For example, older workers are more likely to share knowledge more frequently as they have more work experience and knowledge to share. Based on previous research it is expected that

men share knowledge more frequently than men (e.g. Pangil and Nadurdin 2008; Klyver and Grant 2010). Furthermore, it is expected that smaller organizations are more willing to share knowledge with others in a business centre than larger organizations (e.g. Chevez and Aznavoorian 2014).

## **Methodology**

### ***Data collection procedure***

Data was collected between January and February 2016 in 53 business centres in the Netherlands. First, an email was sent to all owners/managers of 139 business centres who participated in a previous study in 2015 (Authors, 2016), asking whether they were willing to distribute the questionnaire among their tenants. These business centres are an accurate representation of the business centre market in the Netherlands. Next, these tenants (organizations) were subsequently asked to distribute the questionnaire among their employees (business centre users). Therefore, it is unknown how many people received the questionnaire (i.e. intended sample size). To increase the response rate, buildings were also visited in person to ask individuals to fill in the questionnaire (online or paper-pencil). Overall, 299 questionnaires were completed. However, several business centre users did not fill in the questions on knowledge sharing behaviour, social networking and facilities. These respondents were removed from the dataset, which resulted in a total of 268 useful questionnaires.

### ***Measures***

Table 1 and 2 show an overview of the variables measured in this study. Open and multiple choice questions were asked about the personal- and work related characteristics (i.e. age, gender, education level, work situation, number of business club memberships, organizational

type, number of hours working at the business centre per week, work experience at the business centre). Different types of knowledge sharing were measured based on whether knowledge is codified (i.e. documented in some form) or un-codified (i.e. not documented in any form) and whether knowledge is private (i.e. not publicly available or guaranteed by third parties) or public (available and verifiable through third parties) (Marouf 2007). Respondents were asked to indicate how frequently they shared the four types of knowledge that were distinguished this way. The questions on the four types of knowledge were formulated as (adapted from Marouf 2007):

- How many times do you ask your colleagues/other people for advice if you need help with a particular skill or competence for your work? (Public non-codified knowledge)
- How many times do you exchange documents with colleagues/other people? (e.g. notes, reports or annual reports) (Public codified knowledge)
- How many times do you share your expertise in face-to-face interactions or telephone conversations with colleagues/other people? (Private non-codified knowledge)
- How many times do you share your expertise through other ways with colleagues/other people? (e.g. e-mail, notes, letters, instant messaging) (Private codified knowledge)

Respondents were invited to respond to these questions on a 7-point Likert scale, ranging from (1) never, (2) less than once a month, (3) once a month, (4) every week, (5), multiple times a week, (6) daily and (7) multiple times a day. Although these questions give more insight in sharing different types of knowledge, the internal consistency of the four types of knowledge sharing behaviour with colleagues (Cronbach's Alpha of 0.951) and with others (Cronbach's Alpha of 0.921) appeared to be very high in this study, which indicates that the

four questions measure the same concept. In addition, the number of independent and dependent variables included in the model is restricted by the sample size. Therefore, the sum scores of the four types of knowledge sharing behaviour were used for further analyses. This leads to two new (summed) variables, namely knowledge sharing behaviour with colleagues and knowledge sharing behaviour with people from other organizations.

Research has shown that knowledge is mostly shared during face-to-face interactions (networking) between individuals (e.g. Wang and Noe 2010). Therefore, in this study social networking is measured by the frequency of respondents having social- interactions with colleagues and other people in the business centre (adapted from Marouf 2007). Social networking was also measured on a 7-point Likert scale, ranging from (1) never to (7) multiple times a day.

With regard to the physical work environment (i.e. workspace type and use), respondents were asked in which type of workspace they mostly work in the business centre and how they use this workspace. With regard to workspace type, respondents could choose from the following four categories: alone in a closed space (i.e. cellular office), together with others in a closed space (i.e. group office), an open space without partitions or an open space with partitions (adapted from Van Meel 2000). The distinction between open workspaces with or without partitions is based on previous research, which indicated that interactions between workers are encouraged by workspaces with a minimum of partitions (Binyaseen 2010). Open workspaces without partitions allow greater visibility and accessibility (Chusid 2001). Furthermore, respondents were offered a choice from the following three workspace use categories, adapted from Van Meel (2000): a personal office (workspace is used by one person), dedicated shared office (workspace is shared by two or more fixed users) and flexibly used office (non-territorial workspace that is freely used by employees). Respondents

were also asked about the availability of shared facilities/spaces in the business centre (yes/no). Next, they were asked about the frequency that they use the available shared facilities/spaces in the business centre, based on a 7-point Likert scale, ranging from (1) never to (7) multiple times a day. If a facility was not available in the business centre, the frequency of using a facility was recoded as 1 (never). This should be taken into account when analysing the results. In the analysis, the frequency of using a facility is considered to be an interval variable.

### *Analytic strategy*

To simultaneously analyse the hypothesized effects of the physical work environment (i.e. workspace type and use and facilities) on social networking and knowledge sharing behaviour and the effects between social networking and knowledge sharing behaviour, while controlling for demographics and organizational size, a path analysis was used. A path analysis is an extension of multiple regression analysis and a special form of structural equation modelling that only includes observed or measured variables. A major advantage of path analysis, compared to ordinary multiple regression analysis, is that it can estimate direct and indirect effects simultaneously (Streiner 2005). To estimate the path model, the statistical software package LISREL (Jöreskog and Sörbom 2008) was used. Only variables that were expected to have an effect on the frequency of interaction and knowledge sharing behaviour, based on the literature review and bivariate analyses, were added to the model. Nominal and ordinal variables were recoded into dummy variables when they were added to the path analysis model. Binary variables can be used in path analysis provided that they appear exclusively as exogenous variables in the model. In addition, relations between dependent variables (i.e. social networking and knowledge sharing variables) were added to the model. All links that were not significant at the 0.05 level ( $t < 1.96$ ) then were stepwise removed

from the model. For example, variables such as years working in the business centre, hours working in a business centre, frequency of using an informal meeting/social space, project-, creative- or classroom, kitchen, coffee corner were removed from the model. These were eliminated to develop an efficient model that provides a good fit of the data. Although these eliminated variables showed at least one significant bivariate relation with another variable, this relation did not remain significant in the full model. This results in the final model discussed in the next section.

## **Results**

### ***Sample***

Table 3 shows the distributions in the sample in terms of personal and work-related characteristics. This table points out that men (68%) are overrepresented in this research. The age of the respondents on average is 40 years. The gross annual income is equally divided over the three categories. A relatively high number (32%) of respondents has a gross annual income of more than €50.000. This is also related to the high number of respondents that have a higher educational level (i.e. undergraduate or post graduate). Most respondents in the sample work as a freelancer (30%) or work at a SME (39%). Only a small percentage of the respondents (8%) work at a large enterprise. Most respondents work on a fulltime basis (40%). On average, respondents work at the business centre for 3.63 years and spend 33 hours a week at the business centres. The mean number of business club memberships is 1.16.

Table 4 shows the distributions of the sample on the independent and dependent variables used in the path analysis. Regarding the frequency of using offered facilities; respondents use a kitchen, print/copy area, elevator and coffee corner most frequently. An

atelier space, event space, common terrace, lounge room and a concentration room the least. In addition, almost half of the respondents work together with others in a closed space, 31% works alone in a closed space and 24% works in an open space. Similarly as in single-tenant buildings, most of the respondents (79%) have a personal workspace. As expected, respondents in this sample network socially and share knowledge with colleagues more frequently than with people from other organizations in business centres (resp.  $M=5.23$  and  $4.45$  for colleagues versus  $3.93$  and  $2.01$  for others in the building).

### ***Goodness of fit of the model***

There are several measures of model fit. Generally, a model provides a good fit of the data if the value of Chi Square divided by the degrees of freedom and the Normed Fit Index are close to 1 (Golob 2001). For the present model, the values are 1.42 (Chi-square ratio) and 0.97 (NFI). The value of RMSEA needs to be (close to) 0; this model results in a RMSEA value of 0.040. In addition, the value of the model's Akaike information criterion (AIC) needs to be close to the value of saturated AIC (Golob 2001). For the present model, the AIC value of 193.72 is close to the saturated AIC value of 210.00. Overall, it can be concluded that the model shows a good fit with the data. Figure 2 shows the final estimated path model with only the direct standardized significant effects.

### ***Effects between social networking and knowledge sharing***

Table 5 shows several direct and also indirect effects between social networking and knowledge sharing behaviour with colleagues and others. It also shows the total standardized effects. First, frequency of social networking with colleagues was found to affect knowledge sharing behaviour with colleagues. The same was found for social networking with others. This was expected, because knowledge sharing behaviour tends to occur through social

interactions (e.g. Wang and Noe 2010). In addition, a direct significant effect of knowledge sharing with colleagues on knowledge sharing with people from other organizations was found. This suggests that people who share knowledge with colleagues are also more likely to share knowledge with people from other organizations more frequently. With regard to the standardized effects, the results show that social networking with colleagues or people from other organizations has overall the largest standardized effect on knowledge sharing with colleagues ( $\beta=0.48$ ) or with people from other organizations ( $\beta=0.30$ ).

### *Effects of demographics and organizational type*

With regard to demographics, age was found to have a significant negative direct effect on social networking with colleagues. This result suggests that older employees interact less with colleagues. Male employees were found to interact more with colleagues than female employees. Furthermore, as expected, people with more business club memberships more frequently share knowledge with others. The membership of an informal organization (club/association membership) could lead to relationships (networks), which are important resources for knowledge sharing behaviour (Dodd and Patra 2002). However, no relation was found between business club membership and social networking with others.

With regard to organization type, working as a freelancer was found to have a significant negative direct effect on social networking and knowledge sharing with colleagues and a significant positive effect on social networking with people from other organizations.

The results of the overall standardized effects of the demographics and organizational type in Table 5 show that age ( $\beta=-0.37$ ) and gender ( $\beta=0.18$ ) have the largest direct effect on social networking with colleagues. Working as a freelancer has a large direct effect on social networking with colleagues ( $\beta=-0.21$ ) knowledge sharing with colleagues ( $\beta=-0.33$ ) and a

smaller direct effect on social networking with people from other organizations ( $\beta=0.15$ ).

### ***Effects of the physical work environment***

As can be seen in Figure 2, facilities are highly important for knowledge sharing behaviour and social networking with colleagues and others. Frequent use of a restaurant or canteen was found to have a significant positive effect on the number of interactions with others. Frequent use of a lounge room stimulates knowledge sharing behaviour with others. This is also a place where people relax, and it provides opportunities to meet other people and share knowledge (Chevez and Aznavoorian 2014). Table 5 shows that the use of an event space has a direct effect on knowledge sharing behaviour with others. The more frequently business centre users use an event space, the more frequently they share knowledge with people from other organizations. These event spaces are probably used for networking events organized by tenants or the business centre manager. As expected, the use of a meeting space was found to positively affect social networking and knowledge sharing with colleagues only.

Besides facilities, the workspace is also important for knowledge sharing behaviour and social networking with colleagues and others. Having an individual workspace (alone in a closed room) has a negative direct effect on knowledge sharing behaviour with colleagues and a negative direct effect on social networking with colleagues. Moreover, having a flexibly used workspace has a positive effect on knowledge sharing behaviour with other people in a business centre.

With regard to the standardized effects, the results show that an individual workspace ( $\beta=-0.24$ ) and the use of meeting spaces ( $\beta=0.24$ ) have the largest direct effect on social networking with colleagues. Using a lounge room has the largest effect ( $\beta=0.27$ ) on knowledge sharing with people from other organizations. Other indirect or direct

standardized effects on knowledge sharing with people from other organizations were found of a flexibly used workspace (i.e. non-territorial workspace) ( $\beta=0.15$ ), using a restaurant/canteen ( $\beta=0.06$ ), using a meeting space ( $\beta=0.06$ ) and an individual closed workspace ( $\beta=-0.06$ ).

### ***Indirect effects mediated by social networking***

With regard to the indirect effects, social networking with colleagues was found to be indirectly related to knowledge sharing behaviour with others, mediated by social networking with people from other organizations. Apparently, people who have more interactions with colleagues have more interactions with people from other organizations as well and thus eventually share more knowledge with others. These people are probably more extraverted and therefore, overall more willing to interact and share knowledge with others.

Furthermore, indirect effects were found of age on knowledge sharing behaviour with colleagues and others and also on social networking with others, mediated by social networking with colleagues. Older employees interact less with colleagues and therefore probably share less knowledge than younger employees. Male employees indirectly more often share knowledge with colleagues and others, through social networking behaviour.

In addition, an indirect significant positive effect on knowledge sharing with people from other organizations was found. This is expected, because freelancers mostly do not have colleagues to interact or share knowledge with, and therefore they can only interact and share knowledge with people from other organizations in the business centre.

With regard to the physical work environment, the use of a restaurant/canteen was also found to have an indirect effect on knowledge sharing behaviour with others, mediated

by social networking with others. A restaurant is an informal space, and this type of space allows people to relax and connect with other individuals. Furthermore, having an individual workspace (alone in a closed room) has a negative indirect effect on social networking and knowledge sharing behaviour with others, mediated by social networking with colleagues.

## **Discussion**

Organizations are increasingly acknowledging the need for work environments that stimulate knowledge sharing (Ives, Torrey and Gordon 2000), as knowledge sharing increases the performance and innovativeness of individuals and organizations (e.g. Haas and Hansen 2007). For users of business centres, the opportunity for social networking and knowledge sharing is also one of the aspects they mostly value (Ketting 2014). Although business centres have become an important sector of the property market and several new business centre concepts have been emerging, empirical research on this topic is still limited. With regard to social networking and knowledge sharing, previous research mainly focused on knowledge sharing within large organizations in single-tenant offices. Therefore, it is important to better understand the relationship between facilities shared by multiple organizations (as specific characteristic of a business centre) and the perceived behavior in social networking and knowledge sharing within and between organizations.

Previous studies also showed that, besides physical characteristics, user demographics and organization type are additional drivers of social networking and knowledge sharing within a large organization. The aim of this study was therefore to analyse all of these effects on social networking and knowledge sharing within and between organizations. A second contribution to the literature is thus that all antecedents are simultaneously tested in a holistic model, looking at perceived knowledge sharing within as well as between organizations. This

way, similarities and differences in the effects on both important sources for knowledge sharing are uncovered, plus the interrelationship between knowledge sharing and social networking.

The results showed several new insights in the relation between the physical work environment of business centres and knowledge sharing behaviour. The final path model, for example, showed that the use of several facilities directly or indirectly influences knowledge sharing within and between organizations, mediated by social networking with colleagues and others. Especially a variety of facilities for formal and informal meetings was found to positively influence people's social networking with each other or sharing knowledge, namely a restaurant/canteen, event space, lounge room and a meeting space. This is in line with previous research in single-tenant offices by Peponis et al. (2007), Kastelein (2014), Hua et al. (2011) and Staplehurst and Ragsdell (2010). Thus, business centres can focus more on social networking and knowledge sharing by offering a variety of meeting facilities, to attract innovative organizations that strive for more knowledge sharing. In addition, managers of these tenant organizations should also stimulate their employees to use these shared facilities. For example, by changing their work processes or activities into more collaborative and possible interactive work for which these type of spaces are needed. Further research is needed regarding the incentives for employees to use different workspaces and to share knowledge with colleagues or with people from other organizations.

This study showed that an individual closed workspace negatively influences social networking and knowledge sharing within organizations. Thus, the data support the relationship assumed between workspace type and social networking and knowledge sharing. Previous research also showed that a cellular office, whereby mostly individual non-shared workspaces are offered, compared to an open office (with low partitions), decreases the

number of interactions between people (e.g. Blakstad, Hatling, and Bygdås 2009; Binyaseen 2010). An open work environment could increase trust among people, which could result in more willingness to share knowledge (e.g. Zagenczyk, Murrell, and Gibney 2008). In addition, people who are sitting close to each other and can see each other appear to have more interactions (Steen 2009). Despite these advantages, working in a more open workspace has several disadvantages, such as more noise, reduced privacy and fewer opportunities to perform work that needs concentration (Van der Voordt and Van Meel 2000; Blakstad, Hatling, and Bygdås 2009). Therefore, a balanced physical work environment should be designed that facilitates different types of work activities that overcomes the disadvantages of open or closed work environments (Horr et al. 2016) based on the needs and preferences of individual users. This could improve the productivity and creativity of workers (Anjum, Ashcroft, and Paul 2015). For example, a combination of open workspaces for social networking, meeting spaces for planned meetings and concentrations rooms for work that needs more concentration. This is also observed in a previous study by Lee (2016) who showed that a balanced spatial layout leads to a more effective workflow and interaction and collaborating, because the space is flexible and several different work activities (e.g. spaces for idea generation) are accommodated. Business centres with only a cellular office structure probably do not stimulate knowledge sharing within and between organizations. Such office buildings are not optimally transformed to business centres and eventually might exhibit a high level of vacancy when tenants recognize that they are not getting what they expected.

With regard to the use of workspaces, this study offers evidence for the idea that having a flexible workspace increases knowledge sharing with other people in business centres. This is in line with previous studies of single tenant offices that showed that flexible workspaces influence interaction patterns (e.g. Van der Voordt and Van Meel 2000).

However, 79% of the respondents still have a fixed workspace. Thus, business centre managers could provide more flexible spaces to stimulate knowledge sharing between their tenant organizations if these organizations and their employees are interested in and willing to work in such an environment. Although a more flexible use of the work environment increases interactions between people, this could also lead to problems, such as that people are not able to find a workspace or a specific person and it is more difficult to personalize the workspace (e.g. Kim et al. 2016). So it could also push tenants away, if they are unable to adapt their workstyle to a flexible work environment. Therefore, it is also important for owners/managers of business centres to gain insight in user preferences with regard to their work environment. They could adapt to specific preferences and create more attractive business centres with innovative hotspots (i.e. restaurant/canteen, informal meeting spaces, lounge spaces and event spaces) and flexible workspaces where people interact and eventually share knowledge. Although the design of a building can create an innovative setting, the individuals in the building also need to take initiatives to use the various facilities and contribute to sharing knowledge (e.g. Clements-Croome 2015). In addition, it is also recognized that services offered by the business centre (e.g. community membership, partnerships, networking events) are instrumental in increasing knowledge sharing within and between organizations (Petrolaitiene et al. 2017).

Furthermore, people who socially interact more with colleagues also appear to interact more with people from other organizations and therefore indirectly share more knowledge. This underlines the importance of social networking (i.e. social interactions) as a mediator for knowledge sharing within and between organizations, which was also observed in previous research conducted in larger organizations located in single tenant offices (e.g. Marouf and Doreian 2010). For these interactive people, working in a business centre is thus very

important in acquiring external knowledge for their own organization. Innovative organizations should therefore stimulate this type of employees to work (at least a part of their time) in a business centre. Using the physical design of their buildings, business centre managers are indeed able to increase people's efforts towards knowledge sharing and eventually the innovative capabilities of their tenants.

As expected, demographics such as age, gender and membership of a business association were found to have a large effect on social networking and knowledge sharing too. Older employees were found to share less knowledge with colleagues than younger employees. However, especially older workers are likely to have more valuable knowledge and work experience (Oye, Salleh, and Noorminshah 2013). Therefore, motivating older employees, for example by HR managers, to share their knowledge with others may be especially beneficial for the organization. By giving older employees a mentoring role, younger employees can learn from the knowledge and experiences of their more senior colleagues (Brčić and Mihelič 2015). It is also recognized that reversed mentoring could help older employees to acquire technology-related skills from younger employees (Murphy 2012). The model estimated in this study does not reveal the causes of this age effect.

The results showed that male workers socially interact more frequently than women and thus indirectly share knowledge more frequently with colleagues and other people in the business centre. This is in line with previous research that showed that the business network (i.e. personally knowing other entrepreneurs) of female entrepreneurs is smaller than the networks of their male counterparts (Klyver and Grant 2010). This finding can also be related to the fact that women are mostly in different job positions than men, whereby networking and knowledge sharing is less necessary (Ridgeway and Smith-Lovin 1999). Another study showed that females are more willing to share knowledge if they frequently interact with this

other person (i.e. strong tie) (Lin 2006). Female workers, in higher job position (e.g. management function), should be made aware of the fact that they can get knowledge from people within their own organization or from people of other organizations in the business centre.

Being a member of a business club is also important for knowledge sharing with people from other organizations. Previous research has also observed that the membership of a business club (or other organization) increases one's network (Dodd and Patra 2002) and thus also the chance of sharing knowledge with others. As such, business centre managers could stimulate their tenants to create a business club that organizes networking events, to stimulate interactions among tenants and eventually knowledge sharing.

### **Conclusion, limitations and future work**

Although this study showed that the physical work environment significantly influences knowledge sharing in business centres, earlier studies have concluded that knowledge sharing also depends on several other context variables such as trust (Levin and Cross 2004), personality, (Gupta 2008), organizational culture (Xerri and Brunetto 2010), structure (Chen and Huang 2007), organizational size (Chevez and Aznavoorian 2014), and technological context (Ismail and Yusof, 2010). In addition, several other relevant characteristics of the physical work environment were not included in this study: the distance between workspaces and facilities (e.g. Wineman et al. 2014), the actual lay-out of a business centre, the exact location of facilities (e.g. distance to facilities), or the proximity between people. Including all these variables could result in a more comprehensive model that can be used to analyse knowledge sharing in business centres in more depth. In addition, using a larger dataset, also from different countries, would help to increase the generalizability of the results.

The path model simultaneously tests multiple expected direct and indirect effects. However, a limitation of cross-sectional analysis in general is that the model cannot establish the direction of causality. Therefore, statements about the causal direction of the effects cannot be made. In this respect, causal terms such as ‘influence’ and ‘effect’ are often used in this paper, but strictly speaking, these are merely causal *interpretations* of statistically significant relationships that may involve cause-effect relationships in both directions. For example, individuals that overall engage more frequently in social networking with others could also prefer a more open work environment, and vice versa. Although causal relations cannot be unambiguously determined, the analysis in this study nevertheless revealed interesting relationships between the physical work environment, social networking and knowledge sharing.

Furthermore, the results of this study showed some age differences with regard to knowledge sharing, and therefore future research also needs to conduct a more in-depth analysis of the differences between generations of workers (e.g. baby boom generation, generation x and generation y) with regard to knowledge sharing. Older workers may prefer social networking, and therefore knowledge sharing, in more traditional ways (e.g. face-to-face and by telephone), while younger workers are likely to prefer electronic communication (Brčić and Mihelič 2015). Future research in this area also needs to explore whether gender differences exist in the motivation to share knowledge in business centres. Furthermore, more research is needed on how different types of interactions influence knowledge sharing behaviour within and between organizations in business centres, for example, by observing and analysing real-time knowledge sharing behaviour instead of perceived behaviour.

Work style trends such as working from home and virtual working have been changing the work environment in many organizations towards a more social and interactive

environment for face-to-face meetings, collaboration, social events and workshops (Johns and Gratton 2013). Thus, the physical work environment in business centres is becoming more and more important for knowledge sharing, and should therefore be managed and planned in ways that help their residents become more successful (Wang and Noe 2010).

Especially for business centres in which different organizations share spaces, facilities and services, more research is needed to investigate and determine the added value of business centres for knowledge sharing and other important user values. This study contributes to this knowledge gap by demonstrating the relationship between the physical work environment and perceived knowledge sharing between organizations located in a business centre.

## References

- Anjum, N., R. Ashcroft, and J. Paul. 2015. "Privacy in the workplace design." *The Design Journal* 7(1): 27-42. doi: 10.2752/146069204789355236
- Appel-Meulenbroek, H.A.J.A., B. De Vries, and M. Weggeman. 2017. "Knowledge sharing behaviour: the role of spatial design in buildings." *Environment and Behavior* 49(8): 874-903. doi: 10.1177/0013916516673405
- Asheim, B.T., L. Coenen, and M. Svensson-Henning. 2003. "Nordic SME's and Regional Innovation Systems." Final Report, Nordisk Industrifond, Oslo.
- Becerra-Fernandez, I., and R. Sabherwal. 2010. "Knowledge Management: Systems and Processes." Armonk (N.Y.); London: M.E. Sharpe.
- Binyaseen, A.M.A. 2010. "Office layouts and employee participation." *Facilities* 28(7/8): 348-357.
- Blakstad, S.H., M. Hatling, and A.L. Bygdås. 2009. "The knowledge workplace – searching for data on use of open plan offices." Proceedings *EFMC 2009 research symposium*, 16-17 June, Amsterdam, the Netherlands.
- Bøllingtoft, A. and J.P. Ulhøi. 2005. "The networked business incubator-leveraging entrepreneurial agency?" *Journal of Business Venturing* 20: 265-290. doi: 10.1016/j.jbusvent.2003.12.005

- Borgatti, S.P., and D.S. Halgin. 2011. "On network theory." *Organization Science* 22: 1168-1181. doi: 10.1287/orsc.1100.0641
- Brčić, Z.J., and K.K. Mihelič. 2015. "Knowledge sharing between different generations of employees: an example from Slovenia." *Economic Research* 28(1): 853-867. doi: 10.1080/1331677X.2015.1092308
- Brennan, A., J.S. Chugh, and T. Kline. 2002. "Traditional versus open office design: a longitudinal." *Environment and Behavior* 34(3): 279-299. doi: 10.1177/0013916502034003001
- Chevez, A., and L. Aznavoorian. 2014. "Space as a knowledge management tool." *Work & Place* 3(2): 11-14.
- Chigot, P. 2003. "Controlled transparency in workplace design: Balancing visual and acoustic interaction in office environments." *Journal of Facilities Management* 2(2): 121-130. doi: 10.1108/14725960410808159
- Chusid, M. 2001. "Public Musing on Acoustical Privacy. In offices, it's not only what you hear but what you don't hear that matters." *Architectural Record* 189(9): 163.
- Clements-Croome, R. 2015. "Creative and productive workplaces: a review." *Intelligent Buildings International* 7 (4): 164-183. doi: 10.1080/17508975.2015.1019698
- Easterby-Smith, M., M.A. Lyles, and E.W.K. Tsang. 2008. "Inter-organizational knowledge transfer: Current themes and future prospects." *Journal of Management Studies* 45(4): 677-690. doi: 10.1111/j.1467-6486.2008.00773.x
- Gibson, V.A. 2003. "Flexible working needs flexible space?" *Journal of Property Investment and Finance* 21(1): 12-22. doi: 10.1108/14635780310468275
- Golob, T. 2001. "Structural equation modeling for travel behavior research." *Transportation Research Record* 37: 1-25. doi: 10.1016/S0191-2615(01)00046-7
- Granovetter, M. 1973. "The strength of weak ties." *American Journal of Sociology* 78(6): 1360-1380.
- Haas, M. R., and M.T. Hansen. 2007. "Different knowledge, different benefits: Toward a productivity perspective on knowledge sharing in organizations." *Strategic Management Journal* 28(11): 1133-1153.
- Harris, R. 2015. "The changing nature of the workplace and the future of office space." *Journal of Property Investment & Finance* 33(5): 424-435. doi: 10.1108/JPIF-05-2015-0029

- Hartog, L.M., M. Weijs-Perrée, and H.A.J.A. Appel-Meulenbroek. 2017. "The influence of personality on user satisfaction: multi-tenant offices." *Building Research and Information* 46(4): 402-416. doi:10.1080/09613218.2017.1307015
- Horr, Y.A., M. Arif, A. Kaushik, A. Mazroei, and M. Katafyhiotou. 2016. "Occupant productivity and office indoor environment quality: a review of the literature." *Building and Environment* 105: 369-389. doi: 10.1016/j.buildenv.2016.06.001
- Hua, Y., V. Loftness, J.H. Heerwagen, and K.M. Powell. 2011. "Relationship between workplace spatial settings and occupant-perceived support for collaboration." *Environment and Behavior* 43(6): 807-826. doi: 10.1177/0013916510364465
- Huggins, R., H. Izushi, and P. Thompson. 2013. "Regional Competitiveness: Theories and Methodologies for Empirical Analysis." *JCC: The Business and Economics Research Journal* 6(2): 155-172. doi: 10.7835/jcc-berj-2013-0086
- Israilidis, J., E. Siachou, L. Cooke, and R. Lock. 2015. "Individual variables with an impact on knowledge sharing: the critical role of employees' ignorance." *Journal of Knowledge Management* 19(6): 1109-1123. doi: 10.1108/JKM-04-2015-0153
- Ives, W., B. Torrey, and C. Gordon. 2000. "Knowledge Sharing Is a Human Behavior. In D. Morey, M. Maybury, and B. Thuraisingham (Eds.), *Knowledge management Classic and contemporary work* (pp. 99-129). Cambridge.
- Johns, T., and L. Gratton. 2013. "The Third Wave of Virtual Work." *Harvard Business Review* 91(1-2): 66-73.
- Jöreskog, K., and D. Sörbom. 2008. "LISREL 8. User's reference guide." Chicago: Scientific Software International.
- Kabo, F., Y. Hwang, M. Levenstein, and J. Owen-Smith. 2015. "Shared paths to the lab: A sociospatial network analysis of collaboration." *Environment and Behavior* 47: 57-84. doi:10.1177/0013916513493909
- Kastelein, J.P. 2014. "Space meets knowledge." Doctoral dissertation, Nijenrode Business School, The Netherlands.
- Ketting, J. 2014. "Het bedrijfsverzamelgebouw. Een onderzoek naar de toegevoegde waarde van bedrijfsverzamelgebouwen." Master Thesis, Technical University Delft.
- Kim, J., C. Candido, L. Thomas, and R. De Dear. 2016. "Desk ownership in the workplace: the effect of non-territorial working on employee workplace satisfaction, perceived productivity and health." *Building and Environment* 103: 203-214. doi: 10.1016/j.buildenv.2016.04.015

- Klyver, K., and S. Grant. 2010. "Gender differences in entrepreneurial networking and participation." *International Journal of Gender and Entrepreneurship* 2(3): 213-227. doi: 10.1108/17566261011079215
- Lee, Y.S. 2016. "Creative workplace characteristics and innovative start-up companies." *Facilities* 34(7/8): 413-432. doi: 10.1108/F-06-2014-0054
- Levin, D.Z., and R. Cross. 2004. "The Strength of Weak Ties You Can Trust: The Mediating Role of Trust in Effective Knowledge Transfer." *Management Science* 50(11): 1477-1490. doi: 10.1287/mnsc.1030.0136
- Lin, C-P. 2006. "Gender differs: modelling knowledge sharing from a perspective of social network ties." *Asian Journal of Social Psychology* 9: 236-241. doi: 10.1111/j.1467-839X.2006.00202.x
- Marouf, L.N. 2007. "Social networks and knowledge sharing in organizations: a case study." *Journal of Knowledge Management* 11(6): 110-125. doi: 10.1108/13673270710832208
- Marouf, L.N., and P. Doreian. 2010. "Understanding Information and Knowledge Flows as Network Processes in an Oil Company." *Journal of Information & Knowledge Management* 9(2): 105-118. doi: 10.1142/S0219649210002565
- Mitchell, J.C. 1969. "The concept and use of social networks." In J. C. Mitchell (ed.), *Social Networks in Urban Situations: Analyses of Personal Relationships in Central African Towns*, pp. 1-50. Manchester, UK: Manchester University Press.
- Moriset, B. 2014. "Building new places of the creative economy." The rise of coworking spaces. Proceedings of *the 2nd Geography of Innovation, International Conference 2014*, Utrecht University, Utrecht (The Netherlands)
- Murphy, M.W. 2012. "Reverse mentoring at work: Fostering cross-generational learning and developing millennial leaders." *Human Resource Management* 51: 549-573. doi: 10.1002/hrm.21489
- Ngah, R., and K. Jusoff. 2009. "Tacit Knowledge Sharing and SMEs' Organizational Performance." *International Journal of Economics and Finance* 1(1): 216-220. doi: 10.5539/ijef.v1n1p216
- Okyere-Kwakye, E., and K.M. Nor. 2011. "Individual factors and knowledge sharing." *American Journal of Economics and Business Administration* 3(1): 66-72.

- Oye, N.D., M. Salleh, and A. Noorminshah. 2013. "Knowledge Sharing in Workplace: Motivators and Demotivators." *International Journal of Managing Information Technology* 3(4): 71-84. doi: 10.5121/ijmit.2011.3406
- Pangil, F., and A.M. Nadurdin. 2008. "Demographic factors and knowledge sharing behavior among R&D Employees." Knowledge Management International Conference, Langkawi, pp. 128-133.
- Peponis, J., S. Bafna, R. Bajaj, J. Bromberg, C. Congdon, M. Rashid, S. Warmels, Y. Zhang, and C. Zimring. 2007. "Designing Space to Support Knowledge Work." *Environment and Behavior* 39(6): 815-840. doi: 10.1177/0013916506297216
- Petrulaitiene, V., E. Rytönen, S. Nenonen, and T. Jylhä. 2017. "Towards responsive workplaces – identifying service paths for time- and place-independent work." *Journal of Corporate Real Estate* 19(3): 144-156. doi: 10.1108/JCRE-10-2016-0034.
- Rashid, M., K. Kampschroer, J. Wineman, and C. Zimring. 2006. "Spatial Layout and face-to-face interaction in offices-A study of the mechanisms of spatial effects on face-to-face interaction." *Environment and planning B: Planning and Design* 33(6): 825-844. doi: 10.1068/b31123
- Reagans, R., and B. McEvily. 2003. "Network Structure and Knowledge Transfer: The Effects of Cohesion and Range." *Administrative Science Quarterly* 48(2): 240-267. doi: 10.2307/3556658
- Seufert, A., G. Von Krogh, G., and A. Back. 1999. "Towards knowledge networking." *Journal of Knowledge Management* 3(3): 180-190. doi: 10.1108/13673279910288608
- Staplehurst, J., and G. Ragsdell. 2010. "Knowledge Sharing in SMEs: A Comparison of Two Case Study Organizations." *Journal of Knowledge Management Practice* 11(1).
- Suckley, L., and S. Dobson. 2014. "Measuring Social and Spatial Relations in an Office Move." *Social Informatics, Lecture Notes in Computer Science* 8851: 487-492.
- Streiner, D.L. 2005. "Finding our way: an introduction to path analysis." *Canadian Journal of Psychiatry* 50: 115-122. doi: 10.1177/070674370505000207
- Sykes, K. 2014. "Coworking: a workplace paradigm shift." *Contract* 55(6): 140-145.
- Tsai, W. 2002. "Social structure of cooperation within a multiunit organization: Coordination, competition, and intra-organizational knowledge sharing." *Organization Science* 13(2): 179-190. doi: 10.1287/orsc.13.2.179.536

- Vajjhala, N.R. 2013. "Key barriers to knowledge sharing in medium-sized enterprises in transition economies." *International Journal of Business and Social Science* 4(14): 90-98.
- Van den Hooff, B., and J.A. De Ridder. 2004. "Knowledge sharing in context: The influence of organizational commitment, communication climate and CMC use on knowledge sharing." *Journal of Knowledge Management* 8(6): 117-130. doi: 10.1108/13673270410567675
- Van der Voordt, D.J.M., and J.J. Van Meel. 2000. "Lessons from innovations." In: G. Dewulf, P. Krumm, H. de Jonge (eds), *Successful corporate real estate strategies*. Arko Publishers, Nieuwegein, pp. 51-64.
- Van Wijk, R., J.P. Jansen, and M.A. Lyles. 2008. "Inter- and intra-organizational knowledge transfer: a meta-analytic review and assessment of its antecedents and consequences." *Journal of Management studies* 45: 815-838. doi: 10.1111/j.1467-6486.2008.00771.x
- Wang, S., and R.A. Noe. 2010. "Knowledge sharing: A review and directions for future research." *Human Resource Management Review* 20: 115-131. doi: 10.1016/j.hrmr.2009.10.001
- Wasserman, S.T., and K. Faust. 2008. "Social network analysis. Methods and applications, 17." Cambridge: Cambridge Univ. Press (*Structural analysis in the social sciences*, 8).
- Weijts-Perrée, M., H.A.J.A. Appel-Meulenbroek, B. De Vries, and S. Romme. 2016. "Differences between business center concepts in The Netherlands." *Property Management* 34(2): 100-119. doi: 10.1108/PM-04-2015-0015
- Wensley, A. 1998. "The value of story telling." *Knowledge and Process Management* 5(1): 1-2.
- Wineman, J.D., F.W. Kabo, and G.F. Davis. 2009. "Spatial and Social Networks in Organizational Innovation." *Environment and Behavior* 41(3): 427-442. doi: 10.1177/0013916508314854
- Wineman, J.D., Y. Hwang, F. Kabo, J. Owen-Smith, and G.F. Davis. 2014. "Spatial layout, social structure, and innovation in organizations." *Environment and Planning B: Planning and Design* 41: 1100-1112. doi: 10.1068/b130074p
- Xerri, M., and Y. Brunetto. 2010. "The strength of workplace social network ties in SME's: a social exchange perspective." Paper presented at *to Management research in a*

*changing climate: British Academy of Management Conference*. Sheffield, UK, 14-16 September.

Yi, J. 2009. "A measure of knowledge sharing behavior: scale development and validation."

*Knowledge Management Research & Practice* 7(1): 65-.81. doi:

10.1057/9781137552105\_10

Zagenczyk, T.J., A.J. Murrell, and R. Gibney. 2008. "Effects of the physical work environment on the creation of individual- and group-level social

capital." *International Journal of Organizational Analysis*, 15(2): 119-135. doi:

10.1108/19348830710868275

Zengyu Huang, V., A. Nandialath, A.K. Alsayaghi, and E.E. Karadeniz. 2013. "Socio-demographic factors and network configuration among MENA entrepreneurs".

*International Journal of Emerging Markets* 8(3): 258-281. doi:

10.1108/17468801311330329

## Tables

Table 1 Measures of personal, work-related and business center characteristics

	Measurement level	Categories
<i>Personal characteristics</i>		
Age	Ratio	
Gender	Nominal	(1) Male (2) Female
Education level	Ordinal	(1) Secondary or vocational education (2) Undergraduate (3) Postgraduate
<i>Work-related characteristics</i>		
Organization type	Nominal	(1) Freelancer (2) Small and medium-sized enterprises (3) Start-up enterprises (4) Large enterprise (5) Other, namely:
Work situation	Nominal	(1) Fulltime employee (2) Part-time employee (3) On a project basis (4) Student (5) Not applicable
# Years working at the BC	Ratio	
# Hours spent in the BC	Ratio	
# Business club memberships	Ratio	
<i>Physical work environment characteristics</i>		
Workspace type (adapted from Van Meel 2000; Binyaseen 2010; Chusid 2001)	Nominal	(1) Individual closed workspace (2) Together with others in a closed workspace (3) Together with others in an open workspace without partitions (4) Together with others in an open workspace with partitions
Workspace use (adapted from Van Meel, 2000)	Nominal	(1) A personal fixed workspace (2) A shared fixed work space (3) A non-territorial workspace
<i>Business centre facilities</i>		
Frequency of using business centre facilities (adapted from Weijs-Perrée et al. 2016): a kitchen, print/copy area, elevator, coffee corner, meeting space/conference room, restaurant/canteen, informal/social meeting space, concentration room, common terrace, lounge room, event space, project-, creative- or classroom, business unit, laboratory space, fitness/gym, showroom, storage space and an atelier space	Ordinal	(1) Never (2) Less than once a month (3) Once a month (4) Once a week (5) Multiple times a week (6) (almost) Daily (7) Multiple times a day

Table 2 Measures of networking and knowledge sharing behaviour in business centres  
(adapted from Marouf, 2007)

	Measurement level	Categories
<i>Social networking with colleagues</i>	Ordinal	(1) Never (2) Less than once a month (3) Once a month (4) Once a week (5) Multiple times a week (6) (almost) Daily (7) Multiple times a day
Frequency of having a social interaction		
<i>Social networking with people from other organizations</i>		
Frequency of having a social interaction		
<i>Knowledge sharing with colleagues</i>	Ordinal	(1) Never (2) Less than once a month (3) Once a month (4) Once a week (5) Multiple times a week (6) (almost) Daily (7) Multiple times a day
Frequency of asking for advice if you need help with a particular skill or competence for your work (Public non-codified knowledge)		
Frequency of exchanging documents (e.g. notes, reports or annual reports) (Public codified knowledge)		
Frequency of sharing your expertise in face-to-face interactions (Private non-codified knowledge)		
Frequency of sharing your expertise through other ways (e.g. e-mail, notes, letters, instant messaging) (Private codified knowledge)		
<i>Knowledge sharing with people from other organizations</i>		
Frequency of asking for advice if you need help with a particular skill or competence for your work. (Public non-codified knowledge)		
Frequency of exchanging documents (e.g. notes, reports or annual reports) (Public codified knowledge)		
Frequency of sharing your expertise in face-to-face interactions (Private non-codified knowledge)		
Frequency of sharing your expertise through other ways (e.g. e-mail, notes, letters, instant messaging) (Private codified knowledge)		

Table 3 Sample characteristics (N=268)

	Sample (N)	Sample (%)	Mean	St. Dev.
<i>Age</i>	267		40.32	12.033
<i>Gender</i>				
Male	181	68		
Female	87	32		
<i>Gross annual Income</i>				
Low income (< € 30.000)	89	33		
Moderate income (€ 30.000 - € 50.000)	71	27		
High income (> € 50.000)	87	32		
(Missing)	21	8		
<i>Education level</i>				
Secondary or vocational education	54	20		
Undergraduate	139	52		
Postgraduate	75	28		
<i>Work situation</i>				
Fulltime employee	108	40		
Part-time employee	36	13		
Works on a project basis or student	30	11		
Not applicable	94	35		
<i>Organization type</i>				
Freelancer	80	30		
Small and medium-sized enterprises	106	39		
Start-up enterprises	41	15		
Large enterprise	21	8		
Other	20	8		
<i># Years working at the business centre</i>	234		3.63	4.577
<i># Hours spent in the business centre</i>	268		32.96	11.966
<i># Business club memberships</i>	268		1.16	1.436

Table 4 Variables considered in the analyses (N=268)

	Mean	St. Dev.
<i>Frequency of using offered facilities in a business centre: (1) never to (7) multiple times a day</i>		
Kitchen	3.94	2.522
Print/copy area	3.86	2.489
Elevator	3.53	2.611
Coffee corner	3.32	2.641
Meeting space/conference room	2.84	1.802
Restaurant/canteen	2.72	1.783
Informal-/social meeting space	2.47	1.871
Concentration room	1.60	1.284
Common terrace	1.58	1.048
Lounge room	1.56	1.278
Event space	1.49	1.007
Project-, creative- or classroom	1.41	1.120
Atelier space	1.23	0.938
<i>Workspace type (Yes=1, No=0)</i>		
Individual workspace (alone in a closed space) (dummy)	0.31	0.462
Together with others in a closed space (dummy)	0.45	0.500
An open space without partitions (dummy)	0.20	0.399
An open space with partitions (dummy)	0.04	0.190
<i>Workspace use (Yes=1, No=0)</i>		
A personal workspace (dummy)	0.79	0.410
Workspace on rotation basis (dummy)	0.12	0.329
Flexible used workspace (dummy)	0.09	0.286
<i>Social networking with (Frequency of social interactions: (1) never to (7) multiple times a day)</i>		
Colleagues	5.23	2.079
Others	3.93	1.804
<i>Knowledge sharing (sum score frequency of sharing public non-codified knowledge, private non-codified knowledge, public codified knowledge and private codified knowledge)</i>		
Colleagues	4.45	2.001
Others	2.01	1.135

Table 5 Path analysis model estimates (unstandardized and standardized (S) effects)

From	To											
	Knowledge Sharing (KS) colleagues			KS with others			Social networking with colleagues			Social networking with others		
	Direct	Total	S total effect	Direct	Total	S total effect	Direct	Total	S total effect	Direct	Total	S total effect
<b><i>Effects between dependent variables</i></b>												
KS colleagues				0.10	0.10	0.18						
<i>t statistic</i>				3.10	3.10							
KS other												
<i>t statistic</i>												
Social networking with colleagues	0.46	0.46	0.48		0.08	0.16				0.20	0.20	0.24
<i>t statistic</i>	10.37	10.37			4.50					3.86	3.86	
Social networking with others				0.19	0.19	0.30						
<i>t statistic</i>				6.01	6.01							
<b><i>Effects of demographics and organizational type</i></b>												
Age		-0.03	-0.18		-0.01	-0.06	-0.06	-0.06	-0.37		-0.01	-0.09
<i>t statistic</i>		-8.93			-3.82		-7.23	-7.23			-3.34	
Men		0.37	0.09		0.07	0.03	0.81	0.81	0.18		0.17	0.04
<i>t statistic</i>		4.45			2.84		3.66	3.66			2.66	
Business club				0.11	0.11	0.14						
<i>t statistic</i>				2.87	2.87							
Freelancer	-1.44	-1.44	-0.33	0.38	0.38	0.16				0.84	0.84	0.21
<i>t statistic</i>	-7.11	-7.11		2.89	2.89					3.50	3.50	
<b><i>Effects of key variables</i></b>												
Event space				0.17	0.17	0.16						
<i>t statistic</i>				2.90	2.90							
Restaurant					0.04	0.06				0.20	0.20	0.19
<i>t statistic</i>					2.89					3.29	3.29	
Meeting space	0.24	0.24	0.10		0.03	0.06	0.28	0.28	0.24		0.06	0.06
<i>t statistic</i>	4.40	4.40			3.25		4.76	4.76			3.00	
Lounge room				0.24	0.24	0.27						
<i>t statistic</i>				5.06	5.06							
Individual workspace (dummy)	-0.50	-0.99	-0.11		-0.14	-0.05	-1.09	-1.09	-0.24		-0.22	-0.06
<i>t statistic</i>	-4.20	-4.32			-3.21		-4.60	-4.60			-2.96	
Flexibly used (dummy)				0.58	0.58	0.15						
<i>t statistic</i>				2.90	2.90							