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"Employees choice of knowledge sharing tools in a global firm"

-A study of MNC employee's choice of formal or informal knowledge sharing tools

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Abstract

Due to changes in the competitive landscape and increasing globalisation, resources and the most effective use of these has become the key to competitive advantage for most multinational firms. As employees are in the possession of unique knowledge and expertise, employees have become an important resource for firms, and thus efficient transfer of knowledge to other part of the organisation, has become vital for business survival (Lin and Joe 2012; Karkoulian and Mahseredjian 2012). Knowledge sharing is an emerging and increasingly popular theme within in the academic literature, where research has focused on the different impacts on employee's willingness to share knowledge (Argote et al. 2003). However, little existing research has focused on the impacts on employees choice of knowledge sharing tools, thus this thesis aims to fill this gap in literature, by examining how established and emerging impacts on the willingness to share knowledge, namely intrinsic motivation, introjected motivation, external motivation, network centrality, intra-firm competition and the use of organisational rewards, impacts employees choice of formal or informal knowledge sharing tools in a local and global context of multinational companies. In addition the thesis aims to examine how the use of one type of knowledge sharing tool impacts the use of the other, meaning whether they substitute or complement each other.

The research was conducted in the Norwegian subsidiary of the multinational IT-company IBM, with respondents who worked on both local and global teams. Out of 650 possible respondents, we received 154 responses.

The results revealed that contrary to our believes, motivation does not have a significant impact on employee's choice of knowledge sharing tools, with the exception of external motivation, which was slightly significant for the use of informal knowledge sharing tools. The results also showed that the use of rewards had no impact on the choice of knowledge sharing tools. Intra-firm competition had a positive correlation with the use of formal knowledge sharing tools; however the level of employee's network centrality had the highest effect on both the choice of formal and informal knowledge sharing tools. Additionally, the results showed that the two types of knowledge sharing tools complement each other, rather than having a substitution effect.

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1 Introduction

Through increased competition and globalisation, efficient utilisation of resources has become key for business survival. One of the most important resources a business can have in a competitive landscape is the employees and especially the knowledge possessed by these employees (Lin and Joe 2012). The tacit knowledge different employees possess is unique for the firm, and only available within the firm, which makes it hard to copy, thus employee knowledge has become a core competitive advantage of firms (Karkoulian and Mahseredjian 2012). Employee knowledge is perhaps especially important for multinational companies (MNC´s) who face different challenges and competition in different markets, thus sharing employee knowledge within the firm becomes important.

The resource-based view of the firm further explains why knowledge is of upmost importance for global firms. According to the resource-based view organisations dispose several tangible and intangible resources; however the key to competitive advantage lies in how efficiently the intangible resources are being put in to use. Intangible resources are often available only within that specific firm, and thus difficult to imitate for competitors (Barney 1991). The further development of the resource-based perspective views the firm as a bundle of knowledge, where the effective utilisation and dispersion of this knowledge is the key for competitive advantage (Fey and Furu 2008). In fact Hymer (1960/1976) argued as early in the 1960's that the main reason for the existence of MNC's is indeed their ability to transfer knowledge more efficiently than a market would. This view has later gained support by other research, such as Goshal (1987), who further argued that the main competitive advantage within MNC's lies in its ability to effectively transfer knowledge and capabilities from headquarters to subsidiaries, and also back from subsidiaries to headquarters. According to Goshal (1987) it is also of the upmost importance to effectively transfer knowledge between organisational units of the different subsidiaries to increase competitive advantage.

According to Karkoulian and Mahseredjian (2012) knowledge is "information, ideas and expertise with a purpose that have been put to productive use". Knowledge is often highly personal and not easily expressed, and therefore it may be difficult to share with others (Foss et al. 2009). However, knowledge sharing

often involves mutual exchanges among individuals, including sending and receiving knowledge, and can thus be defined as an action based on a sender-receiver relationship that includes communicating one's knowledge to others as well as receiving others' knowledge (Foss et al. 2009). Knowledge and employee knowledge sharing has gained a significant amount of attention in organisational literature due to its implications for organisational performance.

Fey and Furu (2008) further claim that the main source of competitive advantage has moved from the ability to produce efficiently to the utilization of organizational knowledge. Industries are characterised by rapid changes and thus put higher demands on employees and firm's quick response (Rahimli 2012). Increasing demands for firms, while dealing with scarce resources, emphasises the need for employees to make efficient use of all resources available, and also share knowledge with other employees (Rahimli 2012).

Minbaeva et al. (2012) also argue that the effective employment of internal and external knowledge is one of the key challenges firms face today. Multinational corporations are increasingly dependent on the successfully integration of the internal knowledge possessed by their foreign subsidiaries, due to how the effective flow of internal knowledge are positively linked to increased innovation and new product development, improved coordination processes and best practices, and ultimately increased competitive advantages (Minbaeva et al. 2012).

Further Fey and Furu (2008) argue that proper management of knowledge will lead to higher bottom-line, in other words profit, and also higher top-line, meaning sales performance. Fey and Furu (2008) claim that by sharing important knowledge the benefits of proper knowledge management are maximised through the entire organisation, thus knowledge sharing is important for business welfare. However, assuming that all employees are willing to participate in a knowledge-sharing process would be naïve by top-management. One of the greatest challenges for a MNC and its subsidiaries is to develop tools that facilitate the creation, development and sharing of knowledge in both isolated subsidiaries alone and also in a head-quarter-subsidiary relationship. This research will thus focus on how employees share knowledge within and among subsidiaries.

Chao-Sen et al. (2012) argue that knowledge sharing happens on three different levels, individual, group and organisational. The individual level does according to Chao-Sen et al. (2012) refer to altruism, communication and organisational citizenship, whereas the group levels refer to group activity. The organisational level refers to formally implemented knowledge management systems and the performance of these. This research will focus on individual knowledge sharing, as organisational and group knowledge sharing is eventually rooted in individual behaviours and their drives (Foss et al. 2009). Consequently, the current research will examine how individual and organisational factors influence employee's choice of knowledge sharing tools in MNC's. To clarify, the expression of knowledge sharing does in this thesis refer to both the process of sending and receiving knowledge.

1.1 Employees choice of knowledge sharing tools and its implications

To our knowledge little previous research has focused on the choice of employee knowledge sharing tools, and its consequences. For instance, previous research has investigated the importance of sharing knowledge (e.g., Fey and Furu 2008; Lin and Joe 2012; Nonaka, Krogh and Voelpel 2006), and other research has found support that different types of effects such as motivation (Foss 2009) ability (Argote et al. 2003) and trust (Holste and Fields 2009; Schwaer et al. 2012), has an influence on the knowledge sharing process. Also, emerging themes such as network centrality (Reinholt et al. 2011; Obstfeld 2005) and organisational culture effects such as intra-firm competition (Ghobadi and D'Ambra 2013) have gained significant support on effecting knowledge sharing. Additionally, previous research from (Boh and Wong 2013; Schwaer et al. 2012; Cho et al. 2007) has investigated some of the factors that influence the choice of knowledge sharing mechanisms. However, even though this paper is inspired by previous work within the knowledge sharing literature, the aim of this thesis is to further examine how different measures, which to our knowledge has not been combined or used to investigate employee's choice of knowledge sharing tools, affect the choice of formal and informal knowledge sharing.

Knowledge sharing tools refers to the different methods employees within firms take use of when transferring knowledge between employees, between divisions within the firm, or between country subsidiaries.
As knowledge, and the exchange of knowledge, has gained increased attention in literature, firms are further focusing on developing knowledge management systems (KMS's) and spending huge resources on the development and implementation of these systems (Allen et al. 2007). However, with increased globalisation and technology, employees are also more frequently than ever communication through other tools and medias. Employees are also, to a much larger extent developing social networks within the organisation, both locally and globally, which creates additional channels of knowledge flows. The problem, from a managerial perspective, may be that these additional channels may decrease the use of the organisations own KMS. This is a problem because the knowledge shared through these channels may be unattainable for anyone outside these social networks, thus possibly limit the number of receivers. It is also risky, from a managerial perspective, as the knowledge may easily leave the organisation with a few key employees (Schwaer et al. 2012).

Knowledge sharing, and the choice of method when doing so, is also important due to its close interlinks with market orientation. Knowledge sharing between employees facilitates better market orientation of firms, specifically because key information about different characteristics of the market is shared and distributed throughout the organisation for efficient utilisation, thus it is important that this type of knowledge is distributed to all parts of the organisation, particularly for MNC's who operate in several different markets (Fey and Furu 2008).

1.1 Research objectives and problem

We argue that there is a lack of research that examines how the different impacts affect the choice of formal and informal knowledge sharing tools. For instance, Foss et al. (2010) claim that research on knowledge processes has paid insufficient attention to the individual level and the role of different mechanisms.

Also, as pointed out from Foss and Michailova (2009); Schwaer et al. (2012) further research is required to better understand the firm's knowledge governance, which influences the process of using, sharing, integrating and creating knowledge in preferred directions. With that being said, there are still some notable exceptions within the knowledge sharing literature, which has found that different effects such as organisational climate, trust, ability and motivation impacts the choice of formal and informal knowledge sharing tools (Boh and Wong 2013; Schwaer et al. 2012; Cho et al. 2007). However, we argue that little research has been conducted, and further investigation is necessary to get a better understanding of the MNC's knowledge governance. Hence, this paper will combine established measures such as motivation and rewards with emerging themes such as network centrality or intra-firm competition to investigate employee's choice of knowledge sharing tools.

Also, little attention has been paid in the knowledge sharing literature in examining how the use of one knowledge sharing tool impacts the use of the other. It is thus interesting to examine whether employees who take more use of formal knowledge sharing tools, are less likely to take use of informal knowledge sharing tools, meaning if there is a substitution effect or whether the choice of knowledge sharing tools have a more complementary effect.

This thesis will thus aim to investigate some general objectives, which includes the following:

- How does the different measures included in the research impact the choice of knowledge sharing tools
- How important are each of the different measures? Meaning investigating what measures impact the choice of the different knowledge sharing tools more strongly.
- Whether there are measures that impacts one type of knowledge sharing tool without having any effects on the other type.
- When the use of one type of knowledge sharing tool is high will the other decrease?

The research problem has been narrowed down based on the literature review to include a specific unit of analysis:

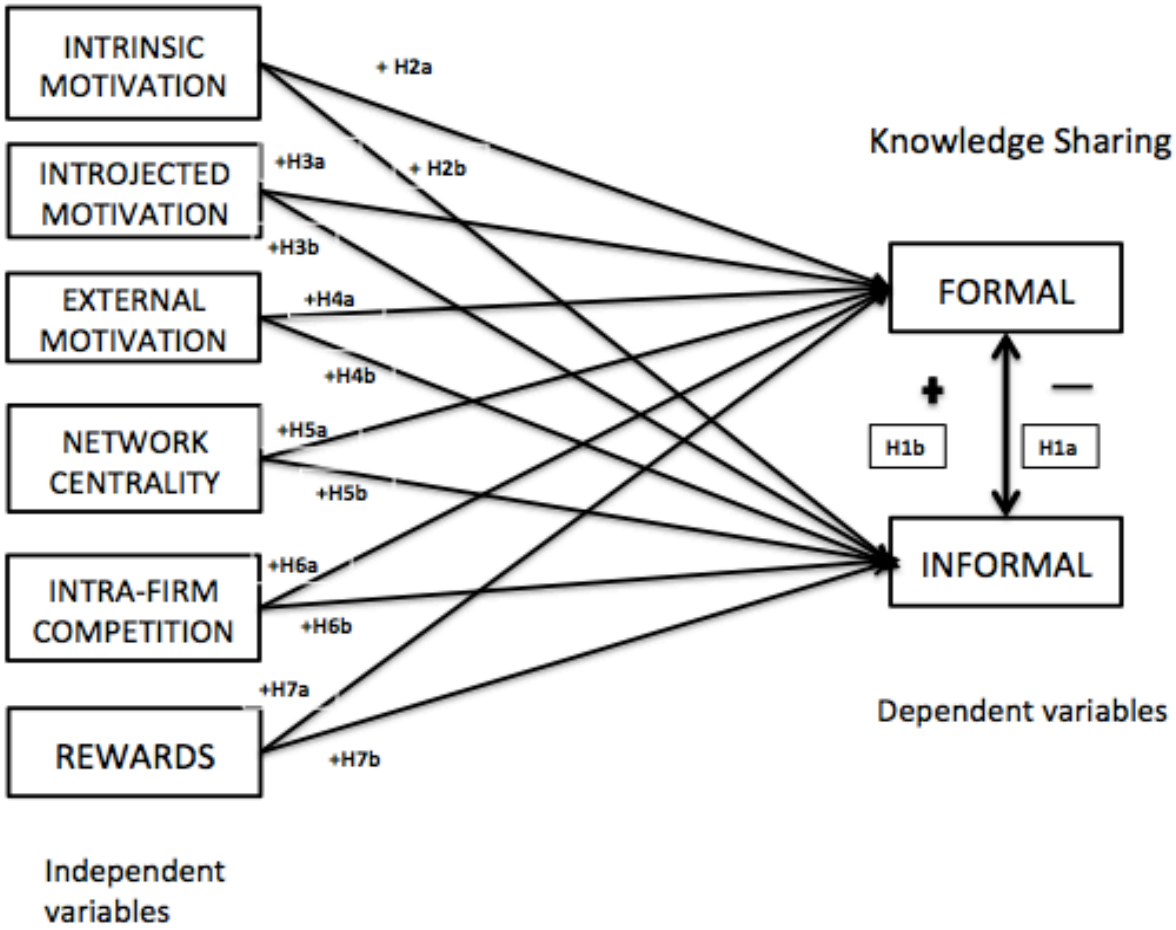
- *"When will employees of a MNC subsidiary, who work on both global and local teams, use formal or informal knowledge transfer methods?"*

The research problem will be put in to context of the following situation; when receiving information about costumers, projects, competitors and so on, how will employees share this information? Is this done in the context of formal or informal knowledge sharing tools, or both? How the different measures mentioned above impact the choice of knowledge sharing tools will be investigated through the different hypotheses.

1.2 Research model

Our research model is based on existing research on individual knowledge sharing (e.g., Allen et al. 2007; Nonaka, Krogh and Voelpel 2006; Fey and Furu 2008; Lin and Joe 2012; Chao-Sen et al. 2012), however we created this model on the basis that the same measures also will impact the choice of knowledge sharing tools (e.g., Argote et al. 2003; Foss et al. 2010; Boh and Wong 2013; Schwaer et al. 2012; Cho et al. 2007; Holste and Fields 2009; Obstfeld 2005). We also added control variables to assist us in explaining the choice of knowledge sharing tools. By investigating these relationships we aim to draw conclusions on how each of the measurements impacts the use of formal and informal knowledge sharing tools. The research model shows 6 independent variables and 2 dependent variables.

Figure 1.1 Research model



The thesis is organised as following. The theoretical background of knowledge sharing mechanisms, the distinction used in this thesis between formal and informal knowledge-sharing tools, and the proposed different impacts on knowledge sharing mechanisms will be outlined, with pertaining hypotheses. Further a description of the different research methods utilised for this thesis will follow. An explanation of the different statistical tools used will be provided, before the results and the findings will be discussed. Lastly, the managerial and theoretical implications will be presented, before the papers limitations and suggestions for further research will conclude the thesis.

2 Theoretical Background and Research Hypotheses

In this section the theoretical background for the thesis is provided. The theoretical background of knowledge sharing tools will be outlined, and additionally the assumed different impacts on knowledge sharing tools, with pertaining research hypotheses. Argote et al. (2003) outlined several popular themes and measures in a study conducted on knowledge management and its influences, and parts of this thesis will use the same type of measures that are outlined in this article. The measures that will be examined from this article are mainly motivation, rewards and network centrality. However, several other measures have increased their importance over the years within the knowledge sharing literature, were intra-firm competition is one of them, which will be further investigated in this thesis (Teh and Sun 2012, Reinholt et al. 2011; Obstfeld 2005; Schwaer et al. 2012). Thus most of the hypotheses are based on existing literature, with some impacts further developed from literature.

2.1 Knowledge sharing tools

Knowledge sharing tools refers to the different methods employees within firms take use of when sharing knowledge between employees, divisions within the firm, or country subsidiaries (Allen et al. 2007). Cho et al. (2007) argue that different organisations naturally implement different knowledge sharing systems, thus it is difficult to put a set distinction on formal and informal knowledge sharing tools, as it is very context dependent on the organisation. Some organisations may have set times when employees can go to the cafeteria and exchange knowledge, whereas others arrange regular meetings for the same purpose, and both situations may be defined as a formal meeting in the organisation. In addition some organisations may consider certain type of medias as being informal, while other will consider this a natural part of the organisations KMS (Cho et al. 2007).

With that being said, it is still possible to provide some distinction between formal knowledge sharing tools and informal knowledge sharing tools. Formal methods usually include procedures and a knowledge-management system that is established by the organisation, whereas informal methods are knowledge sharing tools that employees take use of without incentives or explanations from the organisation, where there is usually no formal record or transcript of the knowledge sharing, thus this type of knowledge sharing is more tacit in nature (Schwaer et al. 2012).

The distinction between the two will further be discussed in the following sections of the thesis, with an explanation of the distinction used in this thesis.

2.1.1 Formal knowledge sharing tools

Pavitt (1993) defines formal knowledge sharing tools as systems that "provide explicit instructions that help guide knowledge exchange processes among employees". The formal tools consist of well-defined management systems and structures prescribed and forcibly generated by management in accordance with organisational strategies and mission. The management implements this type of system, so that the organisation and its employees can more efficiently exchange and reveal new knowledge. Formal knowledge sharing tools put together in a system is usually known as knowledge-management-systems (KMS). How

complex and detailed the knowledge sharing system is depends on the organisational context and it can vary from simple formal tools, such as information regarding meetings, team reports, training seminars and so on, to more complex tools such electronic knowledge databases (Okhuysen 2001).

Hansen et al. (1999) proposes a framework for distinguishing different knowledge sharing mechanisms, by grouping the different tools according to whether they are codified or personalised. Knowledge sharing tools that can be put in the codification group, are tools where knowledge is "carefully articulated, captured, and stored in documents and databases so that other employees in the organisation can access and easily use that knowledge" (Wai Fong and Sze Sze 2013). This framework was further developed by Boh (2007), who defined formal knowledge sharing tools as mechanisms that are designed to "enable the transference of learning and knowledge from an individual to a large number of individuals by embedding knowledge sharing capabilities in to the structure and routines of an organisation". Thus, formal knowledge sharing tools usually include those tools that are implemented and funded by the organisation (Boh 2007).

Yates et al. (1999), on the other hand, defines knowledge sharing systems as genre, where formal knowledge sharing tools are "socially recognized types of communication that are habitually carried out by organisational members to realise a specific purpose". Further they argue, that repeating this process in a specific system is a result of the organisations set norms and values, and that the level of knowledge exchanged through such a systems depends on the organisational context.

Okhuysen and Eisenhard (2002), further defines formal knowledge systems as structural tools developed by organizations in order to facilitate and organize knowledge, to increase the efficiency and frequency of the knowledge exchange process.

According to Schwaer et al. (2012), there are several benefits associated with the use of formal knowledge-systems. Its implementation allows and facilitates knowledge sharing by providing specific guidelines, which also allows the organisation to identify key resources within different areas. It also encourages

employees to participate in knowledge sharing, as there are formal routines for this activity in place. Due to the structural nature of formal knowledge-systems they are heavily implemented in global firms.

2.1.2 Informal knowledge sharing tools

Schwaer et al. 2012 argue that even though formal knowledge sharing tools exist, informal tools may be utilised as frequently as a KMS. Through formal knowledge sharing tools, the sharer is always known to the entire "network" of employees, which might not always be desirable. The knowledge shared may also be shared to any recipient within the network or organisation, which also might not be desirable for the sender. Some employees are already reluctant to share knowledge and the publicity and accessibility of KMS's might not improve this, thus employees engage in the use of informal knowledge sharing tools.

Informal knowledge sharing tools are according to Schwaer et al. (2012) "working relationships, collaborations and exchanges of knowledge between individuals as the result of personal initiative of employees". The issues that are communicated between employees are usually topics that are not governed by management or a KMS system, thus it usually involves a type of network or relation from one employee to the other. Even though not shared through formal knowledge sharing systems, the information may still be important and sensitive for business performance (Lawson et al. 2009).

Hansen et al.'s (1999) perspective on knowledge sharing tools, defines informal knowledge sharing systems as "ad-hoc and unstructured mechanisms that support individual knowledge sharing in an unplanned manner". This framework adopts the term of personalisation for informal knowledge sharing tools, and argue that the knowledge shared via such mechanisms are usually closely tied to the person who developed it, and thus shared through more personal interactions (Wai Fong and Sze Sze 2013; Alavi and Leidner 2001). Knowledge sharing tools that belong in this personalisation category does according to Namjae et al. (2007) typically involve unplanned meetings with co-workers, or other types of informal communication on a more personal level.

The difference is thus usually not in the quality of the information, however rather

in the medium the information is shared. Informal knowledge sharing tools' main difference from formal knowledge sharing tools is according to Schwaer et al. (2012) that informal tools contains voluntary membership, and in "that they help workers achieve work-related, personal and social goals through unofficial channels".

Knowledge is a sensitive topic in general and especially tacit knowledge, which is often as valuable for the organisation as tangible knowledge. Noorderhaven and Harzing (2009) argue that some of the most important knowledge exchange of tacit knowledge in MNC's, happens through social networks and connections that the different employees and often managers have created within the organisation.

2.1.3 Distinguishing between formal and informal knowledge sharing tools

As illustrated above there is really no set definition established in literature of what formal nor informal knowledge sharing tools ultimately consist of, as this is an emerging topic in knowledge sharing literature. However, from the research undertaken for this thesis, it seemed to be a common theme, that most authors believed formal knowledge sharing tools to be tightly connected with the organization (Schwaer et al. 2012; Hansen et al. 1999; Wai Fong and Sze Sze 2013; Alavi and Leidner 2001; Okhuysen and Eisenhard 2002; Yates et al 1999; Pavitt 1993; Boh 2007), and usually a part of the organisations own knowledge management system.

This approach is further what we have chosen to use for our thesis, when distinguishing between formal and informal knowledge sharing tools. This ultimately means that everything that is a part of the organisations own KMS will be defined as formal knowledge sharing tools, while anything outside of this will be defined as informal knowledge sharing tools. A table has been included to illustrate what has been categorized as both formal and informal based on the target company in this thesis (see table 1).

Table 2.1: Distinction of knowledge sharing tools

Formal Knowledge sharing tools	**Informal knowledge sharing tools**
W3 (Intranet)	Facebook
Connections (Employee Portal)	Twitter
Formal Meetings	LinkedIn
Work-shops	Informal Chat
Video-Phone conference	Email
Wiki (IBM tool)	Telephone
Blog (IBM tool)	
Web (IBM expert tool)	
Sametime	

For the convenience of the reader we have included a brief explanation of each of the different communication tools, as many of the formal knowledge sharing tools are highly connected to the organisation where the research was undertaken, and thus may need some explaining.

Table 2.2: Explanation of different knowledge sharing tools

Knowledge sharing tool	**Explanation**
W3	IBM's own intranet, where key personnel can post important information regarding the company, management, costumer etc.
Connections	IBM's employee portal, where wiki's, documents, files and information can be uploaded in to specific communities
Formal Meetings	Planned meetings with a specifically set time, place and purpose
Work-shops	Scheduled work-shops with a specific learning outcome
Video-Phone conference	Video or phone meetings with a specifically set time and purpose
Wiki	Web application from IBM, which allows people to add, modify, or delete content in collaboration with others.
Blog	IBM website, where IBM experts and leaders publish information and happenings related to the organisations products, services and customers.
Web	IBM´s home page
Sametime	IBM's intranet chat where files transferred are stored, and several users can be included in one forum
Facebook	Social media
Twitter	Social media
LinkedIn	Social media
Informal Chat	Unplanned meetings with no set time, place or purpose planned ahead
Email	Employee's work email
Telephone	Employee's work phone

2.2 Complementary and substitute effects

To our knowledge there has not been paid much attention in literature as to whether there are any complementary or substitute effects on the choice of formal and informal knowledge sharing tools. In other words, it would be interesting to examine whether the use of one type of knowledge sharing tool (e.g. formal) has a complimentary or substitute effect on the other type of knowledge sharing tool (e.g. informal). According to Voss et al. (2010) does two variables interact as substitutes, when the marginal benefit of each variable decreases as the level of the other variable increases. For instance, if an employee spends substantial time on one type of knowledge sharing mechanism, such as Facebook, which in this thesis is regarded as an informal knowledge sharing tool, it is likely to assume that the employee is likely to spend less time on formal type of knowledge sharing tools due to time constrains or other factors, hence there is a substitute effect.

Alternatively, two variables can also interact as complements, which implies that the marginal benefit of each variable increases as the level of the other variable increases (Voss et al. 2010). For instance, it is reasonable to expect that if an employee is generally motivated to use one type of knowledge sharing tool, the employee is also motivated to use the other type of knowledge sharing tool, hence there would be a complimentary effect. We therefore hypothesize:

H_{1a} – When there is a high use of one type of knowledge sharing tool the, use of the other will decrease.

H_{1b} – When there is a high use of one type of knowledge sharing tool the, use of the other will increase

2.3 Motivation

Motivation is a highly researched topic within the knowledge sharing literature (Cho et al. 2007; Cheolho and Rolland 2012; Matzler et al. 2008), however it is also a highly complex topic because it is so intangible in nature, and different types of motivation can have different impacts. This thesis has chosen to take use of the approach proposed by Foss (2009), where motivation is divided in to three parts; intrinsic, introjected and external motivation. Intrinsic and external motivation are well established measures used in the knowledge sharing literature (Galia 2008), however Foss (2009) argues that motivation is such a complex topic that a more "fine-grained" type of motivation is necessary to fully understand the impacts of motivation on knowledge sharing, and thus potentially the choice of knowledge sharing tools.

2.3.1 Intrinsic Motivation

When an employee is intrinsically motivated, the behaviour engaged in, is self-endorsed and consistent with the employees own interest and values. The employee thus receives personal enjoyment of conducting the act, and participating in a knowledge sharing process. Consequently, an employee chooses to engage in a particular behaviour, because this is compatible with the employees own needs and wants and not any external pressures (Foss 2009).

Intrinsic motivation is often argued to lead to more behavioural effort and persistence, which results in more positive behavioural outcomes than external motivation. This is because employees who are motivated to perform in accordance with their own interest and values tends to be more open toward others and to view new experience as opportunities, because such experience often widen their abilities (Reinholt et al. 2011). Also, results from (Cho et al. 2007) has shown that intrinsically motivated employees would like to use different combination of knowledge sharing tools, still formal interaction tools are preferred to share knowledge in this of the combination.

On the other hand, Kuvaas et al. (2012) argue that intrinsically motivated employees share knowledge out of their passion and thus the medium chosen are based on the mediums ability to share that specific knowledge. Similarly, research

has shown that a person who is intrinsically motivated are more proactive in ways of sharing knowledge to their network compared to persons who are externally motivated (Reinholt et al. 2011). Based on this we hypothesize:

H_{2a}: Intrinsic motivation is positively related with the use of formal knowledge sharing tools

H_{2b}: Intrinsic motivation is positively related with the use of informal knowledge sharing tools

2.3.2 Introjected Motivation

To explain an individual's behaviour in terms of motivation, another type of motivation has been emerging in the knowledge sharing literature, namely introjected motivation. Deci and Ryan (1985) proposed this third type of motivation to fully understand the choice of human engagement in certain type of behaviour, arguing that internal and external motivation did not fully grasp the extent on how motivation can impact behaviour. Introjected motivation explains the type of human motivation that is internalized, yet based on external demands. This means that an employee can engage in behaviour that the person does not fully accept as being part of their own values, however it is influenced by external forces, however not external rewards and punishments (Deci and Ryan 2000).

The difference is according to Foss (2009) that the individual "monitors and administer sanctions and rewards to himself or herself". This means that an employee can engage in a certain type of behaviour because the person believes that this will help in reaching set goals or targets, such as being positively noticed in the organization or praised by colleagues. An important feature of introjected motivation is thus that it "promotes feelings of worth" (Foss 2009). Foss (2009) introduced this third type of motivation into the knowledge sharing literature by examining how introjected motivation impacts knowledge sharing. The results were somewhat vague, however the results revealed that introjected motivation has a positive impact on sending knowledge in a knowledge sharing setting. It is thus likely that an employee who has goals of being positively noticed in the organization, or high ambitions of being praised by colleagues is likely to engage

in knowledge sharing behaviour.

In terms of choice of knowledge sharing tools this is likely to imply that employees that are highly introjectedly motivated will engage in knowledge sharing behaviour that will lead to the achievement of internal rewards (Foss 2009). As these internal rewards may stem from different parts of the organization, and may differ from the individual's own goals, it is likely to assume that an employee will engage in all types of knowledge sharing behaviour based on what they perceive as being more successful in achieving these individual goals. Based on the results from Foss (2009) and the definition of introjected motivation (Deci and Ryan 1985) we therefore hypothesize:

H_{3a}: Introjected motivation is positively related with the use of formal knowledge sharing tools

H_{3b}: Introjected motivation is positively related with the use of informal knowledge sharing tools.

2.3.3 External Motivation

When an employee is externally motivated, the behaviour of the person is controlled by external pressure, meaning either by the temptation of positive outcomes or to avoid negative consequences. This means that the tasks are performed either because of incentives or because the person wants to achieve a specific outcome.

Employee knowledge sharing is a sensitive topic in general, because it involves a trade-off for most employees. The time spent sharing knowledge could be spent doing something else, or the knowledge being shared may in the employee mind jeopardise the employees own superiority compared to other employees. According to Cabrera and Cabrera (2002) organisations should therefore find incentives that minimise this type of trade-offs by increasing employee's external motivation through external rewards. By attempting to increase employees external motivation, organisations may ensure that employees who were not previously motivated to share knowledge and perceived the trade-off of sharing knowledge of being too great, to engage in such knowledge sharing behaviour.

With that being said this on the expense of external incentives, which may again reduce the two other types of motivation for employees.

A field survey conducted by Bock and Kim (2002) revealed that extrinsic motivators had a positive effect on employee knowledge sharing when imposed by managers. Further a study conducted by Burgess (2005) revealed that employees shared more knowledge when they knew that engaging in such behaviour would lead to rewards that were perceived as desirable, thus employees with high external motivation were more likely to engage in knowledge sharing behaviour. Similarly Irmer et al. (2002) found that externally motivated employees are more likely to engage in knowledge sharing inter-organisationally.

External motivators usually include external rewards such as promotions, a raise or other monetary benefits; however it can also include praise from key employees, such as managers. It is usually external sources, such as costumers, managers or other colleagues that administer the benefits associated with external motivation (Foss 2009). Consequently, employees choose to share knowledge through the media that will most easily lead to these external rewards. Naturally this would be through formal knowledge sharing tools, as the employees input could be easily measured through such tools, however with increasing social networks and changing customer contact it is also likely to assume that an externally motivated employee will engage in any knowledge sharing process as long as it leads to certain benefits. The hypotheses are thus:

H_{4a}: External motivation is positively related with the use of formal knowledge sharing tools

H_{4b}: External motivation is positively related with the use of informal knowledge sharing tools

2.4 Network Centrality

Employees role in organisational networks and employees centrality in organisational network has been an emerging, however much debated area within knowledge management research (Anderson 2008; Reinholt et al. 2011; Hansen et al. 2005; Verburg and Andriessen 2011; Noorderhaven and Harzing 2009). Network centrality refers to how centrally an employee is placed within the organisational network, in other words the size of the employees network, and how close the ties are within this network, thus how centrally oriented the employee's network is (Reinholt et al. 2011).

Anderson (2008) argues that employee's network size and tie strength has an impact on employee's knowledge sharing behaviour. The study revealed that employees who had a large network size were more likely to engage in knowledge sharing processes, whereas tie strength did not have any significant results on knowledge sharing. Hansen et al. (2005) found similar results in a study conducted on how network density and strength influenced knowledge sharing intra-subsidiary and across subsidiaries, where the results revealed that employees who had high levels of network density were more likely to engage in knowledge sharing procedures, whereas the results regarding network strength showed that this did not significantly impact employee's knowledge sharing behaviour.

Reinholt et al. (2011) on the other hand found that network centrality does indeed impact knowledge sharing, however it was debatable whether knowledge sharing increased as sole effect of high network centrality, or whether it had a more mediating effect through other type of measures. Noorderhaven and Harzing (2009) also found that social networks in MNC's forms the basis for some of the important channels of knowledge sharing between employees. Especially the transfer of tacit knowledge was found to be positively associated with the social interaction of employees and managers of MNC's. Employees who are not part of such social networks or centrally placed in these networks are likely to only be able to take use of a limited set of knowledge sharing tools, simply because the employee is not part of any network to create additional channels of knowledge flows.

Based on the research mentioned above it is thus likely to assume that a central network position among employees has a positive impact on knowledge sharing.

In terms of knowledge sharing tools, it is likely to assume that employees who engage in knowledge sharing activity are likely to do so through the media perceived as being the most efficient and effective. This was also found in a study conducted by Nunes and Pereira (2012), which revealed that both formal and informal knowledge sharing tools were preferred for employees who had central roles in networks. In turn this means that employees with high levels of network centrality is likely to engage in the knowledge sharing process found the most convenient at that time, whether this is informal or formal knowledge sharing tools, which forms the basis for:

H_{5a}: High level of centrality of an employee's network is positively related with the use of formal knowledge sharing tools.

H_{5b}: High level of centrality of an employee's network is positively related with the use of informal knowledge sharing tools.

2.5 Intra-firm Competition

Intra-firm competition refers to competition between subsidiaries of a MNC or competition between employees of a firm. According to (Teh and Sun 2012; Ghobadi and D'Ambra 2013) knowledge is a difficult topic in general, because many employees hesitate to share knowledge due to the fact that knowledge is perceived as a valuable asset, and open sharing of knowledge will in turn help others create the same valuable asset. Nonetheless, various studies have demonstrated that organisational climate has been a strong predictor of intention to share knowledge, where especially open and cooperative culture facilitates knowledge contribution, which supports the idea that the social environment is a critical source of influence on individual's knowledge sharing attitudes and behaviours (Boh and Wong 2013; Wolfe and Loraas 2008).

Further, Tsai (2002) found that "coopetition" occurs in multiunit organisations because units and employees have to cooperate with each other to access relevant resources and yet compete to outperform each other. Consequently, the

employee's perception of cooperative and competitive culture in an organisation is often the same, and a competitive culture is positively linked with high level of knowledge sharing (Boh and Wong 2013; Wolfe and Loraas 2008). Ghobadi and D'Ambra (2013) found similar results in a study conducted on how high intra-firm competition between cross-functional teams, divisions and employees foster high level of knowledge sharing, and often the knowledge sharing occurs through both formal and informal channels (Ghobadi and D'Ambra 2013).

However, with global recessions and decreasing job security, employees are becoming more competitive. With that being said the competitive landscape of employees is changing. Employees are aware that the personnel are now the key to business survival and creating core competencies, and therefore want to be perceived as valuable to the organisation. Employees that wants to be positively noticed in the organisation, and motivated by external rewards, are thus likely to engage in a knowledge sharing processes where their efforts are recognised and very visible to others (Foss 2009). We therefore hypothesize:

$H_{6a:}$ Intra-firm competition is positively related with the use of formal knowledge sharing tools

H_{6b}: Intra-firm competition is positively related with the use of informal knowledge sharing tools.

2.6 Rewards

The effect of rewards on knowledge sharing is a highly debated topic within in the knowledge sharing literature (Gupta et al. 2012). For instance, Gooderham et al. (2011), argue that rewards can have a negative impact on knowledge sharing, and thus choice of tools, as the employee will only engage in the knowledge sharing process because of tangible benefits. In other words, when the tangible benefits cease to exist or are limited, employees who engage in knowledge sharing only due to the possible benefits will decrease their knowledge sharing activity. Further Gooderham et al. (2011) argue that rewards may influence tacit knowledge sharing negatively, as this type of knowledge is usually mediated through personal channels based on trust, and not motivated by external rewards.

On the other hand, Argote et al. (2003) argue that rewards and incentives are important factors that can help to facilitate the knowledge sharing process in an organisation. Argote et al. (2003) claim that employees are unlikely to transfer knowledge to other part of the organisations if not rewarded for utilizing internal knowledge. Social rewards can be just as important as monetary rewards. Consequently, different rewards and incentives foster motivation for employees to share knowledge within the organisations (Argote et al. 2003).
Further, Burgess also (2005) found that employees were more likely to engage in knowledge sharing behaviour, when it was known that engaging in such behaviour would lead to beneficial outcomes and rewards that were desirable.

In terms of choice of knowledge sharing tools, Bartol and Srivastava (2002) found contradicting results in a study conducted on rewards and knowledge sharing behaviour. The results revealed that rewards had a positive impact on the use of formal knowledge sharing tools in intra-firm knowledge sharing and knowledge sharing in team-based projects. In terms of the effect of rewards on informal knowledge sharing tools it was found that the "key enabling factor was trust", however that the role of rewards could be an important factor in developing such trust.

This in turn, means that employees who are motivated by their own desire to share knowledge are likely to do so regardless of external benefits; however employees who are very much motivated by external rewards or social rewards are likely to engage in knowledge sharing activities that will lead to the attainment of such goals. Based on this it would be natural to assume that employees, who are highly occupied with different types of rewards, are likely to take use of the knowledge sharing tool most closely connected with the possible achievement of these rewards. It is thus natural to assume that:

H_{7a} – High use of organisational rewards are positively related with the use of formal knowledge sharing tools

H_{7b} – High use of organisational rewards are positively related with the use of informal knowledge sharing tool

Table 2.3: Summary of Hypotheses

H_{1a}	When there is a high use of one type of knowledge sharing tool, the use of the other will decrease.
H_{1b}	When there is a high use of one type of knowledge sharing tool, the use of the other will increase
H_{2a}	Intrinsic motivation is positively related with the use of formal knowledge sharing tools
H_{2b}	Intrinsic motivation is positively related with the use of informal knowledge sharing tools
H_{3a}	Introjected motivation is positively related with the use of formal knowledge sharing tools
H_{3b}	Introjected motivation is positively related with the use of informal knowledge sharing tools
H_{4a}	External motivation is positively related with the use of formal knowledge sharing tools
H_{4b}	External motivation is positively related with the use of informal knowledge sharing tools
H_{5a}	High level of centrality of an employee's network is positively related with the use of formal knowledge sharing tools
H_{5b}	High level of centrality of an employee's network is positively related with the use of informal knowledge sharing tools.
H_{6a}	Intra-firm competition is positively related with the use of formal knowledge sharing tools
H_{6b}	Intra-firm competition is positively related with the use of informal knowledge sharing tools
H_{7a}	Organisational rewards are positively related with the use of formal knowledge sharing tools
H_{7b}	Organisational rewards are positively related with the use of informal knowledge sharing tools

3 Methods

This part of the thesis will describe the different methods utilised in this paper to gather and analyse the data, which our research and results are based on. The section includes a description of the research design, and choice of data utilised in this research. Further an explanation of key informants, the target organisation and the data collection method will be provided, and also the sampling method used. The different variables in the thesis, the data collection process, and the statistical tools will also be described.

3.1 Research Design

There are various research methodologies employed by researchers in conducting research of any kind and it is not possible for any particular type of method to be recognized as a universally applicable tool. The choice of appropriate research designs is according to Easterby-Smith et al. (2008) about making choices about what will and will not, be observed. The research design explains and justifies what data is to be collected, and how and when this data-collection should take place (Easterby-Smith et al. 2008). Several of the different type of research designs that are available is distinguished based on three epistemological positions, which include positivist, relativist and social constructionist. This thesis has taken the approach of a relativist epistemological position, which very often involves survey research, and thus quantitative data.

3.2 Quantitative Data

Research methodologies are generally divided into two categories: qualitative method and quantitative method (Easterby-Smith et al. 2008).

The research design chosen for this thesis is a quantitative design. The reason for this is that in our opinion, this would increase the validity and quality of the research by getting access to a larger sample, and also reduce biases. By choosing a quantitative approach the thesis will benefit by a larger pool of respondents, then what would most likely be possible with a qualitative approach, and also made the analysis process less comprehensive, with all the data collected through a survey (Dillman 2006). Also, previous literature, which some of our hypotheses are based

on, have taken use of quantitative methods, further emphasising that this is the appropriate way to measure our topic and research problem.

3.3 Key Informants

The data from the research was collected from employees in the Norwegian subsidiary of a large MNC with more than 300.000 employees worldwide. The employees worked in numerous departments and had different job roles; however it was the employees' knowledge sharing ability in both a local and global context that made the respondents interesting, thus employees that worked on both local and global teams were selected. To avoid any bias, and increase external validity, the employees belonged to several different departments, and had different responsibilities within the organisation.

3.4 The IT Industry and the MNC

The IT-industry, with its international structure and work-force, was ideal for our thesis due to its dynamic nature where changes happen rapidly, which increases the necessity for knowledge-transfers within companies in this industry. The company where the data was collected from is also a market leader within this industry, well known for its focus on collaboration and employee empowerment. The company was also willing to assist us in collecting the data, and ensure that the right employees were chosen for data collection, to further increase the validity of the results.

3.5 Data Collection Method

This research have chosen to take use of surveys as a mean to collect quantitative data as the use of surveys is an efficient way to collect the data from a large number of people (Easterby-Smith et al. 2008). A survey is a systematic process that requires the researcher to go through a series of decisions (Burns et al. 2009). As our research aims to determine the relationship between different variables and concepts already established in literature, this research has taken use of an inferential survey (Easterby-Smith et al. 2008).

To avoid biases in the survey design, the survey was created following the framework proposed by Burns et al. (2009), which outlines clear do's and don'ts

for how the questionnaire should be designed, pretesting and the wording of the questions. The survey was created in English, as several of the respondents have different nationalities and English is the formal organisational language, so that when referring to different communication methods in the questionnaire this would be similar to what employees were used to referring to.

This study has chosen a closed-end questionnaire design to increase the convenience of measuring data and the descriptive work, and ensure getting relevant answers (Schwarz 1999, 95).

3.5.1 Online Questionnaire

As several participants in our sample were located at different geographical locations, it was decided that an online questionnaire would be the most efficient way to distribute the survey, and to hopefully increase response rates. With an Internet-based survey it is also easier to explain parts of the survey that may be difficult to understand for the respondent and also directly download the data into statistical programs (Easterby-Smith et al. 2008).

The survey was distributed electronically through email to the appropriate respondents, where a link to the webpage containing the questionnaire was included.

The survey was created through the online survey creator Qualtrics, as the tool proved to be cost-efficient and effective. Qualtrics is a leading provider of tools for market research and feedback programs, and with this tool the questionnaire could be customized to suit our thesis. The help from the template already created to fit several types of studies would also hopefully help us increase response rates, due to the clean and simple layout.

3.6 Sampling

As limited resources and time makes it impossible to distribute the survey to an entire population, a sample from this population was drawn. The sample of our research includes the key informants explained above. This part of the thesis will explain the sample method utilised in our research. Sampling designs can usually

be divided in to two main categories; probability sampling and non-probability sampling. Probability sampling involves forms of sampling designs where the probability of each entity being part of the sample is known (Easterby-Smith et al. 2008). Non-probability sampling involves sampling-designs where it is not possible to state the probability of any member of the population being sampled. Due to the complexity of the research problem and the topic of knowledge-transfers, a probability-sampling design was chosen for our thesis. It is only with probability sampling that it is possible to be precise about the relationship between a sample and the population from which a sample is known (Easterby-Smith et al. 2008). This in turn increases the validity of this thesis, and enables us to make more precise judgements about the relationships between the different characteristics of the sample.

The sampling design used for our research involves a simple random sampling design. This means that every sample entity, which in this case is the selected employees of this subsidiary of the MNC, had an equal chance of being part of the sample (Easterby-Smith et al. 2008).

3.7 Measures

Most of the variables in our research model had existing valid and developed measures. We used existing valid measures in our research, and in those cases where this was not possible, we developed new measures in collaboration with our supervisor.

3.7.1 Dependent Variables

The usual starting point for establishing variables and concepts is to isolate the factors that appear to be involved, and to decide what appears to be causing what. The dependent variables represent the output or the effect, which are assumed to be causing the former (Easterby-smith et al. 2008). In the research model, the dependent variables are formal and informal knowledge sharing tools.

3.7.1.1 Formal Knowledge sharing tools

The dependent variable for formal knowledge sharing tools have been measured on a seven-point scale, which measures the regularities of using the specific tool from “never” to “daily” for sharing knowledge. Tools that are defined as formal include tools that are developed by IBM for knowledge sharing such as w3, Connections, Sametime, workshops, Wiki, blog and Web, or tools or procedures that are expected to use in IBM, like formal meetings, for sharing knowledge to others.

3.7.1.Informal Knowledge sharing tools

The dependent variable for informal knowledge sharing tools has been measured on the same seven-point scale as formal. However, tools that are defined as informal are communications tools that are not required or developed by IBM when engaging in knowledge sharing processes. We have included Facebook, Twitter, Linkedin, Email, Telephone and informal chat (F-2F) in this category.

The following text presented both formal and informal sharing tools for sharing and receiving knowledge home and abroad:

1. How often do you use the following communication tools to share knowledge in your country?
2. How often do you use the following communication tools to share knowledge with other countries?
3. How often do you receive knowledge in your country through the following communication tools?
4. How often do you receive knowledge from other countries through the following communication tools?

Table 3.1: Questionnaire items for knowledge sharing tools

Item	Item Statement	Item previously used by
SMS	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Email	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Telephone	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Facebook	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Twitter	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
w3	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Connections	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Sametime	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Formal meetings	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Training (such as workshop)	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Video/Phone conference	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
LinkedIn	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Wiki	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Blog	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Web	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor
Informal chat (F-2-F)	1= Never and 7 = Daily	Developed in a collaboration with our thesis supervisor

3.7.2 Independent Variables

Independent variables are defined as predictors or potential explanatory variables of the dependent variable (Hair et al. 2010). In our research model, independent variables are: intrinsic motivation, introjected motivation, external motivation, network centrality, intra-firm competition and rewards. As mentioned above, we used previous developed scales and developed some new scales with our supervisor.

3.7.2.1 Intrinsic Motivation

We aimed to investigate how different intrinsic motivation relates with the use of formal or informal knowledge sharing tools by the employees. Items 1, 2 and 3, the first motivation section in our questionnaire was based on the Foss et al. (2009) article, "Encouraging Knowledge Sharing Among Employees: How Job Design Matters". The following text that presented the questions asked: "To what extent do you agree or disagree with the following statement: I share knowledge because…" The items were anchored in a seven point scale where 1= Strongly disagree and 7 = Strongly agree.

Table 3.2: Intrinsic Motivation

Item	**Item Statement**	**Item previously used by**
Intrinsic_mot 1	I think it is important to share knowledge	Foss et al. 2009
Intrinsic_mot 2	I like to share knowledge	Foss et al. 2009
Intrinsic_mot 3	I find it personally satisfying	Foss et al. 2009

3.7.2.2 Introjected Motivation

The introjected motivation items 1, 2 and 4 were also based on Foss et al. (2009), however item 3 and 5 where slightly modified. We included the questions "I want my superior to think I am competent" and "I want to be respected by my co-workers" to the questionnaire, as the items may provide insightful information on whether or not employees chose formal or informal knowledge sharing tools. The following text presented the question: "To what extent do you agree or disagree with the following statement: I share knowledge because…" The items were anchored on a seven point scale where 1= Strongly disagree and 7 = Strongly agree.

Table 3.3: Introjected Motivation

Item	**Item Statement**	**Item previously used by**
Introjected_mot 1	I feel proud of myself	Foss et al. 2009
Introjected_mot 2	I want my superior to think I am a good employee	Foss et al. 2009
Introjected_mot 3	I want my superior to think I am competent	Modified from Foss et al. 2009
Introjected_mot 4	I want my colleagues to think I am competent	Foss et al. 2009
Introjected_mot 5	I want to be respected by my co-workers	Modified from Foss et al. 2009

3.7.2.3 External Motivation

External motivation items 1 to 4 for sharing knowledge was based on Foss et al. (2009). Items 5 to 7 where further developed with the thesis supervisor, as we wanted to investigate other external motivational factors that may contribute for sharing knowledge. The items were presented by the following text: "To what extent do you agree or disagree with the following statement: I share knowledge because…" The items were anchored in a seven point scale where 1= Strongly disagree and 7 = Strongly agree.

Table 3.4 – External Motivation

Item	**Item Statement**	**Item previously used by**
External_mot 1	I want my superior to praise me	Foss et al. 2009
External_mot 2	I want my colleagues to praise me	Foss et al. 2009
External_mot 3	I might get a reward	Foss et al. 2009
External_mot 4	It may help me get promoted	Foss et al. 2009
External_mot 5	I might get a raise	Further developed from Foss et al. 2009 in cooperation with the thesis supervisor
External_mot 6	I want to be positively noticed in the organisation	Further developed from Foss et al. 2009 in cooperation with the thesis supervisor
External_mot 7	I want to improve the performance and reputation of the organisation	Further developed from Foss et al. 2009 in cooperation with the thesis supervisor

3.7.2.4 Network Centrality

The next independent variable included in the questionnaire was network centrality. The items, which investigated the respondents network centrality both in home-country and abroad, were based on the items in Antia and Frazier (2001) "The Severity of Contract Enforcement in Interfirm Channel Relationships" and from Reinholt et al. (2011) "Why a central network position isn´t enough: The role of motivation and ability for knowledge sharing in employee networks", and slightly modified to fit the purpose of the paper. We have chosen to measure network centrality through degree centrality, which refers to "the number of direct contacts an employee is connected to". This approach was first proposed by Freeman (1979), and further used in Reinholt et al. (2011), where many of our survey questions were developed from.

The items were presented by the following text: "To what extent do you agree or disagree with the following statement". The items were anchored in a seven point scale where 1= Strongly disagree and 7 = Strongly agree.

Table 3.5: Network Centrality

Item	**Item Statement**	**Item previously used by**
Network_cent 1 (domestic)	I am an important part of the organisation's network in my country	Modified from Antia and Frazier 2001
Network_cent 2 (domestic)	I have many connections in the organisation's network in my home country	Modified from Antia and Frazier 2001
Network_cent 3 (domestic)	How many people in the organisation in your home country do you regularly communicate with?	Reinholt, Pedersen and Foss 2011
Network_cent 1 (international)	I am an important part of the organisation's network in other countries	Modified from Antia and Frazier 2001
Network_cent 2 (international)	I have many connections in the organisation's network in other countries	Modified from Antia and Frazier 2001
Network_cent 3 (international)	How many people in the organisation outside your home country do you regularly communicate with?	Reinholt, Pedersen and Foss 2011

3.7.2.5 Intra-firm Competition

The items that investigated intra-firm competition were developed in collaboration with our thesis supervisor. The items were presented by the following text: "To what extent do you agree or disagree with the following statement". The items followed the same seven point scale in the questionnaire where 1= Strongly disagree and 7 = Strongly agree.

Table 3.6: Intra-firm Competition

Item	**Item Statement**	**Item previously used by**
Intra-firm comp1	There is internal competition in my organization	Developed in a collaboration with our thesis supervisor
Intra-firm comp2	Other employees can threaten my position in the organization	Developed in a collaboration with our thesis supervisor
Intra-firm comp3	There is strong rivalry among colleagues in my organization	Developed in a collaboration with our thesis supervisor
Intra-firm comp4	There is strong rivalry between different subsidiaries in my organization	Developed in a collaboration with our thesis supervisor
Intra-firm comp5	Individual performance is important in my organization	Developed in a collaboration with our thesis supervisor

3.7.2.6 Rewards

The last independent variable in our questionnaire was reward systems. The items in the questionnaire were based and modified from the paper by Gooderham et al. 2011. Where item 1 and 2 were modified, the remaining items, 3-6, were directly grounded from the paper. Item 1 and 2 were presented by the following text: "To what extent do you agree or disagree with the following statement" and item 3-6 where presented with: "To what extent does your company currently reward you for sharing knowledge…" The items were anchored in a seven point scale where 1= Strongly disagree and 7 = Strongly agree.

Table 3.7: Rewards

Item	**Item Statement**	**Item previously used by**
RewSys1	The reward systems that are applied to me are directly tied to my efforts in sharing knowledge	Gooderham, Minbaeva, and Pedersen 2011
RewSys2	Frequent, high-quality knowledge sharing increases my salary	Gooderham, Minbaeva, and Pedersen 2011
RewSys3	To what extent does your company currently reward you for sharing knowledge by increments/bonuses	Gooderham, Minbaeva, and Pedersen 2011
RewSys4	To what extent does your company currently reward you for sharing knowledge by promotion	Gooderham, Minbaeva, and Pedersen 2011
RewSys5	To what extent does your company currently reward you for sharing knowledge by positive performance evaluation	Gooderham, Minbaeva, and Pedersen 2011
RewSys6	To what extent does your company currently reward you for sharing knowledge more recognition from my superiors	Gooderham, Minbaeva, and Pedersen 2011

3.7.3 Control Variables

In the model we included control variables, as control variables assist to explain the use of informal and formal knowledge sharing tools. For instance, respondents that do not actively engage in knowledge sharing have limited contribution value in this research.

3.7.3.1 Knowledge sharing level

The control variables were divided into two parts, where one model investigated how much an employee used and received knowledge to colleagues home and abroad. The other part examined how much the employee's colleagues home and abroad receive and used this knowledge. The items presented in table 3.8 were based on the Foss et al. 2009 article "Encouraging Knowledge Sharing Among Employees: How Job Design Matters".

Table 3.8: Control variables

Item	**Item Statement**	**Item Previously used**
RecKnow - domestic	**received** knowledge from colleagues in your country	Foss et al. 2009
UsedKnow - domestic	**used** knowledge from colleagues in your country	Foss et al. 2009
RecKnow – intern.	**received** knowledge from colleagues in other countries	Foss et al. 2009
UsedKnow – intern.	**used** knowledge from colleagues in other countries	Foss et al. 2009
SentKnow - domestic	in your country **received** knowledge from you?	Foss et al. 2009
CollUsedKnow - domestic	in your country **used** knowledge from you?	Foss et al. 2009
SentKnow – intern.	in other countries **received** knowledge from you?	Foss et al. 2009
CollUsedKnow – intern.	in other countries **used** knowledge from you?	Foss et al. 2009

3.8 Data Collection Process

While creating the survey, we received valuable feedback from both the thesis supervisor, however also from our contacts within the firm. Throughout this process the survey was pretested several times with our contacts, and also other employees to avoid confusing wording and adapt the survey to the context of the target organisation.

The respondents were first notified about the survey through an email saying that a survey would be distributed to appropriate respondents within the next week. The same information was posted in an article on the company's intranet, explaining the background of the thesis and the purpose of the survey. A week later potential respondents received an email from the communications manager containing the link of the survey and encouragement to respond. The email was distributed to 650 employees.

This way of distributing the survey proved to be highly successful, and after the first two weeks, the initial goal of 80 respondents was reached. A reminder email was sent after these two weeks, which further increased the number of respondents to 154 valid responses, after another two weeks. This gave us a response rate of 23.69 %. Nulty (2008) recommends the response rate of being between 20-40%. As we conducted the study internally in an organisation, however without any incentives from management, we find the response rate of almost 24 % to be satisfactory. The size of the sample, given that it was quite large, also makes the response rate satisfactory.

Further, the data was coded into numbers for a more precise and accurate statistical analysis. In the questionnaire we included the function of forced responses, so that respondents had to answer all questions in the survey, leaving us with no missing values.

3.9 Sample Characteristics

The 154 respondents were distributed unevenly in regards to gender, with 113 males and 41 females, which is natural as IBM has a dominant male workforce in this particular subsidiary. The age of the respondents in the research varied from 18 to 60 and above, which is interesting as employees from different generations

are likely to have different perceptions of knowledge sharing and knowledge sharing tools. With that being said, the majority of the respondents in the survey were from 40 to 59 years old, which is also natural as this generation is predominant in this particular IBM subsidiary.

Table 3.9: Age distribution of respondents

Age	**Frequency**	**Percent**	**Valid**	**Cumulative Percent**
18-29	14	9.1	9.1	9.1
30-39	26	16.9	16.9	26.0
40-49	40	26.0	26.0	51.9
50-59	54	35.1	35.1	87.0
60+	20	13.0	13.0	100.0
Total	154	100	100	

The survey was distributed to several different departments in IBM with a clear focus on the different sales departments, and departments were respondents worked on both local and global teams. Respondents were distributed quite evenly throughout the different departments, however the majority of respondents were from the consulting business unit of this IBM subsidiary.

3.10 Factor analysis

"Factor analysis is a data reduction technique, whose primary purpose is to define the underlying structure among the variables in the analysis" (Hair et al. 2010, 94). In this paper, to test the measurement models, we used confirmatory factor analysis (CFA). Confirmatory factor analysis allows one to understand how much the X variables depend on the latent variables. Analyses were conducted in Lisrel 8.80 Edition. Kelloway (1998) argues when determining the model fit for the measurement models the root mean squared error of approximation (RMSEA) value should be low, as smaller values indicates a better fit to the data, however this number is a subjective judgement and cannot be regarded as dependable. In addition, Joreskog and Sorbom (1993) suggest that RMSEA values below 0.10 indicate a good fit to the data, whereas value below 0.05 suggests a very good fit to the data. Also, Hair et al. (2010) argue that the measurement models has a good

fit if the Chi-square and degrees of freedom is close in value, and if the p-value is above the recommended value of 0.05.

According to Stevens (2002), a factor is reliable if it has a loading above 0.50 and thus considered "practically significant". However, this is a rule of thumb and does not cover every case, however it provides the researcher with some guidance. For instance, Hair et al. (2010) recommends that factor loadings from 0.38 to 0.51 are practical significant based on a sample size of 100-200 (154). As a result, we follow the recommended values from Hair et al. (2010) when evaluating the factor loadings for the measurement models. Also, by running a reliability analysis called Cronbach Alpha, one can estimate internal consistency associated with the score derived from the scale. A high Cronbach Alpha value of 0.70 or higher indicates good internal consistency (Hair et al. 2010). This is important because you want to ensure that all items in the questionnaire measure what they are supposed to measure.

3.10.1 Single Factor Confirmatory Analysis (CFA)

The first step in our analysis is to examine how the one-factor model fits the entire model. The first model investigated is motivation. As explained in the literature review, there are three different types of motivation. Hence, the motivation model is divided in three parts in the questionnaire that are called intrinsic, introjected and external motivation.

The *intrinsic motivation model* (appendix 5) had a good fit, with factor loadings above the recommended values (Var 1 = 0.72, Var 2 = 0.91 and Var 3 = 0.78. When running the second model, *introjected motivation* (appendix 6), we removed the second item (I want my superior to think I am a good employee) due to the high measurement error. The model fit increased when we removed the second item. This was done as this question had similar wordings with the third item, indicating that the wording of items elicits different response. For instance, wording of "good" in the second variable is vague and unclear, which results in many different responses. However, with factor loadings well above the recommend values and a P-value of 0.07 and a RMSEA of 0.10 indicated that the model had a good fit.

The third model *External motivation* (appendix 7) aims to measure employee's outward motivation for sharing knowledge. The model showed a poor fit and factor loadings for item 7 (I want to improve the performance and reputation of the organisation) was only 0.18, which is below the recommended value. This may imply that item 7 measures an external motivational factor on an organisational level instead of on personal level compared to items 1 to 6. Hence, measurement item 7 should not be in the external personal motivation category in the questionnaire and is therefore removed. Furthermore, when investigating the modification indices for the model, the correlation between item 1 and 2 was too high. This may imply that wordings of the variables are too similar. Hence, by removing item 7 and opening item 1 and 2 the factor loadings and the fit of the model were acceptable. The Cronbach's Alpha statistics for the 12 items that measure motivation is 0.892 suggesting that the items have a very high internal consistency.

When running the measurement model *Reward* (appendix 8) we kept all items due to a high factor loadings on all items (lowest 0.61) and a Cronbach value of 0.875. The model received an unsatisfying model fit when converging the items together into one model. The unsatisfying model fit occurred as the wording structures in the sentences are different from item 1 and 2 and item 3 to 6, which separated the measurement model reward. However we chose to converge the reward items as least three different items was needed to run a single-factor CFA in Lisrel, and the first part of the reward questions in the questionnaire contained only 2 items. Based on reasoning above, all items were kept for the model.

The next measurement models *Knowledge sharing level Home* (appendix 10) and *Knowledge Sharing level Abroad* (appendix 9 had high factor loadings (lowest 0.63 Home and 1.01 Abroad) and Cronbach values (0.941 Home and 0.940 Abroad). However, the model received an indecisive model fit due to the similar wordings for the items. All items were kept for the model.

The next measurement models investigated the employee's network centrality home (appendix 11) and abroad (appendix 12). Network1 showed satisfying factor loadings (lowest loading were Item 3= 0.53) and a Cronbach value on 0.774.

Also, Network2 revealed very satisfying factor loadings (lowest loadings were Var 3= 0.73) and Cronbach value 0.887. Hence, good model fit for both models and all items were kept.

The final measurement model *intra-firm competition* (appendix 13) had an almost perfect fit with factor loading well above the recommended values (lowest 0.59) and P-value of 0.06 and RMSEA of 0.107. The Cronbach's Alpha statistics for the 4 items showed 0.762 indicating good internal consistency.

3.10.2 Two-Factor Confirmatory Analysis

After investigating each single measurement model, we tested them against each other for evaluating the model fit and examine the possibility for error covariance between the items in the model (Appendix 4). The first pair of items that dealt with related issues in terms of external motivation were item 9 and 10 (I want my superior to raise me) and (I want my colleagues to praise me). The statements are also worded very similar and it is reasonable to assume that these two items share some error covariance. The second pair of items that also share some error covariance consists of two statements in the reward measurement model, item 5 (by positive performance evaluation) and item 6 (by more recognition from my superiors). This is reasonable to expect since both deal with related issues in terms of recognition by top management.

Further analysis of the fit for the measurement model revealed error covariance between all items in the control variables between home country and abroad. The error covariance between the items occurred as we needed to structure the sentences in a certain way to avoid respondent biases and measurement errors. As seen in Appendix 9 and 10 we measured knowledge sharing home and abroad in the same section for both of the models. As a result, there are large error covariance issues between knowledge sharing home and abroad and for employees and colleagues. Indicating that the items result in too many different responses, which is expected as employees often share and receive the amount of knowledge differently from home and abroad.

The measurement model has a good fit since the value of the Chi-square and DF are relatively close in value (Chi-Square = 814.03 and DF = 537). Also, the RMSEA value are well below the recommend value of 0.10 (0.058) indicating a very good fit to the data. All factor loading are above the recommended value of 0.38 (lowest 0.49) concluding that our measurement model has a good fit.

3.11 Descriptive statistics

For all the constructs measured in Lisrel we ran descriptive statistics to give an overview over the responses in the questionnaire (appendix 14). All scales for the items were measured in 1 to 7 scales except network centrality, which was measured from a 1 to 6. From the scales in the descriptive statistics overview (appendix 14) it was clear that not all of the 7 values of the scale were used, and the minimum and maximum values are therefore 2 and 6 for some of the variables in the questionnaire.

Skewness and Kurtosis explains and characterise the shape and symmetry of the distribution in the dataset. Skewness in descriptive statistics explains where the data lies on the scale, for instance is it heavily weighted to the left or right side of the scale. According to Hair et al .(2010) a Skewness value is > 0, indicates that the values are right skewed distributed, meaning that most of the values are concentrated on the left of the mean, with extreme values to the right. If a Skewness value is < 0, the values is left skewed, meaning that most of the values are concentrated on the right of the mean, with extreme values to the left (Hair et al. 2010). The descriptive statistics table (appendix 14) indicates that many of the values are unbalanced and therefore skewed distributed.

Kurtosis on the other hand explains how flat or peak the distribution of the data is. Positive kurtosis indicates a relatively peaked distribution, whereas a negative kurtosis indicates a relatively flat distribution (Hair et al. 2010). The descriptive statistics table (appendix 14) indicates that many of the values are both flat and peaked distributed. However, since we have a relatively large sample size the effect of Skewness and Kurtosis have very little impact on the results (Hair et al. 2010).

4 Analysis and Results

This part of the thesis will explain how the different independent variables and hypothesis was tested. To further analyse the results and examine the proposed hypotheses the data was implemented in to the statistical software IBM SPSS Statistics Data Editor version 20. This software allowed us to make reasonable estimates on how well the different variables correlate and how the independent variables impact the dependent variables.

Based on the Lisrel analysis all the different measures initially proposed were kept for further analysis as they all showed satisfactory loadings, with some questions as explained above removed. This means that all the remaining questions measured the constructs intended. However, new variables where created using SPSS to be able to run the different regressions. These require some explanation. As the aim of the thesis is to examine knowledge sharing locally and globally, these two constructs were measured separately to ensure that respondents fully understood that we wanted to measure their use of knowledge sharing tools both locally and globally. However, as the aim of the thesis was to examine the different impacts on formal and informal knowledge sharing tools, the different questions examining knowledge sharing globally and locally were merged into some main variables. This was the case for the questions of level of knowledge sharing globally and locally, network centrality globally and locally, and choice of formal or informal knowledge sharing tools locally and globally. These variables were further renamed knowledge sharing level, formal, informal and network centrality.

The correlations tables (see appendix 4.1, 4.2 and 4.3) further confirmed that it was natural to merge these questions into new variables as they all correlated highly with each other (Hair et al. 2010).

The other new variables created in SPSS were further: intrinsic motivation, introjected motivation, external motivation, intra-firm competition and rewards. The variables used in the regressions was thus as explained above the dependent variables of formal and informal, and the independent variables intrinsic motivation, introjected motivation, external motivation, intra-firm competition

and rewards. In addition the control variable of knowledge sharing level was included.

To estimate the general model fit of the regressions we examined the R^2. The significance level was set to 95 % (Hair et al. 2010). Based on our research model the following equations are given for our two dependent variables.

Formal Knowledge sharing: = a0 + a1 x intrinsic motivation + a2 x introjected motivation + a3 x external motivation + a4 x network centrality + a5 x intra-firm competition + a5 x rewards + a6 x knowledge sharing level + e

Informal Knowledge sharing: = a0 + a1 x intrinsic motivation + a2 x introjected motivation + a3 x external motivation + a4 x network centrality + a5 x intra-firm competition + a5 x rewards + a6 x knowledge sharing level + e

Chapter 4.1 will explain the analysis process of estimating the substitution and complimentary effects of the two types of knowledge sharing tools, meaning examining whether they substitute or complement each other. Chapter 4.2 will explain the model estimation process of formal knowledge sharing tools as the dependent variable, while chapter 4.3 will explain the model estimation process of informal knowledge sharing tools as the dependent variables. We have attached a table (see table 4.1) with a summary of the hypotheses for the ease of the reader.

Table 4.1: Summary of Hypotheses

H_{1a}	When there is a high use of one type of knowledge sharing tool, the use of the other will decrease.
H_{1b}	When there is a high use of one type of knowledge sharing tool, the use of the other will increase
H_{2a}	Intrinsic motivation is positively related with the use of formal knowledge sharing tools
H_{2b}	Intrinsic motivation is positively related with the use of informal knowledge sharing tools
H_{3a}	Introjected motivation is positively related with the use of formal knowledge sharing tools
H_{3b}	Introjected motivation is positively related with the use of informal knowledge sharing tools.
H_{4a}	External motivation is positively related with the use of formal knowledge sharing tools
H_{4b}	External motivation is positively related with the use of informal knowledge sharing tools
H_{5a}	High level of centrality of an employee's network is positively related with the use of formal knowledge sharing tools
H_{5b}	High level of centrality of an employee's network is positively related with the use of informal knowledge sharing tools.
H_{6a}	Intra-firm competition is positively related with the use of formal knowledge sharing tools
H_{6b}	Intra-firm competition is positively related with the use of informal knowledge sharing tools
H_{7a}	Organisational rewards are positively related with the use of formal knowledge sharing tools
H_{7b}	Organisational rewards are positively related with the use of informal knowledge sharing tools

4.1 Analysis of complementary and substitute effects

We tested the complementary and substitute effects in SPSS, by running a bivariate correlation of the unstandardized residual between formal and informal knowledge sharing tools. As shown in table 4.2, the two variables show a positive correlation of 0.557. According to Arora and Gambardella (1990), a positive correlation between two variables indicate that there is a complementary effect, meaning that in this case the two types of knowledge sharing tools complement each other. Consequently, the marginal effect of the use of one knowledge sharing tool has a positive effect and increases the use of the other knowledge sharing tools (Voss et al. 2010). This in turn means that hypothesis H_{1a} is **rejected**, while hypothesis H_{1b} is **supported**.

Table 4.2: Correlations Matrix – Formal and Informal Knowledge Sharing

Correlations	**Formal Knowledge Sharing**	**Informal Knowledge Sharing**
Formal Knowledge Sharing		
Pearson Correlation	1	.557**
Sig. (2-tailed)		.000
N	154	154
Informal Knowledge Sharing		
Pearson Correlation	.557**	1
Sig. (2-tailed)	.000	
N	154	154

4.2 Model estimation of Formal Knowledge Sharing tools

To test the model a regression analysis was run in SPSS with formal knowledge sharing as the dependent variable. As shown in table 4.3 the adjusted R^2 shows satisfactory levels of .441, which indicates that 44, 1 % of the variation of the dependent variable formal knowledge sharing is explained by the independent variables included in the model (Hair et al. 2010).

Table 4.3: Model Summary – Dependent variable: Formal knowledge sharing tools

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.683[a]	.466	.441	.84064

a. Predictors: (Constant), Rewards, Intra-firm competition, Knowledge sharing level, Intrinsic motivation, Introjected motivation, External motivation, Network centrality

Further the ANOVA-table (table 4.4) showed us that the model is statistically significant with a p-value above .005 (Hair et al. 2010).

Table 4.4: ANOVA. Dependent variable – Formal knowledge sharing tools

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	90.198	7	12.885	18.234	.000[b]
Residual	103.174	146	.707		
Total	193.372	153			

a. Dependent Variable: Formal
b. Predictors: (Constant), Rewards, Intra-firm competition, Knowledge sharing level, Intrinsic motivation, Introjected motivation, External motivation, Network centrality.

4.2.1 Hypothesis

After establishing that the model had satisfactory R^2 levels and significance level, the different independent variables and control variable could be examined. Table 4.5 shows the significance level that each of the independent variables and control variable has on the dependent variable.

Table 4.5: Coefficients table – Dependent variable: Formal knowledge sharing tools

Coefficients[a]

Model	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
(Constant)	.621	.745		.834	.406		
Network_Cent.	.466	.077	.448	6.026	.000	.661	1.513
Knowl. sharing level	.050	.013	.289	3.925	.000	.676	1.480
Intrinsic_Mot.	-.048	.116	-.028	-.412	.681	.777	1.287
Introjected_Mot.	-.061	.088	-.057	-.688	492	.525	1.904
External_Mot.	.093	.072	.104	1.289	.199	.558	1.791
Intra-firm Comp.	.130	.059	.138	2.196	.030	.926	1.080
Rewards	.013	.059	.015	.226	.821	.860	1.163

a. Dependent Variable: Formal

For any of the independent variable to be significant, the variable must have a significance level of below p-value, which is 0.05 (Hair et al. 2010). As shown in the coefficients table (table 4.5) only three of the independent variables are below this level. These include network centrality (.000 < .05), intra-firm competition (.030 < .05), and the control variable of knowledge sharing level (.000 < .05). By examining the beta values in the coefficients table (table 4.5) it is clear that network centrality has a positive relationship on formal knowledge sharing tools (.466), which means that hypothesis H_{5a} is **supported**. Further it is clear from the coefficients table (table 4.5) that intra-firm competition has a positive impact (.130) on formal knowledge sharing tools, which means that hypothesis H_{6a} is

supported. As assumed the level of knowledge sharing employees engage in, has an impact on the use of formal knowledge sharing tools (.050), which is as expected.

From the coefficients table (table 4.5) it is also clear that neither intrinsic motivation (.668 > .05), introjected motivation (.492 > .05), external motivation (.199 > .05) nor rewards (.821 > .05), has any impact on choosing formal knowledge sharing mechanisms, thus hypothesis H_{2a}, H_{3a}, H_{4a} and H_{7a} is **rejected**.

Based on the beta-values in the coefficients table (table 4.5) the equation model of formal knowledge sharing tools was now reconstructed:

Formal Knowledge sharing: = .621 + intrinsic motivation x - .048 + introjected motivation x - .061 + external motivation x 0.93 + network centrality x .466 + intra-firm competition x .130 + rewards x .013 + knowledge sharing level x .050

By examining the reconstructed model it is clear that for the significant variables: when network centrality increases by 1, formal knowledge sharing increases by .466, and when intra-firm competition increases by 1, formal knowledge sharing increases by .130. When the knowledge sharing level increases by 1 the use of formal knowledge sharing tools increases by .050. As the other independent variables did not show satisfactory significance levels they were not included (Hair et al. 2010).

4.2.2 Multicollinarity

After testing the hypotheses for the dependent variable formal, we further tested for multicollinarity. By examining the correlations table below (table 4.6) it is clear that the significant variables of knowledge sharing level (.550), intra-firm competition (.174) and network centrality (.606) have the highest correlations with the dependent variable formal. Intrinsic motivation (.080) and introjected motivation (.117) have the lowest correlations with the dependent variable formal. The collinarity levels in coefficients table above (table 4.5), also show that tolerance levels for all variables are above .10 and VIF levels are below 10, thus it is reasonable to conclude that multicollinarity is not present (Hair et al. 2010).

Table 4.6: Correlations table – Dependent variable: Formal knowledge sharing tools

	Formal	Knowl. sharing level	Rewards	Intrinsic_mot.	Introjected _mot.	External_ mot.	Intra-firm Comp.	Network _cent.
Formal								
Pearson Correlation	1	.550**	.161*	.080	.117	.183*	.174*	.606**
Sig. (2-tailed)		.000	.046	.322	.148	.023	.031	.000
N	154	154	154	154	154	154	154	154
Knowl._sharing level								
Pearson Correlation	.550**	1	.097	.163*	.160*	.137	.081	.553**
Sig. (2-tailed)	.000		.233	.044	.047	0.90	.316	.000
N	154	154	154	154	154	154	154	154
Rewards								
Pearson Correlation	.161**	.097	1	.092	.212**	.331**	.060	.201*
Sig. (2-tailed)	.046	-.233		.258	.008	.000	.463	.012
N	154	154	154	154	154	154	154	154
Intrinsic_mot.								
Pearson Correlation	.080	.163*	.092	1	.421	172*	-.117	.185*
Sig. (2-tailed)	.322	.044	.258		.000	.033	.147	.022
N	154	154	154	154	154	154	154	154
Introjected_mot.								
Pearson Correlation	.117	.160	.212**	.421**	1	.609**	.072	.142
Sig. (2-tailed)	.148	.047	.008	.000		.000	.373	.079
N	154	154	154	154	154	154	154	154
External_mot.								
Pearson Correlation	.183*	.137	.331**	.172**	.609**	1	.200*	.104
Sig. (2-tailed)	.023	.090	.000	.000	.000		.013	.198
N	154	154	154	154	154	154	154	154
Intra-firm comp.								
Pearson Correlation	.174*	0.81	.060	-.117	.072	.200*	1	-.019
Sig. (2-tailed)	.031	.0316	.463	.147	.373	.013		.815
N	154	154	154	154	154	154	154	154
Network cent.								
Pearson Correlation	.606**	.553	.201*	.185*	.142	.104	-.019	1
Sig. (2-tailed)	.000	.000	.012	.022	.079	.198	.815	
N	154	154	154	154	154	154	154	154

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

4.3 Model estimation of Informal Knowledge sharing tools

Further we tested the dependent variable of informal knowledge sharing tools. This variable was tested much the same way as described above, where table 4.7 revealed a satisfactory adjusted R2 level of .200, which means that 20% of the variation of the dependent variable informal is explained by the independent variables in the model (Hair et al. 2010).

Table 4.7: Model Summary – Dependent variable: Informal knowledge sharing tools

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.487[a]	.237	.200	1.08069

a. Predictors: (Constant), Rewards, Intra-firm competition, Knowledge sharing level, Intrinsic motivation, Introjected motivation, External motivation, Network centrality.

Further the ANOVA-table (table 4.8) confirmed that the model is statistically significant with a p-value below .05 (Hair et al. 2010).

Table 4.8: ANOVA - Dependent variable: Informal knowledge sharing tools

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	52.875	7	7.554	6.468	.000[b]
Residual	170.512	146	1.168		
Total	223.387	153			

a. Dependent Variable: Informal
b. Predictors: (Constant), Rewards, Intra-firm competition, Knowledge sharing level, Intrinsic motivation, Introjected motivation, External motivation, Network Centrality.

4.3.1 Hypothesis

As the model proved to be statistically significant we further examined the independent variables and the control variables to establish the impact on the dependent variable informal knowledge sharing tools. Table 4.9 shows the significance level that each of the independent variables and control variable has on the dependent variable (Hair et al. 2010).

Table 4.9: Coefficients table - Dependent variable: Informal knowledge sharing tools

Model	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	.432	.958		.451	.4653		
Network cent.	.279	.099	.250	2.805	.006	.661	1.513
Knowl. sharing level	.049	.016	.265	3.014	.003	.676	1.480
Intrinsic_mot.	-.070	.149	-.039	-.473	.637	.777	1.287
Introjected_mot.	-.076	.114	-.067	-.672	503	.525	1.904
External_mot.	.181	.093	.190	1.959	.052	.558	1.791
Intra-firm comp.	.059	.076	.058	.775	.439	.926	1.080
Rewards	-.057	.076	-.059	-.753	.453	.860	1.163

a. Dependent Variable: Informal

As mentioned above, the independent variable must have a significance level of below p-value, which is 0.05 (Hair et al. 2010). From the coefficients table (table 4.9) it is clear that only 2 independent variables are significant, while one is weakly significant. The significant variables include network centrality (.006 < .05) and the control variable of knowledge sharing level (.003 < .05). The independent variable of external motivation shows a weak significant level (.052 > .05), however due to its strong presence in previously established literature (Cabrera and Cabrera 2002; Bock and Kim 2002; Burgess 2005; Irmer et al. 2002), and the significance value being barely over significance level we choose to keep this variable for further analysis. Further, it was clear by examining the

beta values in the coefficients table (table 4.9) that external motivation (.181) has a positive impact on informal knowledge sharing tools, meaning that hypothesis H_{4b} is **supported.** Network centrality (.279) has a positive impact on the dependent variable informal knowledge sharing tools, thus hypothesis H_{5b} is **supported.** As assumed the control variable level of knowledge sharing, has an impact on the use of informal knowledge sharing tools (.049), which is as expected.

From the coefficients table (table 4.9) it is also clear that neither intrinsic motivation (.637 > .05), introjected motivation (.503 > .05) , intra-firm competition (.439 > .05), nor rewards (.453 > .05), has any impact on choosing informal knowledge sharing tools, thus hypothesis H_{2b}, H_{3b}, H_{6b} and H_{7b} is **rejected.**

Using the beta-values in the coefficients table (table 4.9) the equation model of informal knowledge sharing tools was now reconstructed:

Informal Knowledge sharing: = .432 + intrinsic motivation x - .070 + introjected motivation x - .076 + external motivation x 0.181 + network centrality x .279 + intra-firm competition x .059 + rewards x -.057 + knowledge sharing level x .049

From the reconstructed model it is clear that for the significant variables: when network centrality increases by 1, informal knowledge sharing increases by .279, and when external motivation increases by 1, informal knowledge sharing increases by .181. When the knowledge sharing level increases by 1, the informal knowledge sharing increases by .049. As above, the independent variables that showed higher p-values than significance level of .05 were not included (Hair et al. 2010).

4.3.2 Multicollinarity

For the model of informal knowledge sharing we also tested for multicollinarity. By examining the correlations table below (table 4.10) it is clear that the significant variables of knowledge sharing level (.411), external motivation (.197) and network centrality (.386) has the highest correlations with the dependent variable informal. Rewards (.066), intrinsic motivation (.043) and introjected

motivation (.102) have the lowest correlations with the dependent variable informal. The collinarity levels in the coefficients table above (table 4.9), also shows that tolerance levels for all variables are above .10 and VIF levels are below 10, thus it is reasonable to conclude that multicollinarity is not present (Hair et al. 2010).

Table 4.10: Correlations table - Dependent variable: Informal knowledge sharing tools

	Informal	Network_cent.	Knowl. sharing level	Intrinsic_ mot.	Introjected_ mot.	External_ mot.	Intra-firm comp.	Rewards
Informal								
Pearson Correlation	1	.386**	.411**	.043	.102	.197*	.109	.066
Sig. (2-tailed)		.000	.000	.600	.209	.015	.177	.419
N	154	154	154	154	154	154	154	154
Network_cent.								
Pearson Correlation	.386**	1	.553**	.185*	.142	.104	-.019	.201*
Sig. (2-tailed)	.000		.000	.022	.079	.198	.815	.012
N	154	154	154	154	154	154	154	154
Knowl. sharing level								
Pearson Correlation	.411**	.553**	1	.163*	.160*	.137	.081	.097
Sig. (2-tailed)	.046	.000		.044	.047	.090	.316	.233
N	154	154	154	154	154	154	154	154
Intrinsic_mot.								
Pearson Correlation	.043	.185*	.163*	1	.421**	172*	-.117	.092
Sig. (2-tailed)	.322	.022	.0.44		.000	.033	.147	.258
N	154	154	154	154	154	154	154	154
Introjected_mot.								
Pearson Correlation	.102	.142	.160*	.421**	1	.609**	.072	.212**
Sig. (2-tailed)	.148	.079	.047	.000		.000	.373	.008
N	154	154	154	154	154	154	154	154
External_mot.								
Pearson Correlation	.197*	.104	.137	.172**	.609**	1	.200*	.331**
Sig. (2-tailed)	.023	.198	.090	.000	.000		.013	.000
N	154	154	154	154	154	154	154	154
Intra-firm comp.								
Pearson Correlation	.109	-.019	.081	-.117	.072	.200*	1	.060
Sig. (2-tailed)	.031	.815	.316	.147	.373	.013		.463
N	154	154	154	154	154	154	154	154
Rewards								
Pearson Correlation	.066	.201*	.097	.092	.212**	.331**	0.60	1
Sig. (2-tailed)	.000	.012	.233	.022	.079	.000	.463	
N	154	154	154	154	154	154	154	154

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Further we have summarised the hypotheses in table to show which hypotheses were supported and not supported, for the ease of the reader.

Table 4.11: Summary of Hypotheses-testing

H_{1a}	Not supported
H_{1b}	Supported
H_{2a}	Not supported
H_{2b}	Not supported
H_{3a}	Not supported
H_{3b}	Not supported
H_{4a}	Not supported
H_{4b}	Supported
H_{5a}	Supported
H_{5b}	Supported
H_{6a}	Supported
H_{6b}	Not supported
H_{7a}	Not supported
H_{7b}	Not supported

5 Discussion

The discussion part of the paper will discuss the following: summary of findings, theoretical implications and managerial implications.

5.1 Summary of findings

After investigating existing literature on knowledge sharing within international firms, several different measures that impact individual knowledge sharing was established. We argued that it is natural to assume that the same measures also will impact the choice of knowledge sharing tools. We also investigated the scarce existing literature on the impacts on employee's choice of knowledge sharing tools, and further combined and developed these measures where we identified gaps in the existing literature. In our paper we also found it important to make a clear distinction between formal and informal knowledge sharing mechanisms due to the inconsistent definitions in the existing literature.

One of our research objectives was to examine whether the use of one type of knowledge sharing tool would complement or substitute the use of the other. From our analysis it was clear that the use of one type of knowledge sharing tool complements the use of the other type, rather than substituting it. It is thus likely to assume that employees, who engage in knowledge sharing processes, are likely to engage in both types of knowledge sharing mechanisms.

Our hypotheses regarding intrinsic motivation and introjected motivation did not receive any support on having any significant impact on the choice of knowledge sharing tools. However, our analysis revealed that employee's external motivation received a weak support in terms of the use of informal knowledge sharing tools. The results thus showed that motivation has very little impact on the choice of knowledge sharing mechanisms.

We propose that high level of centrality of an employee's network is positively related with use of informal knowledge sharing tools. This proposition is supported. We also argued that high level of centrality of an employee's network is positively related with the use of formal sharing tools. This hypothesis was supported.

We further suggested that high intra-firm competition is positively related with the use of formal knowledge sharing tools, as it is natural to assume that employees wants to be positively noticed in the organisation. This proposition was supported. We further suggested that high intra-firm competition was positively related with the use of informal knowledge sharing tools, due to desire of being positively noticed in the organisation and receiving praise from colleagues, however this hypothesis did not gain any support.

We also argued that high use of organisational rewards is positively related with the use of formal knowledge sharing tools, this proposition was not supported. We further claimed that high use of organisational rewards is positively related with the use of informal knowledge sharing tools. However, the analysis did not provide any support for this hypothesis.

As assumed, the control variables knowledge sharing had significant impact on knowledge sharing tools. Consequently, the more the respondents engage in knowledge sharing activities, the more the respondents relate to the use of informal and formal knowledge sharing tools.

5.2 Theoretical Implications

In the introduction we discussed that knowledge has become the key competitive advantage of global business, and much of the challenges thus lies in how to share and retain knowledge within the organisations (Karkoulian and Mahseredjian 2012; Lin and Joe 2012; Fey and Furu 2008; Rahimli 2012; Minbaeva et al. 2012). Large proportions of existing literature within the field of knowledge sharing have confirmed both theoretically and empirically, that certain measures have effects on knowledge sharing within the organisation (Foss 2009; Argote et al. 2003; Holste and Fields 2009; Schwaer et al. 2012; Reinholt et al. 2011; Obstfeld 2005; Boh and Wong 2013; Cho et al. 2007). In this paper, we propose that the same measures will also impact the choice of knowledge sharing tools. To our knowledge, no research in the knowledge sharing literature has examined how some of these established and emerging measures influence the choice of formal or informal knowledge sharing tools, locally and globally. Also, there is little existing literature regarding whether the use of one type of knowledge sharing tool impacts the other.

The paper therefore holds several important contributions into the field of international knowledge sharing. Our analysis established that the use of one type of knowledge sharing tool does not substitute the use of the other type, thus the knowledge sharing tools rather has a complementary effect, than replacing each other.
Contrary, to some existing studies, our research confirms that already established measures such as rewards and partially motivation have non-significant effect on the choice of formal or informal knowledge sharing tools. Hence, we propose that both rewards, intrinsic- and introjected motivation neither has positively nor negatively impacts on the choice of knowledge sharing tools.

The analysis proves that network centrality has significant support and plays an important role in the choice of formal or informal knowledge sharing tools both locally and globally. Consequently, the results argue that employee's network centrality has a direct effect with the use of knowledge sharing tools. Hence, depending on the circumstances, the employee chooses knowledge sharing tools that will in the best possible way reach the majority of the employee's network.

In addition, the results from the analysis suggest that an increase in intra-firm competition has a significant effect on the use of formal knowledge sharing tools. This result is in line with existing findings of knowledge sharing from Ghobadi and D'Ambra (2013). The study of Ghobadi and D'Ambra (2013) suggests that increased intra-firm competition, results to more knowledge sharing within the organisation in cross-functional teams. Hence, this measure supports and adds to existing literature by establishing that intra-firm competition has a significant impact on the choice of formal knowledge sharing tools.

The results from the research also suggest that employees utilize more informal knowledge sharing tools when externally motivated. Foss (2009) argued that employees, who are externally motivated, share knowledge due to the possibility of receiving external rewards. In our research we proposed that employees would choose the knowledge sharing tool which is perceived as being most successful in the attainment of these rewards. Due to the increased use of social media in business and continuously change in customer contacts, employees may become

more externally motivated in using also informal knowledge sharing tools, as the desired external rewards may lie in less tangible benefits than solely monetary rewards, such as increases in business network and costumer relations. Employees may thus perceive the use of informal knowledge sharing tools to be more effective in sharing their knowledge due to its overall popularity. Consequently, we propose alongside with our findings that employees may perceive the use of formal knowledge sharing tools as less effective in achieving these external rewards compared to informal tools when sharing knowledge.

5.3 Managerial Implications

The topic of our research is highly relevant due to the importance of employee knowledge. Fey and Furu (2008) argue that employee knowledge has become the key core competence for companies. Consequently, one of the greatest challenges for international firms and its subsidiaries is to develop communication tools that effectively communicate and share knowledge throughout the entire organisation. However, to accomplish this, managers must first understand what factors may have a significant impact on individual knowledge sharing and the choice of knowledge sharing tools. It is also important for managers to realise whether the use of one type of knowledge sharing tools replaces the use of the other, or promotes more use of knowledge sharing tools in general.

The results in this paper show several implications for international companies. Firstly, the fact that the use of one type of knowledge sharing tool does not exclude or minimise the use of the other, has several managerial implications. Particularly in global firms, managers tend to promote only the use of the organisations own KMS, without much regard for the other mechanisms of sharing knowledge. The results revealed that the two types of sharing knowledge are highly interlinked, thus managers must take this into consideration when promoting the use of the organisations own KMS. Rather than focusing solely on the use of such mechanisms, managers should perhaps encourage the joint use of these types of tools, to ensure that knowledge is shared the most efficient way, however also retained within the organisation.

Secondly, the results argue that rewards have no effects on the selection of formal or informal knowledge sharing tools. As a result, it may not always be beneficial for managers to encourage the use of specific knowledge sharing tools by offering certain rewards. The finding offers valuable insights, as it suggests that less time should perhaps be focused on designing time-consuming rewards systems that are directly tied to employee's efforts in sharing knowledge.

Thirdly, our findings implicate that intra-firm competition has a significant effect on the use of formal knowledge sharing tools, which may be positive as it promotes knowledge sharing that retains employee knowledge within the organisation. However it also contains several points of worry for management. A company with strong intra-firm competition may have employees that only collaborate because it benefits the individual employee, not the entire firm, which is a thought of concern for management, as the welfare of the firm should also be promoted. Also, even though the results showed that employees prefer formal knowledge sharing tools when there are high levels of intra-firm competition, this research has not investigated its effect on knowledge sharing in general. Employees who experience high levels of intra-firm competition may be hesitant to share any knowledge at all, due to how it may threaten their individual position, even though formal knowledge sharing tools may be preferred when it is found beneficial to engage in knowledge sharing processes. It may also limit the employee's creativity when engaging in knowledge sharing processes, where only the knowledge sharing tool found to be more beneficial for the individual employee is utilised, which may not be the most effective medium of transferring this specific knowledge.

Fourthly, the results indicate that network centrality has significant effect in the choice of using formal or informal knowledge sharing tools. These findings should motivate managers to promote certain types of knowledge sharing tools in certain positions. For instance, employees with high level of centrality are often in positions that require the use of several different types of knowledge sharing tools to ensure that they communicate their knowledge to all people in their network. Hence, managers should be cautious in designing and forcing certain types of knowledge sharing tools for employees in positions with high level of network

centrality, rather promote the combined use of these tools to ensure knowledge retention within the organisation.

Finally, managers should also be careful in implementing knowledge sharing tools based on employee's introjected and intrinsic motivational factors. This is an important insight for managers, as it would be naïve for managers to believe that employees engage in knowledge sharing behaviour because they will find it personally satisfying. However, the results argue that employees engage in knowledge sharing activities due to external factors. Hence, promoting knowledge sharing tools, where colleagues and supervisors can easily give feedback or other types of external recognitions would be advisable.

6 Limitations and Future Research

There are several limitations in this paper. Firstly, the research was only done in one firm with large resources. It would have been interesting to conduct this study with multiple international firms and industries with different types of resources to see whether the results provided here are applicable. Therefore, to increase the external validity of the paper, the research should have included several international firms from different types of industries. Alternatively, it would have been interesting to measure several subsidiaries towards each other in order to see how the results differ on a group-level compared to the individual level. Another important issue is how cultural differences may impact the willingness to share knowledge through different type of knowledge sharing tools. A suggestion for future research is thus to investigate how cultural differences between different subsidiaries in a global firm influence the choice of formal and informal knowledge sharing tools.

Through the process of conducting our research it also became evident that the IBM culture is characterised by highlighting the importance of sharing knowledge. An IBM employee is expected to constantly share and promote best practices and knowledge throughout the firm, and often, the employees who share more knowledge are perceived as being more successful within the firm. It would have been interesting to see if the results would differ if this research was conducted in other international firms, where the emphasis on knowledge sharing

is less evident. Further research should therefore aim to be more generalizable by investigating several international firms with different corporate cultures across multiple industries.

Our research was also conducted in environments where the respondents are from highly advanced geographical areas of the world. The use of technology is common from early career stages. The business culture in the Scandinavian area is also likely to differ compared to other countries, meaning that the results may be less applicable to other geographical regions, with considerably differences in business policies and etiquette. Thus it would be interesting to compare the results of this thesis, with future research conducted in areas with a different business culture.

Another issue that may limit the result of this thesis is the type of industry the company where our data was collected from is currently operating. The IT-industry is a rapidly changing industry with many global players, which increases the necessity of constantly transferring knowledge and adapting the tools that this is done through. Arguably, the results may differ if the research was conducted in companies operating in less global and technology influenced environments.

The fact that our sample is male dominated and the majority of the respondents are over 40 years old should be taken into consideration when interpreting the results of this study. Also, our questionnaire was extensive and time-consuming. The average respondent used over 10-15 minutes on completing the questionnaire. Consequently, our response rate would improve if the questionnaire was less extensive.

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8 Appendices

Appendix 1 – Preliminary Thesis Report

Appendix 2 – Online Survey

Appendix 3 – Cover letter for online survey

Appendix 4 – Lisrel: First order

Appendix 5 – Lisrel: Intrinsic motivation

Appendix 6 – Lisrel: Introjected motivation

Appendix 7 - Lisrel: External motivation

Appendix 8 – Lisrel: Rewards

Appendix 9 – Lisrel: Knowledge abroad

Appendix 10 – Lisrel: Knowledge home

Appendix 11 – Lisrel: Network Centrality Home

Appendix 12 – Lisrel: Network Centrality Abroad

Appendix 13 – Lisrel: Intra-firm competition

Appendix 14 – SPSS: Overview of the responses

Appendix 15 – Correlation table: all variables

Appendix 16 – Correlation table: formal and informal knowledge sharing

Appendix 17 – Correlations table: network centrality and knowledge sharing level