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The relationship between face to face social networks and knowledge sharing: an exploratory study of manufacturing firms

Said Abdullah Al Saifi, Stuart Dillon and Robert McQueen

Said Abdullah Al Saifi is Lecturer at the Department of International Business Administration, Nizwa College of Applied Sciences, Nizwa, Oman. Stuart Dillon and Robert McQueen are both based at the Department of Management Systems, Waikato University, Hamilton, New Zealand.

Abstract

Purpose – This paper aims to explore the relationship between face-to-face social networks and knowledge sharing.

Design/methodology/approach – Qualitative data gathered through 25 semi-structured interviews in five manufacturing firms were collected and analysed. A grounded theory approach was used to analyse the data, which was supported through NVivo qualitative data analysis software.

Findings – The results reveal that face-to-face social networks facilitate knowledge sharing in diverse ways. These include the use of multiple communication styles, brainstorming and problem-solving, learning and teaching, training, consultations and employee rotation.

Practical implications – The findings of this research are expected to help practitioners to comprehend the big picture and scope of the steps they take to facilitate knowledge sharing in organisations. Viewing knowledge sharing from a holistic perspective can help practitioners comprehend how face-to-face knowledge sharing fits with and complements other knowledge-sharing channels, such as electronic social media and document repositories. In addition, through face-to-face social networks, practitioners can leverage work groups to increase knowledge sharing, meaning that potential cost savings and improved work practices can be achieved.

Originality/value – For researchers, three new models are developed which provide new insights into the nature of the relationship between face-to-face social networks and knowledge sharing. The first model relates to brainstorming and problem-solving, the second to knowledge levels and the direction of learning and teaching and the third to factors influencing social networks and knowledge sharing.

Keywords Knowledge management, Face to face social networks, Knowledge sharing

Paper type Research paper

1. Introduction

The primary goal of this research is to explore the nature of the relationship between face-to-face social networks and the sharing of knowledge. Knowledge is recognised to be the only resource that increases in value, so it is worth putting great effort into managing it (Probst et al., 2000). All organisations make strategic decisions, but smart decision-making lies at the heart of organisational knowledge and its management (Chien, 2006). Aside from its role in decision-making, knowledge management can add value in terms of innovation. Innovation is becoming an important driving force for individual companies, as well as the entire economy, and can play a significant role in the success of organisations (Gonzalez-Padron et al., 2010; He and Abdous, 2013). Another valuable outcome of knowledge management is that it has given many organisations a sustainable competitive advantage (Davenport and Prusak, 2000; Gonzalez-Padron et al., 2010; Liu and Lai, 2011), giving them a high ranking position in their markets.

The sharing of knowledge can enhance innovation through facilitating the free flow of ideas (Ritala et al., 2015; Wasko and Faraj, 2000), which in turn builds knowledge. It can also

enhance knowledge of market requirements and customers' demands (Fathi *et al.*, 2011). Knowledge sharing also brings opportunities to manufacturing companies in the area of product and service improvement and in the development of both visions and strategies (Sanchez and Palacios, 2007). Additionally, with effective knowledge sharing, manufacturing companies can get products and services to the market more quickly (Davenport and Prusak, 2000).

Knowledge within a modern manufacturing company commonly is widely regarded as one of its most valuable assets (Fischer and Stokic, 2002; Khodakarami and Chan, 2014). Previous literature suggests that high importance is placed on effective knowledge sharing by many manufacturing companies. However, there is a requirement to further reinforce implementation of knowledge sharing by effectively offering tangible evidence regarding the nature of the relationship between face-to-face social networks and knowledge-sharing practice.

The paper proceeds as follows: In the next section, relevant literature is reviewed and definitions of face-to-face social networks and knowledge sharing are presented, and the link between the two is illustrated. Next, the research methodology and design of the study are presented, followed by the findings and discussion sections. The paper concludes with conclusions and implications.

2. Literature review

2.1 Social networks

The term "social networks" has recently come to imply mainly electronic social networks, such as Facebook or LinkedIn. However, there are longer-standing uses of the term that go beyond this narrow view. A social network can be defined as "the pattern of ties linking a defined set of persons or social actors" (Seibert *et al.*, 2001, p. 220). Ideally, one person would set off a chain reaction so that everybody could be reached as quickly and with the least burden on any specific individual (Christakis and Fowler, 2011). Liebowitz (2007) and Nelson and Hsu (2008) define social networks as a set of relationships between a group of "actors" (the "actors" could be individuals, departments and so on) who usually have similar interests. Social network theory has been used as a theoretical lens aimed at elucidating the nature and interaction of individuals in social networks.

Social networks in the broad sense involve communication, dialogue and individual or group interaction that enhances and encourages knowledge-related employee activities (Leonard and Sensiper, 1998). Since the spectacular rise of computer-mediated social networking websites like Facebook, most of the contemporary use of the term social networks has come to mean the use of these online social media types of systems, and this has been reinforced by the movie "The Social Network" that described the genesis of Facebook. However, this study is not about computer-mediated communication, but instead focuses on the face-to-face interpersonal communications that happen constantly when people interact with each other in organisational contexts as they develop relationships, and in turn share their knowledge. To be more specific, the concept of a face-to-face social network in this research concentrates on the structure and interactions of interpersonal relationships.

2.2 Knowledge sharing

Knowledge sharing can be defined as "the act of making knowledge available to others within the organisation" (Ipe, 2003, p. 341). Similarly, Davenport and Prusak (2000) and Hsu and Chan (2014) propose that knowledge sharing means providing others with one's knowledge and receiving knowledge from others. This definition signifies that every knowledge-sharing behavior constitutes both donating or bringing knowledge together and collecting or receiving it. Knowledge sharing can also be defined as a culture of social interaction, denoting the exchange of people's knowledge, experiences and skills

throughout an entire organisation (Lin, 2007). In the same way, Ardichvili *et al.* (2003) observe that knowledge sharing involves both the provision of and the demand for new knowledge. Van den Hooff and de Leeuw van Weenen (2004) believe that knowledge sharing includes both the voluntary communication of one's knowledge to another and knowledge collecting. Examples of knowledge sharers include people who are willing to share knowledge to communicate effectively with colleagues (knowledge senders) and those who effectively consult friends to learn from them (knowledge receivers).

The effective sharing of knowledge in manufacturing companies can assist them in diverse ways. It can enhance innovation through facilitating the free flow of ideas (Wasko and Faraj, 2000), which, in turn, builds knowledge. It could also assist with knowledge of market requirements and customers' demands (Fathi *et al.*, 2011). Moreover, knowledge sharing brings advantages to manufacturing companies regarding the improvement of products and services, and the development of both vision and strategies (Sanchez and Palacios, 2007). In addition, with effective knowledge sharing, manufacturing companies can get products and services to the market more quickly (Davenport and Prusak, 2000).

2.3 Face-to-face social networks and knowledge sharing

The social interaction literature outlines numerous benefits of face-to-face social networks relevant to knowledge sharing in organisations. People who have a history of interaction with others are generally more helpful and accessible (Cross and Sproull, 2004), provide more assistance, support one another (Seibert *et al.*, 2001) and grow and evolve (Christakis and Fowler, 2011). Another group of researchers affirm that face-to-face social networks can be used for a variety of individual and organisational functions, including enhancing decision-making practices, providing messaging consistency and setting up social linkages (Mehra *et al.*, 2006; Mischen and Jackson, 2008; Seibert *et al.*, 2001). In addition, social interaction optimises the creation of novel strategies to deal with social issues (Christakis and Fowler, 2011). These functions help people to become better connected so the organisation can get the true advantage of their knowledge more quickly (Cross *et al.*, 2001).

Previous research shows that there is an urgent need for employees to collaborate and share knowledge instead of hoarding it (Husted *et al.*, 2012; Lu *et al.*, 2006). Taking a more pragmatic view, Chakravorti (2011) claims that knowledge management is not about only managing knowledge, but also about changing a culture to one that values knowledge sharing. Wong and Aspinwall (2004) point out that the most critical among the building blocks of knowledge management is creating a conducive and comfortable culture in an organisation to facilitate knowledge sharing.

In fact, the workplace is changing as greater social networking among employees becomes vital; therefore, diverse methods of knowledge sharing are required to provide employees with important skills and strategies for it (Drucker, 1999). Notwithstanding, it is acknowledged that organisations commonly repeat mistakes, duplicate tasks and otherwise waste resources because staff members are not able to see or find each other's work (Krebs, 2009). Therefore, it is necessary to build social networking by creating a strong culture of knowledge sharing.

To facilitate social networks, there is a need to build strong relationships. This in turn affects how much an employee wants to share knowledge, because good relationships can result in favourable receptions of knowledge from other actors in the network. Knowledge sharing also functions as a reciprocal process, particularly in cooperative circumstances (Bock *et al.*, 2005). In a knowledge management case study carried out on a large information technology service company, Garud and Kumaraswamy (2005) argue that enhancing face-to-face social networks among employees can lead to the improvement of knowledge sharing. Such sharing is inevitable when one actively engages in learning and attempts to work with others in the organisation in a collaborative relationship, and this is enhanced by open communication (Gibson and Vermeulen, 2003).

In a quantitative study, Noorderhaven and Harzing (2009) found that face-to-face social interaction forms a channel of communication which makes the sharing of tacit knowledge, in particular, easier. Even in the most bureaucratic organisations, individuals do, with a high degree of regularity, interact with others using an extremely high number of methods unspecified by the organisation charter (Cross *et al.*, 2002). Taken in the extreme, this perspective implies that there will be no knowledge to share if there is no social interaction between employees.

It is noted in reviewing the extant literature that many factors contribute to face-to-face social networks and knowledge sharing. Two key factors are relationship and communication. This study aims to make an important contribution to existing knowledge by offering some tangible evidence of how and why face-to-face social networks influence the sharing of knowledge. There is clearly a need to explore the role of face-to-face social networks in knowledge sharing using a qualitative approach. To do this, the following research question is formulated:

> *RQ1.* What is the nature of the relationship between face-to-face social networks and knowledge sharing?

3. Research methodology

To explore the nature of the relationship between face-to-face social networks and knowledge sharing, a qualitative methodology was adopted. A semi-structured interview guide was prepared and was used in the data collection from 25 interviews across five manufacturing companies. The five interviewee participants in each company included top and middle managers, along with frontline employees. This distribution allowed the researchers to compare and contrast employees' roles in their companies with behaviour related to knowledge sharing. Interviews were conducted following ethical approval and were audio-recorded and transcribed. Due to the qualitative nature of the research question, grounded theory was used to guide the data collection and to analyse the interview data. The data analysis process was supported by the NVivo coding software.

As a systematic process, the data analysis commonly used with grounded theory involves a standard format comprising three phases:

1. open coding, whereby categories of information are chosen;

2. axial coding, whereby the categories are interconnected; and

3. selective coding, whereby a story is formed connecting the assembled categories (Strauss and Corbin, 1998, 2008).

The implementation of each phase is described in more detail below.

3.1 Open coding

During this phase of coding, the researchers attempted to concentrate on incidents that reflect action and strove to continue to be open to potential themes shown by the data. Data documents (interview transcripts) were examined line-by-line, by which means the researchers became immersed in the data. This was followed by a process where the initial codes were named. This permitted the next stage of data abstraction firstly forming higher-level concepts and latter categories.

3.2 Axial coding

In this stage, the researchers began to explore the relationships between categories, using both inductive and deductive thinking to make connections between them.

3.3 Selective coding (storylines)

Selective coding involved systematically relating nodes to one another. This might indicate some further requirement for refinement of other nodes; their properties and dimensions

may need to be filled out. At this stage, much of the work entailed manipulating nodes: moving them, creating new ones and amalgamating or dividing them (Gibbs, 2002). Selective coding was used as the final phase of the coding process to combine the categories around the core category and develop the theoretical framework. The following section will set out the storyline of the nature of the relationship between face-to-face social networks and knowledge sharing.

4. Findings

This section presents, examines and interprets the data and patterns obtained from the interviews. In all, 513 incidents emerged from the 25 interview transcripts (sources), including six main concept groupings, which are set out in Table I.

4.1 Using multiple communication strategies

The study participants are exposed to multiple communication strategies to enhance knowledge sharing. These strategies can be divided into three groups, namely, codification strategies, personalisation strategies and strategies of both. Codification and personalisation strategies were initially developed by Hansen *et al.* (1999). These strategies are explained in the following subsections.

4.1.1 Codification strategy. In the use of a codification strategy, employees do not share their knowledge with one another directly but through diverse communication technologies. Information technologies in this situation become the conduit through which knowledge sharing happens.

Two-thirds of participants mentioned diverse information system tools that enable the open sharing of knowledge, for example email systems, internet, intranet, online forums, knowledge-based systems and knowledge repositories. Email systems, coupled with the internet, have allowed employees to share knowledge with other employees irrespective of their location. Thus, the internet facilitates contact between employees who seek knowledge and those who possess it by supporting discussion groups through the use of diverse databases that enable discussions.

Around half the participants stressed the role of online forums to bring together vital knowledge to workers and, in some situations, employees of implementation teams. What was clearly seen in the studied firms is that such forums bring diverse benefits. First, by dealing with day-to-day problems, employees help each other to build social interaction. In addition, by solving problems in a public forum, employees can create a common comprehension of techniques and solutions to different problems. Moreover, online forums are not only related to solving problems but can also enable employees to build and share their knowledge and skills. A typical comment was:

> We've got online forums where you can ask questions. People come back, we can search that forum, it gets moderated, things get sorted, so we can actually use the intelligence and the experience and the knowledge of the person.

4.1.2 Personalisation strategy. The second knowledge-sharing strategy is personalisation, in which knowledge is associated with its source and shared and created through

Table I	Main concept groupings ranked by number of incidents per concept		
Concept code	*Concept name*	*Sources*	*No. of incidents*
SN1	Using multiple communication styles	24	289
SN2	Training	19	91
SN3	Learning and teaching	20	59
SN4	Brainstorming and problem-solving	10	42
SN5	Consultation	8	26
SN6	Employee rotation	6	6

face-to-face interaction. In such situations, there is a direct sharing of knowledge between the knowledge senders and receivers.

It was noted by seven participants that, to build and sustain social interaction, there is a need for face-to-face engagement, especially if the knowledge is complex or hard to share in an email. An important feature of face-to-face engagement is that feedback to the sender can be accomplished directly through diverse communication styles, for example visually, verbally and by means of sound, textual materials and non-verbal gestures and body language, all of which play important roles during the process of knowledge sharing. Such face-to-face interaction gives employees the opportunity for collective knowledge sharing and the development of individual thoughts.

Results indicated that face-to-face forums can exist both internally and externally according to the place of occurrence inside or outside the company. Internal face-to-face forums ensure that people have the right understanding and receive the right messages about jobs. External face-to-face forums are mainly related to company clients. Internal forums can be quite informal, but external forums required a little more skill and effort to make sure that they stay at the right level and have the right level of friendliness and respect. The environment of face-to-face forums helps to create a workplace that is efficient, effective, productive, inspiring and team-oriented.

Another example of personalisation strategy is participation in seminars and conferences. Examples of these were provided by eight participants. Seminars and conferences are organised, in the first place, to bring a group of people together to achieve diverse objectives. These people have some common interest, experience, knowledge, skills or expertise. Participation in various seminars or conferences, internal and external, allows employees to enhance presentation and discussion, provide effective knowledge and strengthen targeted knowledge sharing. In these situations, the roles of knowledge producer and knowledge user might change, as various opportunities are provided for all participations to share their knowledge or simply transfer it. This might be because some seminars and conferences are built to create heightened interaction with the audiences to enhance knowledge sharing. On the other hand, some seminars or conferences are mainly useful for transferring knowledge between the sender and receiver. In addition, networking, relationships, building and establishing contacts with clients and work opportunities can all be achieved through attending seminars or conferences. The advantage of carrying out these activities to share knowledge is the high commonality that often exists among participants, allowing easily the practice of communication and the two-way flow of knowledge. That means the challenge of ensuring that participant can have this commonality and correctly communicate in a collaborative manner can be met. One senior manager described one of his roles in this way:

> We send people on seminars for networking, relationship building and establishing contacts with clients and work opportunities.

Around two-thirds of the participants described how, through meetings, employees can share their knowledge and hence facilitate social networks. In meetings, employees can be brought in from different departments to deal with specific issues. In fact, if people have their turn at contributing to the meetings, two things are achieved. One is that it makes them become involved in the meeting and the other is that it improves their ability to stand up in front of their co-workers and talk. Such meetings can help to get feedback regarding company performance. One middle manager shared this perspective as he talked about the role of a meeting in knowledge sharing among employees:

> The respecting each other, the performing together and the driving customer success is something that is aligned with the KPIs as well as the EIT meetings: [the goal] to ensure that the behaviour is kept and people are recognised for that behaviour. And the sharing of the knowledge happens in those meetings as well.

Nearly two-thirds of participants provided examples of meetings between employees at different levels. For example, there are meetings between top managers and frontline employees. These kinds of meetings and the levels of tacit and explicit knowledge sharing involved are illustrated in Figure 1.

The high interaction between employees who work at the same level can enhance the personalisation of their social interactions. This can give rise to tacit and explicit knowledge sharing. The hierarchical distance between top managers and frontline employees can inhibit explicit and tacit knowledge sharing.

Frontline employees often have their own meetings. Any issue they cannot resolve is passed on to their manager and, hence, to the next level of management, which has its own approach to meeting style. If they cannot resolve issues, they are expected to put the issues to senior management. For example, one frontline employee provided this example:

> All the shop floors have a daily meeting programme. Any issues from [these] that they cannot resolve on the shop floor are escalated to the Foreman and to the next-level management, who also have their own meeting pattern.

4.1.3 Codification and personalisation strategies. As can be inferred from the name of this strategy, it is one that occurs by the use of information technology that can act as a channel through which employees can directly share their knowledge with each other. In one company being studied, employees tend to receive and share knowledge through the use of videoconferencing. Through this, knowledge senders and receivers share on the same occasion and have a social context for their interaction. Such an application permits audio and visual knowledge sharing between employees at the same time, which ultimately leads to the experience of greater cross-office knowledge sharing. It is a useful technique to enhance knowledge sharing as a replacement for face-to-face meetings that would otherwise require extensive travel. All in all, the research findings show that, irrespective of whether knowledge sharing is mediated or not, employees do not just share knowledge, but also utilise this useful technology to help employees share contextual and psychological antecedents as well. One middle manager was very clear in stating the importance of videoconferencing in enabling knowledge sharing:

> I think it's really good, because you can see the person and they can see you and they can hear you, so it makes it more effective to be able to just see the person communicating.

4.2 Brainstorming and problem-solving

Ten participants stated that brainstorming and problem-solving can play a significant role in supporting knowledge sharing and in facilitating social networks. In brainstorming sessions, employees can sit together to deal with a specific problem in a creative way. During these sessions, employees have a chance to illustrate their perspectives, critique specific methods, modify specific techniques and improve ideas. Based on the research findings, it would appear that there are diverse steps for brainstorming and

Figure 1 Types of meeting and the level of sharing knowledge among employees

	Top manager	Middle manager	Frontline employee
Top manager	High	Moderate	Low
Middle manager	Moderate	High	Moderate
Frontline employee	Low	Moderate	High

problem-solving, which are defining the problem, understanding its root cause, debating a number of different solutions and taking action.

During the first stage of brainstorming and problem-solving, an inductive and deductive thinking process takes place among employees. This is not just to facilitate inquiry, but, equally importantly, it allows employees to narrow down the scope of the topic. As illustrated in Figure 2, knowledge giving and receiving are required between top managers, middle managers and frontline employees, to interactively recognise the precise problem as a step to finding a way of dealing with it. Once the scope of topic is identified, a series of meetings is required to explore it in depth. One middle manager noted the following:

> So [the committee included] everybody that needed to partake and drive whatever needed to happen in the next week. So, through that committee, they met on a daily basis or, more often, the first day to discuss and delegate out to other people from that.

Another middle manager noted that, through problem-solving and brainstorming, social interaction between employees can occur:

> I think it's a very good way of getting social interaction because the guys can say what they want to say at the meetings and then we kind of do a little brainstorm and problem solving.

The main objective of the next step is understanding the root cause of the issue. Once a topic has been understood, brainstorming will take place through diverse meeting activities. These can be achieved through debating a number of different options. Following that, there is a need to make a decision on the correct action that will effectively solve the problem. Alternatively, if the problem is not easy to address, a preventative action will need to be considered. These steps are summarised by one top manager:

> It's taking information about something that's happened in the past, understanding the root cause of what's happened and, then, putting in place some corrective action or preventative action.

From the findings emerged two basic aspects of knowledge sharing, giving and gaining. These and the processes of problem-solving are combined together in an inductive, exploratory model, which is shown in Figure 2.

Seven participants stated that problem-solving requires a collaborative working arrangement between employees and cross-functional teams. For example, one said:

> If you want to problem-solve effectively, you need the biggest group or the widest effective group possible.

Figure 2 Exploratory model of brainstorming and problem-solving processes in the studied companies
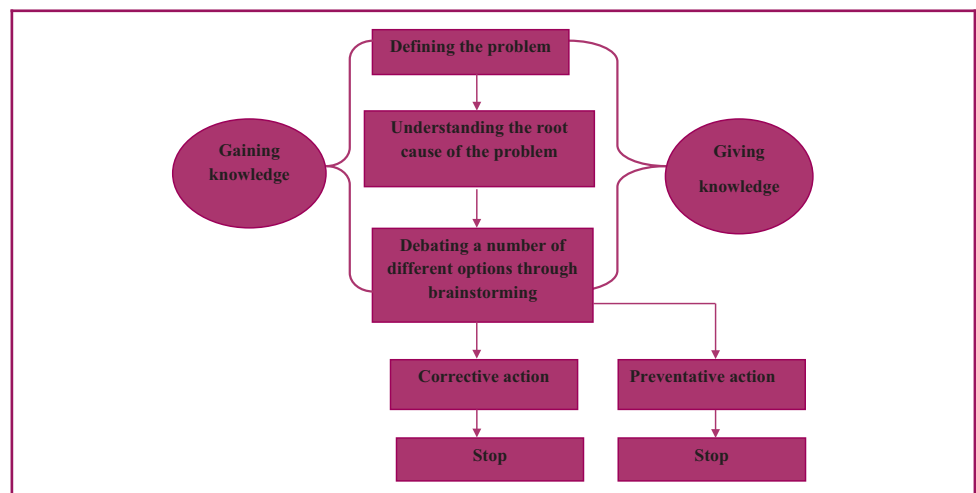
Another participant emphasised that, through knowledge sharing, problems can be solved. He made this statement:

> So it's really important to share knowledge to find out what the problem is and then how to fix it and, also, how that's gonna affect other departments and those flow-on effects.

4.3 Learning and teaching

A significant number of participants indicated that, in the course of sharing, a number of learning and teaching opportunities are created. Within companies, employees learn about collaborative teaching partners, team meetings and formal and informal collaboration. These collaborative knowledge-sharing processes that exist within companies make learning between employees and within the support network possible. As Figure 3 shows, learning not only entails learning inside companies; there are external sources of learning that are brought to a company, such as learning from past experience. In other words, for learning to be more effective, it is important for social networking between employees to occur.

This model of the development of knowledge sharing is divided into four levels based on the receiver's levels of knowledge, namely, the novice, competent, expert and proficient levels. The following quote by one top manager is reflective of what many said:

> We have developed four different levels of knowledge sharing from novice to expert, and the expectation is that [. . .] the competent would teach the novice, [the] proficient teach the competent and the expert teach the proficient technicians.

As shown in the above model, at the bottom of the trapezoid, the sign "+" means that the novice has mainly explicit knowledge, while the sign "-" means that he or she has less tacit knowledge. Hence, novices do not have the same types of knowledge as the other group of recipients. It seems that there is a difference between the kinds of knowledge for each level. Accordingly, those at each level tend to immerse themselves in tacit and explicit knowledge sharing to compensate for its weakness. This can be accomplished through learning and teaching.

In this model, a novice can share more explicit and less tacit knowledge with a competent to reach a higher level of knowledge, such as practical or complex knowledge. Conversely, an expert holds more tacit than explicit knowledge. Therefore, he or she is likely to share more tacit knowledge. This can be achieved through teaching other employees who are less expert, such as those at the competent and novice levels. The highest level of an

Figure 3 Exploratory model of employee's knowledge levels and the direction of learning and teaching
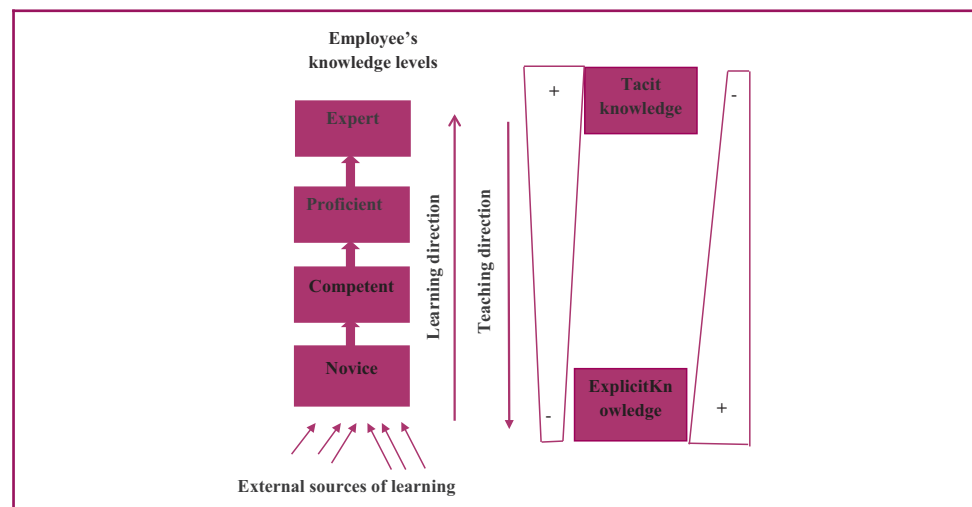
employee's knowledge is the proficient level at which employees have a high proportion of tacit knowledge, which is thus more likely to be shared with those at other levels. This level can be developed more and more through social interaction. Figure 3 also shows that the opposite direction to learning is that of teaching. This direction moves downstream from expert to novice. The following quote from one frontline employee describes how novices can enter into and build up social interaction with more knowledgeable employees, such as those at the competent, proficient and expert levels:

> I'm a graduate and my manager put me through learning from more knowledgeable employees. There's also other opportunities [. . .] through support network.

Another example illustrated that, when employees start working, they mainly have theoretical knowledge, which is mainly related to explicit knowledge. In this situation, through learning, face-to-face social networks can be augmented. This is mentioned by one middle manager in the following quote:

> Most engineers have come with the key elements of theoretical knowledge and they hone that knowledge by applying it, so every day is a new learning experience that can be augmented through social interaction.

One middle manager described how more knowledgeable employees can teach novice engineers. He said:

> So most of our employees are degree-qualified engineers of various levels, so we would start with graduate engineers; we'd teach them up for three years, they become engineers, then we move [them] through [the stages of] senior engineers through lead engineering.

4.4 Training

According to the data collected in the studied companies, training can be classified under two types, i.e. internal and external training.

4.4.1 Internal training. This kind of training can be provided within the main physical location of a company. Ideally, the main goal of internal training is to enhance the tacit knowledge that is the experimental knowledge, technical knowledge, etc., of employees. A significant number of participants noted that this kind of training can take the forms of peer training, cross-training and invited experts from outside a company. Peer training can allow new employees to buddy up with expert employees inside a company. It can lead to increased communication, build social ties and enhance cooperation, all of which are vital for stimulating knowledge sharing. The following interview transcript extract provides evidence of the role of peer training in knowledge sharing:

> When I first started here, we were buddied up with a senior person, so I've got a buddy and if I have any questions or anything I can ask him anything about technical difficulties.

Cross-training can enhance knowledge sharing among staff from different departments within a company. A total of 16 participants described internal training as either informal or formal. Formal training can occur through meeting with team leaders or inviting experts from outside the company. Informal training can occur even during a break by means of casual interactions; this kind more effectively creates dialogue between employees and, hence, allows explicit knowledge sharing to thrive. One middle manager shared the importance of training in which informal knowledge sharing is the norm:

> Once people have developed their technical competencies, then there will be relationship, helping people to relate to people, so there's not necessarily formal training, but it's kind of a growth and development aspect that people need to learn.

4.4.2 External training. External training was mentioned by only six participants as being a means to facilitate knowledge sharing and social interaction. This kind of training can be brought about by sending employees outside their company to initially gain knowledge from the outside and then share it when they come back. Such training is useful, especially to gain explicit knowledge from trainers and then having it combined, edited or processed

for the formation of new knowledge. The new explicit knowledge is then disseminated amongst the employees of the organisation. Individuals exchange and combine knowledge through diverse mechanisms such as meetings and telephone conversations. Such mechanisms can help also to build social interaction. Hence the following quote by one top manager:

> External training can be quite good for meeting other people and for building social interaction.

4.5 Consultation

The analysis of research findings revealed that the objective of a consultation policy is to generate and optimise a consultative culture within and outside a company. Around one-third of participants identified the role of consultation as improving knowledge sharing and social networks. Consultation helps to fill knowledge gaps in companies through the provision of advice when the company is being overcome with different problems. In addition, consultation not only helps to remedy company weaknesses in information, but is also useful for gaining skills. One top manager described the role of consultation:

> We're looking for consultation to bridge, if you like, our weaknesses and the skill level that we have on site. And, also, we use them a lot just to challenge what we're doing through a deep discussion, which helps in improving the level of interaction.

As examples, many participants named and described different forms of consultation, characterised as internal, external, bilateral and multilateral. Internal consultation can be achieved through consulting employees within a company. Such consultation can occur, for example, when a novice technician consults an expert technician to provide a help. External consultation can be accomplished by consulting an expert from outside a company in a more formal manner. External consultation can be targeted at, for instance, the judicial sector, a city council or a stakeholder. Bilateral consultation is a method of discussion of ideas between employees who share common goals. Multilateral consultation is a method of discussion of ideas among employees who share a common goal. These findings strongly suggest that all these forms of consultation are necessary to positively influence face-to-face social networks and knowledge sharing.

4.6 Employee rotation

Employee rotation entails the shifting of employees across different tasks to optimise their exposure to a variety of knowledge. In this way, employees are drawn together from diverse departments of the company to pool their knowledge and complement one another. One top manager related this perspective by saying:

> What I'm doing in operations, at least, is moving people around a bit now and creating opportunities for people to move, so that we had people moving across different functions, into different roles within the manufacturing space.

Six participants were of the view that job rotation can accomplish benefits for employees. The first benefit is that employee rotation will increase employees' accumulation, not just of explicit knowledge, but also tacit. Additionally, the policy of job rotation was used with another goal: that of enhancing both individual knowledge and the group's tacit knowledge (know-how). Moreover, the movement of employees to different tasks enhances their capabilities to build new expertise and determine the areas in which they can best use their creativity skills. Furthermore, an employee who is prepared to function in a variety of jobs will bring breadth and depth of cross-functional knowledge to the company. As noticed in field interviews, job rotation not only helped employees promote tacit, practical, complex knowledge, but was also equally important in making either explicit or tacit knowledge more fluid and easier to put into practice. Work design based on rotation of work rather than hierarchical distribution of roles reinforces staff members' motivation to share their knowledge, and build social ties. These findings suggest that job rotation can broaden

employee perspectives so that they implement their work from diverse angles rather than just concentrating on the issues of their specific department's function.

5. Discussion

This section summarises the factors influencing face-to-face social networks and knowledge sharing in the studied companies and outlines the originality of the study and the findings. These factors comprise using multiple communication strategies, brainstorming and problem-solving, learning and teaching, training, consultations and employee rotation. These factors are illustrated in Figure 4 and further discussed in the following sections. The sign "+" means that each of the previous factors influences face-to-face social networks and knowledge sharing positively.

5.1 Using multiple communication strategies

This research has identified three communication strategies that influence face-to-face social networks and knowledge sharing. These strategies are codification, personalisation and a combination of these.

In using the codification strategy, employees do not share their knowledge directly with one another but through various communication technologies. This finding is in line with that of previous research which illustrates the role of information technology tools in facilitating the sharing of knowledge (Alavi and Leidner, 2001; Alazmi and Zairi, 2003; Allee, 2001; Bock et al., 2005; Fairuz et al., 2008; Hariharan, 2005; Kim et al., 2014; Wong, 2005). These useful tools, such as email and other collaboration systems, are considered to be among the most important tools by which individuals are able to reach advanced levels of knowledge and, ultimately, share knowledge (Al-Ma'aitah, 2008).

In using the personalisation strategy, knowledge can be shared and created through face-to-face interaction. Thus, there is a direct sharing of knowledge between the knowledge senders and receivers. This finding confirms that of Cross and Borgatti (2000) and Nelson and Hsu (2008), who believe that personalisation provides a rich medium for communication, as it involves the use of individuals as a mechanism for the sharing of

Figure 4 Overarching exploratory model of factors influencing face-to-face social networks and knowledge sharing
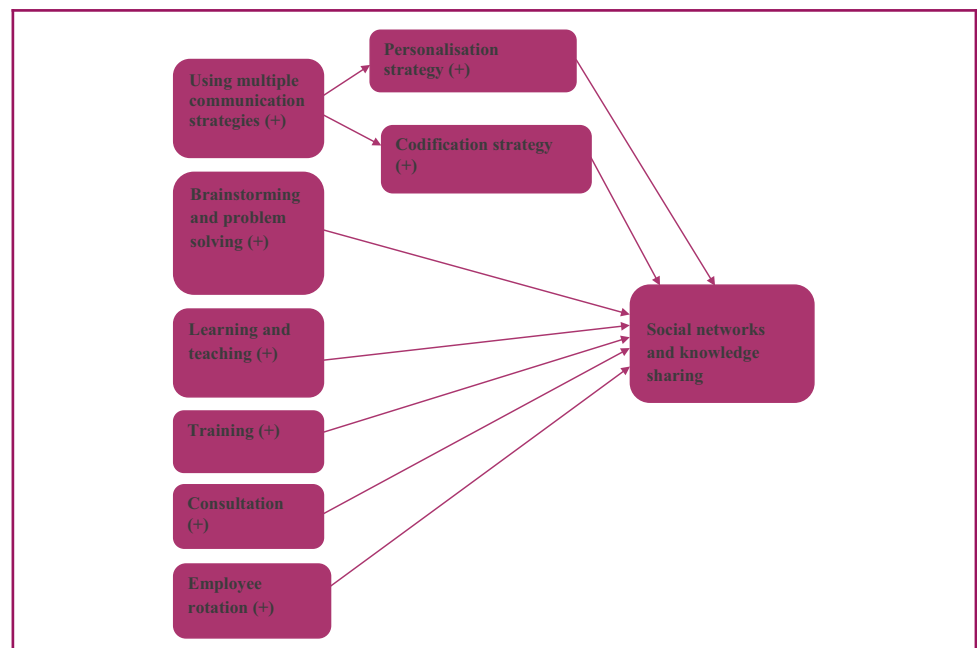
knowledge. Other studies illustrated specifically that face-to-face social interaction shapes a channel of communication which makes tacit knowledge sharing, in particular, easier (Noorderhaven and Harzing, 2009; Prencipe and Tell, 2001).

Current research findings also highlighted that employees tend to gain and share knowledge through videoconferencing. Although there are some studies (Egbu and Botterill, 2002; Yoo and Ginzberg, 2003) that discuss the role of videoconferencing in transferring knowledge across vast distances, these studies do not address the issue of knowledge sharing. Therefore, this study makes an important contribution to the existing literature by illustrating the role of videoconferencing in knowledge sharing and in initiating face-to-face social networks among employees.

5.2 Brainstorming and problem-solving

The results of the study revealed that brainstorming and problem-solving through collaborative work between employees and cross-functional teams can play a significant role in enabling social networks. To some extent, this finding is in line with that of Jermann and Dillenbourg (2008), who emphasise that collaborative problem-solving occurs through the dialogue between partners. Another study described that collaborative networks enhance the capacity to deal with problems by increasing face-to-face social networks (Putnam, 1995).

This study is not only confirmatory of previous studies but also expands what has previously been identified. This has been achieved through the development of a new model of brainstorming and problem-solving. This model suggests diverse steps of brainstorming and problem-solving, which are defining the problem, understanding the root cause of it, debating a number of different solutions and taking action. Although there are existing models of brainstorming and problem-solving and some are within the context of knowledge management (Juan et al., 2006; Wei et al., 2012), these models, collectively, do not elucidate how brainstorming and problem-solving help to strengthen knowledge sharing. In addition, this research has illustrated that, in each step of problem-solving, the giving and gaining of knowledge can be accomplished where face-to-face social networks are present. Although many previous researchers illustrated that problem-solving can play a critical role in enhancing knowledge sharing (de Toni and Nonino, 2010; Jermann and Dillenbourg, 2008; Klerkx and Proctor, 2013; Nickerson and Zenger, 2004), they do not identify problem-solving processes as a mechanism for enabling social networks. In addition, these researchers did not explicitly illustrate knowledge giving and receiving in each step of problem-solving.

5.3 Learning and teaching

A significant number of participants indicated that learning and teaching can play an important role in facilitating knowledge sharing. This finding confirms that of Matzler and Mueller (2011) and Swift et al. (2010), who found that an individual's learning orientation has a significant positive effect on knowledge sharing because the motivation to improve one's own skills to deal with difficult conditions necessitates learning, for which knowledge sharing is the prerequisite. Another study recognised that the sharing of knowledge of practices and initiatives commonly forms a vital element of knowledge management programmes in terms of individual learning (Riege, 2005). Rowley (2000) goes further by illustrating that it is not only important that individuals get knowledge and skills from the learning process but also that they are capable of digesting and implementing these skills as actions.

For this research, a new model has been established that involves knowledge levels and the direction of learning and teaching. This model shows that learning not only entails learning inside companies but also learning from external sources that are brought to a company, such as past work experience. This finding is supported by Roth (2003), who suggests that individual learning comprises both learning from past experience and

sharing viewpoints of the current moment. According to Jones *et al.* (2003), the steps of effective learning, by means of knowledge sharing among an organisation's employees, allow members to reflect on the effects of their behaviours and actions and to gain viewpoints from the environment in which they operate to respond to it with more correct approaches.

This study not only confirms what has been illustrated in the literature regarding the significant positive effect of learning on knowledge sharing, but on it by the development of a new model regarding the role of learning and teaching in facilitating social networks. In addition, this research links knowledge-sharing types to the direction of learning and teaching. In other words, for learning to be effective, it is necessary that interaction among employees takes place. In line with this finding, there is a growing body of research focusing on face-to-face social networks as a *locus* of learning (Liebeskind *et al.*, 1996; McEvily and Zaheer, 1999; Rhee, 2004).

5.4 Training

Participants indicated that training can play a significant role in facilitating knowledge sharing and social networks. Scholars argue that the implementation of training might inculcate in staff the value of knowledge sharing and enhance social interaction skills that are vital for it (Fong *et al.*, 2011; Kang *et al.*, 2008). Another study showed that, during training, an open organisational climate is set up through interactive discussions, contributing to staff members' knowledge sharing (Gronroos, 2000). Research finding is also consistent with the findings of Ramirez and Li (2009) that knowledge exchange takes place, as staff members are trained to use new equipment and, in turn, teach others. As illustrated by the research findings, such training can lead to increased communication, build social ties and enhance cooperation, all of which are vital for the stimulation of knowledge sharing.

5.5 Consultation

According to the data collected on the studied companies, consultation helps to fill various gaps in companies through the provision of advice for when they are being overcome by different problems. This finding, to some extent, is in line with that of Chen and Cheng (2012), who found that an atmosphere of open communication will enhance discussion and consultation among staff, thus helping to make knowledge sharing achievable.

Research findings also identified that consultation can take different forms, namely, internal, external, bilateral and multilateral. The authors found only one study that supports the role of external consultation in seeking knowledge and facilitating social networks. Henry (2001) explained that external consultation allows knowledge to expand beyond the walls of the organisation in terms of including outside perspectives on issues. Through this interaction with the external environment, social interaction can be developed within it. In addition, all these types of consultation can help to build informal, formal, problem-solving, operational, complex and complementary networks. Even though Crossley (2010) and Pescosolido (2006) have found that informal and subjectively meaningful social relationships, through consultations, build a network of social interaction, little attention has been given to consultation types and their link to building these types of social networks.

5.6 Employee rotation

Research findings suggest that employee rotation will increase the exposure of employees, not just to explicit knowledge, but to tacit knowledge as well. This finding partly confirms that of Aelmans (2008), who identifies that the rotation of staff across departmental boundaries enhances tacit knowledge sharing. Another study goes further by illustrating that the plan of job rotation has been executed with the goal of enhancing both individuals' knowledge and teams' collective know-how (Hong *et al.*, 2008).

Current research findings also suggest that employee rotation permits new and old employees to know more about each other. This finding implies that face-to-face social networks can be built. This finding is consistent with Gherardi *et al.* (1998), who illustrate that employee rotation can lead to the building of social interaction between employees and participation in the development of mutual understanding. Eby *et al.* (2003) go further by describing how employee rotation can create opportunities to build internal and external networks. This current study also further noted that the role of employee rotation is not only to promote implicit knowledge but, equally importantly, to facilitate the development of mutual relationships. On the other hand, Aelmans (2008) affirms that informal interaction can be hampered by the lack of employee rotation.

6. Conclusions and implications

The findings of this research revealed six factors that influence face-to-face social networks and knowledge sharing. These factors are using multiple communication strategies, brainstorming and problem-solving, learning and teaching, training, consultations and employee rotation. These factors impact knowledge sharing positively.

The findings have implications for both practice and theory. They are expected to help practicing, knowledge-sharing managers to better comprehend the big picture and scope of the steps they take in business. The capability to view a knowledge sharing from a holistic perspective will help practitioners to better comprehend how it is included in many organisational activities and how face-to-face social networks can be enhanced. In addition, through social networks, practitioners can leverage work groups for knowledge sharing, by which means cost savings can be achieved. Another implication for practitioners is that adequate levels of support from organisations are required to ensure that face-to-face social networks perform adequately so that knowledge-sharing processes are accomplished.

This research contributes theoretically in terms of developing a new model of brainstorming and problem-solving. In addition, this research is presented together with a new model of knowledge levels and the direction of learning and teaching. Moreover, this research has involved the development of a new model of knowledge sharing that illustrates the nature of the relationship between it and social networks in the studied companies.

To extend theory, follow-up research might necessarily focus on the exploration of other more specific factors influencing face-to-face social networks and knowledge sharing between employees. In addition, subsequent to the exploratory research findings presented here, there is the obvious need to develop and test relevant hypotheses. Further exploring and testing these factors would provide useful input regarding how face-to-face social networks can be built such that an effective culture of knowledge sharing might be created.

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About the authors

Said Abdullah Al Saifi is an Assistant Professor in the Department of International Business Administration, at Nizwa College of Applied Sciences. His research interests are in the areas of knowledge management, the role of information technology and cultural differences in knowledge management and science education. Said Abdullah Al Saifi is the corresponding author and can be contacted at: ensan12345@hotmail.com

Stuart Dillon is Associate Professor and Chairperson of the Department of Management Systems at the University of Waikato Management School in Hamilton, New Zealand. Most of his research is in the area of emerging technologies for electronic commerce. Past and current relevant research includes work on e-government, consumer perceptions on e-tailing, and data curation. He has published his research in academic journals such as *MIS Quarterly, International Journal of Public Sector Management* and *Journal of Global Information Management*. He is an active member of the European Center for Information Systems (ERCIS), of which the University of Waikato is the sole New Zealand institutional member.

Robert McQueen is Professor of Electronic Commerce Technologies at the Waikato Management School, University of Waikato. He holds a PhD from Waikato, an MBA from Harvard Business School and a BApSc in Electrical Engineering from the University of Waterloo. His research interests are in electronic commerce, computer-mediated group communication and technology support for tacit knowledge building in individuals.

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