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INFLUENCE OF KNOWLEDGE SHARING AND VIRTUAL TEAMS ON EMPLOYEE PRODUCTIVITY: A CASE STUDY IN A FINANCIAL INSTITUTION

Master's Thesis

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Name and signature of supervisor…….

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We have composed this master's thesis independently. All viewpoints of other authors, literary sources and data from elsewhere used for writing this paper have been referenced accordingly.

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Abstract

This study is examining the influence of knowledge sharing and virtual teams on employee productivity. The influence is further evaluated through a set of dimensions on different aspects of the independent variables. To get relevant information on the variables, the sample is based in a highly decentralized and knowledge dependent unit of a financial institution. The triangulation method was used where quantitative data is collected by a questionnaire and qualitative data through interviews. The analysis is based on a multiple hierarchical regression to have more control over the variables. The analysis results show that both virtual teams and knowledge sharing have a positive effect on productivity and are likely to increase employee's productivity. However, some of the dimensions seem to be affecting the productivity much more than others and the organizations should prioritize their focus on those.

Keywords: Virtual teams, Knowledge sharing, Employee productivity.

Introduction

Knowledge is one of the most important assets for any individual as well as any organization. Good knowledge sharing can be considered as one of the most important competitive advantages for any organization (Derven, 2016) since it allows incremental growth of the organization (Lin et al., 2014). One of the signs of incremental growth can be seen by an increase in profits (Riege, 2005). That is why global organizations are working on different knowledge management strategies and making themselves more flexible regarding ways of working virtually. Efficient knowledge management strategies and working in virtual teams are especially important for different knowledge workers inside various financial institutions. Like in their name, their main capital is knowledge and their productivity is highly dependent on it. Nowadays, many of the knowledge-workers are scattered in different locations, and to maximize their productivity, it is important to research how these processes affect productivity and see in what ways on how they could be improved.

One of the major subtypes of knowledge management is knowledge sharing, and it is proven that being proactive in this area is leading companies towards more competitive markets (Townsend et al., 1998). Efficient knowledge sharing can lead to shorter completion times in every project stage and an increase in the skills of employees who are part of it. This will also enable people to become domain specialists more quickly and therefore be more useful to the company by giving their contribution to the knowledge sharing processes (Khalil et al., 2013).

Virtual teams are becoming more and more popular, especially in times of crisis that will not allow them to work traditionally. Most of the global organizations are already

working with the cross-border workforce (Killingsworth et al., 2016). This allows them to be active 24/7 and hire different talents from all over the world (Ebrahim et al., 2009).

The purpose of this research is to see the influence of knowledge sharing and virtual team dimensions on employee productivity in a financial institution. To achieve this purpose, the following research tasks are established:

- Provide an empirical and theoretical overview of different papers on productivity, knowledge sharing, virtual teams and its influence on employee productivity;
- Formulate and collect data based on a questionnaire that focuses on knowledge sharing, virtual teams, and employee productivity dimensions;
- Conduct the semi-structured interviews with the two team managers;
- Build hierarchical multiple regression model with dimensions of knowledge sharing, virtual teams being independent variables and productivity as the dependent variable;
- Interpret the results on the influence of knowledge sharing and virtual team dimensions on productivity and provide a reasoning behind the regression results based on interviews;
- Based on the results, provide suggestions on how to improve an organization's knowledge sharing processes and collaborative virtual working structure.

Despite the importance of the relationship between knowledge sharing and virtual teams on productivity, there is limited research done on how virtual teams are devoting themselves in the process of knowledge sharing and working in virtual teams with its influence on productivity (Benson et al., 2007). Since these variables are very important for organizational success, they should be analyzed more closely. This study focuses on understanding the influence of knowledge sharing and virtual teams on employee productivity by using a triangulation method. The data is collected with a questionnaire from different employees' focusing on their experiences working in virtual teams and their knowledge sharing practices in a highly decentralized division of a financial institution that is operating in several geographical locations. The division has in total around 550 employees who were chosen as participants for this study. Out of those 550 employees, 100 participants responded to the questionnaire who does most of their daily

work through virtual means and involved in knowledge sharing activities. The participants were presented with a questionnaire consisting of 29 questions from which 22 are used for measuring different dimensions based on the variables. To get further information, two managers from different teams were interviewed to get a deeper understanding on how they manage their teams virtually and what ways they use to allow efficient knowledge sharing practices in their team.

This study starts with a theoretical interpretation and overview of previous studies focusing on employee productivity, knowledge management including knowledge sharing, and virtual teams. These chapters also focus on describing the ways of how these variables influence employee productivity. The literature chapters on knowledge sharing and virtual teams end with a hypothesis with the dimensions that the literature claims to have a positive relation with employee productivity. This will continue with the empirics where the data, data collection methods, and methodology are explained. In the methodology, everything related to the creation of dimensions and pre-analysis before the hierarchical regression is brought out in detail. The interpretation of the regression and suggestion based on interviews are discussed under discussion on findings, after the regression analysis.

1.THEORETICAL BACKGROUND: EMPLOYEE PRODUCTIVITY, KNOWLEDGE SHARING, VIRTUAL TEAMS

1.1 Employee productivity

Employee productivity is mostly defined as the amount of output produced in a certain period while having some factors as inputs. Many factors can measure productivity based on this (Nwelih and Amadin, 2008). For example, according to Bhatti, productivity is a big performance measure umbrella that comprises a lot of factors under it which makes it difficult to measure with traditional methods (Bhatti and Qureshi, 2007). Traditional measurements are based on a common criterion to measure productivity in a certain way. For example, they consider only the number of outputs and the number of hours spent on the measurement which is too generic without considering if the organization works in the IT sector or manufacturing (Nwelih and Amadin, 2008). It is also demonstrated that productivity cannot be progressively quantified because the productivity aspect is too broad for measurement with a multifactor perspective (Antikainen and Lönnqvist, 2005).

Depending on the company's objectives, they can use different techniques to increase productivity by using the existing knowledge of the employees and creating new knowledge with it. This is especially important for knowledge workers who are heavily dependent on intellectual assets than an average production firm. For example, some of the most popular jobs of knowledge workers are engineers, financial analysts, accountants, and lawyers (Hendriks and Vriens, 1999). Certain determinants greatly affect employees whose main capital is knowledge. Also known as Drucker's knowledge

workers productivity theory (Drucker, 1999), it states that knowledge-workers productivity is determined by these factors:

1. Continuous learning and teaching in everyday life;
2. Must have rights or conditions for self-government;
3. Knowledge-workers should be treated as an intellectual asset, not a cost;
4. Efficiency and effectiveness are both important;
5. Responsibility to continuously innovate;
6. All tasks should be only knowledge-oriented to get the maximum efficiency out of them

Also, according to Drucker, productivity is not having a direct relationship between the input efforts and outcome produced because there are a lot of other factors and variables. As discussed earlier, it is difficult to measure productivity in a certain way with certain variables because of its complexity and intangibleness (Drucker, 1999). In the modern world, most of the organizations are opting to work in cross-functional teams. In these teams, the measurement of productivity is more difficult because the tasks are not fixed without a routine and there is no standard time for different task delivery deadlines. Most of the tasks are dealt with based on a priority basis and these tasks can be done differently by different employees according to their expertise and capability (Stray, 2018).

Some of the factors that play an important role are also connected to the continuous intellectual development of an employee through development in core skills. These are also important in producing positive outputs which increases productivity, although measuring the quality can be hard since the standards are different for every organization (Ramírez and Nembhard, 2004); (Drucker, 1999). The factors influencing productivity on every member of the team are proven to be the type of task, work environment, social relationship, cooperation between each other in the team, commitment towards work, skills, and motivation (Martz and Beranek, 2005).

Majorly, productivity is measured by using some factors like motivation, personal skills, personal development, work environment, and ethics as a measurement of productivity. According to Srivatsava, motivation is important for every organization because this is one of the important factors which allows employees to improve their job commitment and increase their capacity to be more productive. Employees are motivated when their

work is meaningful and satisfy them in terms of increasing their skills and knowledge (Srivatsava and Kailash, 2011). Additionally, Andries also discussed that employees must have the motivation to improve their development aspects in terms of being competent to learn new things. This means that organizations also should facilitate different training programs for their employees to deepen their analytical and cognitive thinking competency (Andries and Jan, 2012).

However, there is no proved or universally agreed method for measuring productivity (Ramírez and Nembhard, 2004); (Antikainen and Lönnqvist, 2005). Considering this, it is important to reuse different factors proven to be working also in this study. Therefore, the study uses these dimensions in table 1:

Table 1: Dimensions of productivity used for analysis

Quality and quantity	If employees complete their tasks in time, if there are a lot of dependencies in their work and if they must rectify mistakes in dependency tasks
Employee Motivation	If employees feel satisfied with their work performance, if they are enough challenged with their work and if they are motivated enough to work longer periods to complete urgent tasks
Personal development	If employees want to learn new things in their job, if the industry offer ways to develop core skills and if they use their problem-solving skills during their daily work
Skills	If employees help team members to solve problems, if employees are ready to adapt to organizational changes and if the employees feel they are competent with the tools used

Source: Created by authors

As previously mentioned, important factors for productivity can be different employee competences and output can be the quality and quantity of work. These measures are used to create the variable of productivity in this study.

1.2 Knowledge sharing definition, types, influencing factors and relation with productivity

Knowledge is quickly becoming one of the most valuable assets that most companies can have. Companies are relying less and less on traditionally important factors that were important in the past, like capital, land, and labor. The importance can be seen in the creation of new positions in big companies, like Chief Knowledge Officer and

organizational learning officers. They are internally responsible to have efficient Knowledge Management (KM). (Sher and Lee, 2004). Knowledge Management can be defined as ''*a bundle of principles, models, approaches, techniques, and tools aimed at developing and exploiting organizational knowledge to support company's business performance improvements''* (Carlucci and Schiuma, 2006, p.44). Knowledge management itself is a bigger area and is tightly connected with its subtypes like knowledge sharing, knowledge barriers, knowledge practices, and so on (Schwartz, 2006). To fully understand the processes of knowledge sharing, it is important to know the insights in overall knowledge and its management.

Knowledge can be divided into two big groups - explicit and tacit. Explicit knowledge is considered knowledge that can be readily articulated, stored, codified, and accessed. This means that this kind of knowledge can be transmitted to others through communication or documentation (databases, manuals, theoretical approaches). Tacit knowledge is the opposite of that – it is difficult to transfer by writing it down or verbalizing it, as it involves a lot of cognitive and technical elements (concrete skills and knowledge) (Hélie and Sun, 2010). This study is mostly interested in seeing how explicit knowledge gets shared between employees in a company through codifying or communication.

Some criteria needed to be met that organization and its employees need to have to be able to share the explicit knowledge (Bukowitz and Williams, 2000):

1. Employees can share knowledge when they can describe the information (Articulation);
2. The receiver of the knowledge must be aware that knowledge is available (Awareness);
3. The receiver of the knowledge can access the knowledge provider by some means (Access);
4. Knowledge is shared in small parts and should be well defined to avoid information overload. Easy access to relevant information should also be provided (Guidance);
5. There should be a centrally managed knowledge sharing form (Completeness).

These are the basic framework principles that need to exist on some level to share knowledge on different levels of hierarchy. Without meeting all points in the criteria, the

quality of knowledge management is for sure to be affected negatively (Bukowitz and Williams, 2000).

However, these criteria only offer a framework that gives knowledge management a certain framework. To have successful knowledge management in place, a lot more factors need to be directly worked on. If they are not addressed correctly and on time, they may turn from knowledge enablers to knowledge barriers that slow the flow of knowledge internally (Holsapple and Joshi, 2000). This possible stagnation of this flow may severely affect the knowledge in an organization. Some of the more popular barriers are often related to fear and if there are unsuccessful knowledge management processes in place, employees use their knowledge as a kind of leverage for negotiating. They can be scared that if they share or document their knowledge, they may get fired and replaced easily. This is just one of the more popular barriers, but there are many more that are related to networking, organizational structures, communication, technology, and overall processes (Stylianou and Savva, 2016).

To relieve these problems, different organizations have tried various initiatives to better KM. For example, some companies have made content submission mandatory. This ensures to the company that no information is lost in case of some specialists decide to quit. Other companies try to motivate people to share knowledge by offering rewards. Each employee initiative is measured by performance measurement plans and after some time, they get various monetary rewards (Benbasat, 1999).

To find out how KM influences the competitive advantage, there is a need to find out what has worked for different organizations. To convey these differences as compact as possible, table 2 was put together. Table 2 summarizes studies of different research papers, their objectives, methodologies, and findings. From the findings, it is possible to conclude on what variables are important for companies to be successful in managing knowledge inside the company.

Table 2. Relevant factors for successful knowledge management

Authors	Study objective	Methodology	Important factors
(Skyrme and Amidon, 1997)	Presenting key success and failure variables on KM, including Knowledge Sharing	Interviews, observation, questionnaire	Strong link to a business imperative, compelling vision, knowledge leadership, knowledge-creating and sharing culture, continuous learning, IT structure, systematic knowledge processes
(Davenport et al., 1998)	Identifying factors that contribute to successful KM projects	An explorative study on the factors of successful KM projects in early KM adopters	Senior management support, knowledge-friendly org. culture, IT structure, clear purpose, several channels for sharing knowledge, good motivational practices
(Ansari et al., 2012)	Determine causal relations between the factors and successful KM	Questionnaire, analysis	Organizational culture, Organizational structure, Human Resources, IT, leadership and strategy,
(Holsapple and Joshi, 2000)	Developing a descriptive framework to see the factors that influence KM	Literature sources, Delphi study on KM	Resources, leadership, control coordination, a measurement for progress
(Stylianou and Savva, 2016)	Finding factors relevant for successful KM	Literature sources; focus groups; interviews; analysis	Knowledge- friendly org. structure, IT structure, culture, org. processes, employee training, teamwork, motivation, leadership

Source: Compiled by authors

From table 2, the papers that have researched knowledge management start to have repeating important factors. It comes out that the most recurring things are motivating leadership, knowledge-friendly organizational culture, and having good IT structure platforms.

Leadership, more exactly knowledge-oriented leadership is one of the essential elements to obtain innovation. This means that management is supporting all kinds of creation, transferring, and storing all the knowledge that may benefit the company at some point in time. To implement this, it requires a lot of initial investment, development, and attention. Good knowledge-oriented leadership would lead employees to believe that

continuous knowledge creation is required for organizational development and therefore competitive advantage (Donate and Sánchez de Pablo, 2015). Management also has to encourage people to share their knowledge without being afraid that it might result in losing their job or costing their power (Stylianou and Savva, 2016).

Knowledge-friendly organizational means that there is an overall positive orientation to knowledge on and off the job that allows a faster experience gain, expertise, and individual innovation (Davenport et al, 1998). This is empowered by management level on supporting informal networking or encourages different knowledge sharing activities inside the team or between different organization units (Skyrme and Amidon, 1997). However, creating a knowledge-friendly organization not easy. It might even be one of the hardest things to create if it is not already existing at some level. It is difficult since this requires an overall positive orientation to knowledge - employees must be intellectually curious, willing to improve on- and offline while also sharing the important information in-team (Davenport et al., 1998). It also relies on if the employees follow and are accepting the different principles, unwritten rules, procedures, and norms inside the company (Stylianou and Savva, 2016).

Implementation of knowledge-based systems (KBS) in the face of different IT structure platforms makes knowledge sharing more controllable. These systems vary in different organizations, but they are often seen in the face of intranets, workspaces, and eLearning software. Their main purpose is to make sharing and accessing knowledge easier. Since accessing solutions to different problems are just a simple search from the organization's intranet, it allows employees to deliver services and products faster and with better quality which therefore achieves better competitive advantage (Sher and Lee, 2004).

Although, not all researchers are so keen on KBS and state that the implementation of knowledge-based systems. Yoon (1995) studied the negative effects of them and it came out that the systems might decrease the motivation of a knowledge worker, depending on the employees' job content. However, the study was concluded with a relatively small sample size of 69 participants and is quite old and the newer systems have come a long way from this time. (Yoon et al., 1995). This should still be taken under consideration that KBS can take out the problem solving that might be satisfactory for some, depending on their values and job content.

As previously was mentioned, knowledge management is a large view of knowledge practices and consisting of several subtypes. Knowledge management has been under research for decades and has received a lot of attention from academicians. To have more insight into the less researched subtypes of KM, the thesis is scoped down to focus on the practices of knowledge sharing (KS). Knowledge sharing is known as *'The exchange of knowledge between and among individuals, and within and among teams, organizational units, and organizations. This exchange may be focused or unfocused, but it usually does not have a clear prior objective'* (Paulin and Suneson, 2012, p. 83). Since KS is an important part of KM, it would be interesting to know how this influences productivity and is managed inside organizations. However, for an organization to have good KS practices there should also already be good KM processes in place. Knowledge sharing has also not received a lot of attention from researches which is also a contribution for scoping it down from knowledge management

If an organization succeeds in creating good KS processes, they can see the increase in productivity in several ways. For example, good documentation will allow new employees who are working with the task for the first time to finish their projects faster. If the processes are rapidly changing and there are no available resources to document it, then there should be an area specialist who is ready to teach people. This will allow for efficient knowledge sharing with people who do not have that much knowledge about the processes (Skyrme and Amidon, 1997).

However, these productivity changing metrics might fluctuate based on if the team is mostly working in traditional or virtual ways. Working in virtual means can affect the relevant factors for successful knowledge sharing in different ways. For example, if employees do not have a lot of face to face communication, there is no good way of converting tacit knowledge to explicit knowledge. There can be a lot of information in different virtual documents and the technology can even allow employees to have real-time communication, yet even the brightest companies have not found an efficient way to convert tacit knowledge to explicit. This is important since it is human nature to learn by seeing, exactly the lacking part of virtual teams. An additional problem with virtual knowledge is that creating virtual documents and maintaining them is highly demanding

in resources. If something changes, it is likely to take hours or even days in redocumentation and uploading (Khalil et al., 2013).

A cross-sectional study has been concluded that researched the relationship between knowledge sharing and team effectiveness. The study was done through a questionnaire in a Malaysian company and it came out that knowledge sharing is quite important in the success of a team with trust being the key factor (Pangil and Chan, 2014). Trust is the basis that allows team members to talk to each other and the more employees communicate, the more likely they are to also share their knowledge (Pangil and Chan, 2014). Knowledge sharing allows team members to develop a knowledge pool that is often necessary to complete the jobs that they are assigned to. This can be done through networking and it is especially important for companies that work with research and development (Yoo and Kanawattanachai, 2007). In one aspect, it is perceived that competence, behavioral conduct and knowledge sharing attitude of every team member enhances their willingness to increase the productivity (Van den et al., 2004).

If the organization does not have the appropriate employees, enough resources or any other important factor to implement knowledge sharing practices, the output can severely suffer. Therefore, it is also interesting to know the causal relationship between knowledge sharing and productivity. For this, the dimensions in table 3 were created.

Table 3: Dimensions of knowledge sharing used in analysis

Knowledge sharing criteria	Level of documentation of the tasks and if people know who to approach regarding any questions in daily work
Knowledge sharing structure	How knowledge sharing-friendly an organization is. Focuses on if employees feel free to express opinions, if they are considered and if they receive enough satisfaction from the job
Knowledge sharing motivation	Focuses if employees are motivated to document their knowledge and if they are motivated to participate in important decisions

Source: Created by authors

Knowledge Sharing hypothesis convey that all the 3 dimensions mentioned in table 3 will have a positive influence on productivity.

1.3 Virtual team definition, types, influencing factors and relation with productivity

A team is defined as a group of people who are working towards achieving a common goal with their independent contributions and integrating with the organizational context (Guzzo and Dickson, 1996). According to Henry Ford, '*Coming together is a beginning. Keeping together is progress. Working together is a success*.' During 1960-1980, the traditional way for most of the companies was working with different groups of people at one geographical location focusing on improving the quality management to reduce cycle time for completing tasks with more efficiency compared to the tasks completed individually (Devine, 2002).

Cascio (2003) defined virtual teams (VT) as virtual groups that are formed to overcome geographical and separation barriers to work from different time zones by using developed technological infrastructure in the face of different virtual channels (Cascio and Shurygailo, 2003). This means that the members of a virtual team can be spread widely with team members being in different countries. Virtual teams are also a part of sub-teams interacting with different people through different interdependent tasks with a common goal (Gassmann and Zedtwitz, 2003). Traditionally, teams used to be one of the major components in the structure of an organization but now with the availability of advanced IT infrastructure and cross-border workforce, teams are collaboratively working with each other using web-based team applications. This way of working makes virtual teams also a part of an organization's structure. Additionally, Table 4 gives a comparative overview of traditional teams and virtual teams gathered from the available literature.

Table 4: Comparison overview of traditional teams and virtual teams

	Traditional teams	**Virtual teams**	**Source**
Dependency on ICT services	Work at a single location and have regular face-to-face interactions	Highly dependent on technology services like e-mails, video conferencing, cloud-based software applications for interactions, and exchange of information.	(Ebrahim et al., 2009); (Mihhailova, 2007)
Task co-ordination, work improvement & co-operation	Task coordination is simple because of constant feedback from colleagues. Regular informal verbal interactions help to the bond between team members	Task coordination is complex because of different time zones. This may cause delays in work. Also, there are limited team interactions that may decrease cohesion but can lead to better task-orientation.	
Diversity & culture	Does not have a widespread of the multi-diversified workforce from different countries	Multi-diversified workforce background teams can have more talents that may help in team productivity	(Hung and Ngyuen, 2008);(Krawczyk, 2017)
Work Rotation	More difficulties performing virtual documentation or arranging online meetings with other units.	Easier virtual knowledge documenting and quickly arrange virtual meetings with other units if required.	(Beata Krawczyk-Bryłka, 2017)
External Factors affecting work	External unforeseen reasons do not allow the team members to work.	Virtual teams can work across the globe by using virtual channels. During the restrictions, this way of working supports the betterment of employees which ultimately helps an employee to be more productive than otherwise.	(Zakaria et al., 2004)

Source: Compiled by authors

Currently, in the global markets, many organizations are changing their traditional way of working to technology-driven working style. This means there are less and less of regular face-to-face meetings and more virtual meetings through different digital channels (Tavoletti et al., 2019). To maximize the overall efficiency, companies must continuously adapt new rapidly changing technologies from the perspective of virtual communication. Companies that use virtual communication also have the benefit of eliminating country-boundaries for the workforce. Eliminating country-boundaries have

different pros and cons. For example, there can be a lot cheaper and more effective workforce overseas to do the work but there can be difficulties in time-zones that will limit the work and therefore the productivity (Glikson and Erez, 2019).

Virtual teams allow organizations to be more succeeding and competitive because they can recruit different employees across the globe regardless of the location. The virtual way of working may make the team more productive due to some factors like flexibility in their worktimes, better work-life balance, and different environmental benefits (Lee-Kelley and Sankey, 2008). Also, working in virtual teams helps an organization to reduce physical infrastructure costs in terms of rental and utility costs. This improves overall net profit due to cut in different physical infrastructure expenses, environmental benefits by reducing carbon emissions with no transportation for employees and eliminating air conditioning equipment in the physical locations. There are increased global market opportunities because the employees are spread all over the globe which gives them a competitive advantage with diversified languages, domestic market exposures, and new market opportunities to diversify the business operations to other potential countries (Stough et al., 2000). Virtual teams should have some measurable benchmarks to be able to work in a virtual environment. These most researched benchmark characteristics are mentioned in Table 5.

Table 5: Common benchmarks characteristics of virtual team members

Benchmark	Description	Reference
Work readiness	Capability to be able to work from any part of the globe with different time zones	(Bal and Teo, 2001), (Lee-Kelley and Sankey, 2008)
Individual Participation	Every team member should give their contributions towards achieving a common goal	(Bal and Teo, 2001); (Gassmann and Zedtwitz, 2003)
Organizational adaptiveness	Employees should follow organization norms which will reflect their imperativeness towards work or organization	(Peters and Manz, 2007)
Virtual communication infrastructure	A company should have a required virtual communication infrastructure that allows employees to collaborate work.	(Olson-Buchanan et al., 2007); (Rezgui, 2007)
External networking	Employees should collaborate with other teams which would help in coming up with ideas	(Rice et al., 2007)
Interactions with co-team members	Different interactions with team members enable to build strong relations between team members	(Chen et al., 2008)
Managing tasks without any conflicts	Mainly focused on managing different conflicts among the team which arise during task completion	(Ches, Teece, 2002)
A higher degree of cohesion	The team can collaborate and participate in different meetings (Task-related) from anywhere using virtual channels and	(Bhat et al., 2017), (Gaudes et al., 2007)

Source: Compiled by authors

According to Bjørn & Ngwenyama, translucence is considered a crucial element in virtual teams. Translucence refers to the invisible social clues to become visible making it easier for team members to understand the distinction and deeper understanding of the work they are doing, in other words, being transparent. Translucent nature will make employee collaboration much easier and increases productivity with better efficiency (Bjørn and Ngwenyama, 2009).

A study by Pangil & Chan indicated that virtual teams can be differentiated based on the number of people involved and the interactions between each other in the team. For example, there are network teams that consist of many people and have daily interactions from different cross-functional units inside the organization and outside the organization. They also work continuously and are not project dependent. Parallel teams are consisting

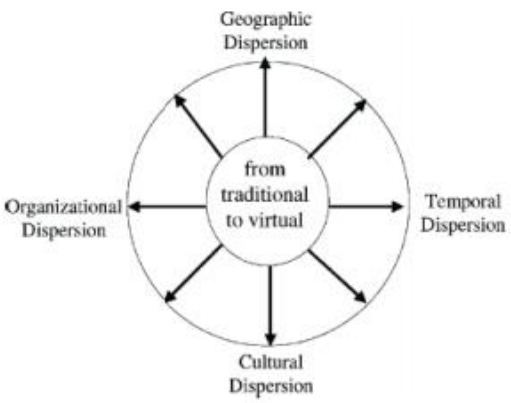
of a small number of people from one business division of the organization having a limited number of interactions. They are also project dependant and the teams exist only on a project basis. After a project, the division is restructured (Pangil and Chan, 2014). Overall, these virtual clusters are a group of people with diversified knowledge working collaboratively with their contributions to the tasks to achieve common targets and all team members report to the same manager. They are often from different geographical locations and participating in collaboration meetings via different web-based platforms like Skype, Slack, or other virtual platforms. Their focus is accomplishing the task efficiently by following the organization's hierarchal roles, quality standards, and procedures (Davidekova and Hvorecky, 2017).

According to Zigurs (2003), the main driving dimensions for the virtual teams are:

1. Geographic dispersion - employees are working from different locations;
2. Temporal dispersion - team members working in different time zones;
3. Cultural dispersion - cultural diversification of team members in different countries;
4. Organizational dispersion - distances in regulations, objectives & goals in collaboration.

Figure 1 represents the dimensions dispersion from traditional teams to virtual teams. The inner-circle in the figure represents a traditional team with all four dimensions, whereas moving away from the inner circle towards the outer-circle represents the team becoming more virtual focused based on the degree of dispersion with each virtual teams' dimension.

Figure 1, Dimension dispersion (Traditional – Virtual)



Source: (Zigurs, 2003)

Increased virtual way of working in teams brings more challenges and complexity to handle. More precisely, complexity increases when people work both in traditional teams at one location and virtually in different geographic locations. Cascio illustrated different forms of virtual teams with 2 variables – number of locations and number of managers.

Table 6: Forms of virtual teams

		Managers	
		Single	**Multiple**
Locations	**Single**	Teleworkers **[1]**	Matrixed Teleworkers **[3]**
	Multiple	Remote Team **[2]**	Remote Matrixed Teams **[4]**

Source: (Cascio and Shurygailo, 2003)

According to table 6, there are four different categories of virtual teams:

[1]- A team working at one location with a single manager;

[2]- A team working from different geographical locations with a single manager;

[3]- A team working at one location with multiple managers;

[4]- A team working from different geographical locations with multiple managers.

However, there is an important variable missing from the above matrix, which is time. It does not show how team members spend different time lengths to complete various tasks in different work-shifts overall. It is known that an increased level of virtual way of working brings unique challenges and benefits to virtual teams (Cascio and Shurygailo, 2003). There are many benefits and drawbacks from virtual teams which are discussed further in table 7.

Table 7: Different viewpoints on the advantages and disadvantages of virtual teams in the relation of traditional teams

Virtual Teams (VT)	
Advantages	**Disadvantages**
• Allows employees to reduce their travel, relocation costs, and minimize the time and space constraints (Hertel et al., 2005) • More potential to acquire necessary human capital, knowledge, and skills to handle complex projects with diversified diffused knowledge by dispersed workforce (Chen et al., 2008) • More freedom and flexibility for the employees to give their contributions to different projects with shorter completion times (Precup et al., 2006) • It gives an advantage for the companies to perform better with limited resources and allow them to hire talent in other countries (Philip and Johanna, 2008) • Allow companies to have a cross-functional talented workforce working from different geographic location and have operative 24/7 due to different time zones (Blaise et al., 2008) • Easy to e-trainings to all employees as required for different projects, which also eliminates the employees traveling to different countries for training purposes. (Zaccaro and Bader, 2003). • Geographical dispersion in VT gives the potential for generating social capital, which is a form of relationship and networks that each team member would build during their daily work (Philip and Johanna, 2008)	• Requires high ICT infrastructure costs with complex technological applications, however, this can be eliminated by using IaaS (Infrastructure-as-a-service) and SaaS (Software-as-a-service) (Blaise et al., 2008) • Virtual communication may not allow employees to understand the full conceptual problem or understanding of a task (Badrinarayanan and Arnett, 2008) • Virtual communication issues due to different time zones may delay the schedules for various tasks (Avolio et al., 2014) • Misinterpretation of e-mails due to different cultural backgrounds having a different level of language skills, this may lead to lack of trust. (Joinson, 2002) • High flexibility can lead to some employees using the time in an un-productive manner that leads to poor performance (Zigurs, 2003) • Lack of general adaptiveness to the virtual teaming technological applications may lead to stress and inefficient work performance (Harry and Paul, 2005) • More likely for security and compliance issues to arise when companies work with sensitive and confidential data (Blaise et al., 2008)

Source: Created by authors

As discussed above, virtual teams created a stream to work digitally by replacing or as an alternative to the traditional way of working. Considering different scenarios where people cannot come to the office, virtual teams create an opportunity for most of the IT

employees across the globe to continue their daily work as usual in work-from-home mode.

Current literature focuses largely on measuring costs and effects of reducing costs using virtual means of working with a focus on quantity, timing, and costs. However, many aspects are lacking in measuring individual employee productivity in virtual teams (Bell and Kozlowski, 2002). Main influencing elements affecting productivity in virtual teams that are lacking in current literature is a performance in terms of quality, attitude towards work, behavioral aspects, knowledge sharing, motivation, and communication (Costa et al., 2001). Also, these elements allow team members to make quick decisions and give leverage for generating unique ideas (Martins et al., 2004);(Costa et al., 2001). Andres also mentioned that competence, diversified thinking, and motivation are major elements for an employee in increasing their productivity with efficiency in virtual teams that helps in improving the productivity of the team members by supporting each other during different scenarios (Andres, 2002).

To research the virtual team's influence on productivity, three dimensions were used in table 8. The three dimensions that are used in this analysis are:

Table 8: Virtual team dimensions used in the analysis

Dimension Name	Dimension description
Virtual Team Relationship Building	Focuses on the relationship and support of team members
Virtual Team Communication	Looks into the effectiveness of virtual team meetings in relation to face-to-face meetings
Virtual Team Environment	How a virtual team employee manages stress and if they share similar objectives within the team

Source: Created by authors

Virtual team hypothesis convey that all the 3 dimensions mentioned in table 8 will have a positive influence on productivity.

2. EMPIRICAL ANALYSIS OF KNOWLEDGE SHARING AND VIRTUAL TEAM ON EMPLOYEE PRODUCTIVITY

2.1 Data collection and methodology

Choosing the right methodological approach is important to reach a successful conclusion for the thesis. Since this master thesis aims to determine the influence between variables of knowledge management, virtual teams, and employee productivity, the triangulation method was redeemed to be the most useful way to collect information. The triangulation method will result in a higher quality of research and decreases the measurement error by involving more than one way of collecting data. To get relevant information on all the interesting variables, the population for this analysis was chosen to be financial institution employees working in virtual teams and were highly dependent on sharing their knowledge in their everyday work.

The method of collecting data to study the relations of desired variables, a questionnaire was formulated by taking an already existing instrument. The base questionnaire is done by Lurey and Raisinghani and focuses on the best practices in virtual teams' effectiveness with their instrument tested in high-technology, agriculture and professional services industry (Lurey, Raisinghani, 2000). The questions were scoped down to be reasonably sized (out of ~100 questions, 29 were used) and only related to knowledge sharing, virtual team, and product dimensions. For some of the questions, the wording was rephrased to fit the style of the thesis more specific to the financial institution, however, the meaning remained the same. For example, the questions in the thesis start with ''I am …'' when the Lurey questionnaire was more formal and generic. To assure the accuracy of the questionnaire, it went through a pilot study of 12 employees who fit the sample profile. The study was adjusted and correlated based on their opinions.

The questionnaire was distributed to different employees in a highly decentralized and specialized unit of a financial institution that is in four different countries. The division has in total around 550 employees who were chosen as participants for this study. Out of those 550 employees, 100 participants responded to the questionnaire who does most of their daily work through virtual means and involved in knowledge sharing activities.

The questionnaire that can be seen in appendix 1 was divided into three parts, based on the respective variable. The independent variables were divided into three dimensions while the dependent variable took on four dimensions that were important in the literature review. Table 9 brings out the name, number of questions, and description of these dimensions.

Table 9: Knowledge Sharing, Virtual Team, and productivity dimensions

Dimension Name	Dimension description
VTRelationship (2Q)	Focuses on the relationship and support of team members
VTCommunication (2Q)	Looks into the effectiveness of virtual team meetings in relation to face-to-face meetings
VTEnvironment (2Q)	How a virtual team employee manages stress and if they share similar objectives within the team
KSCriteria (2Q)	Level of documentation of the tasks and if people know who to approach regarding any questions in daily work
KSStructure (3Q)	How knowledge sharing-friendly an organization is. Focuses on if employees feel free to express opinions, if they are considered and if they receive enough satisfaction from the job
KSMotivation (2Q)	Focuses if employees are motivated to document their knowledge and if they are motivated to participate in important decisions
Quality and quantity (3Q)	If employees complete their tasks in time, if there are a lot of dependencies in their work and if they must rectify mistakes in dependency tasks
Employee Motivation (3Q)	If employees feel satisfied with their work performance, if they are enough challenged with their work and if they are motivated enough to work longer periods to complete urgent tasks
Personal development (3Q)	If employees want to learn new things in their job, if the industry offer ways to develop core skills and if they use their problem-solving skills during their daily work
Skills (3Q)	If employees help team members to solve problems, if employees are ready to adapt to organizational changes and if the employees feel they are competent with the tools used

Source: Compiled by authors; VT - Virtual Teams, KS - Knowledge Sharing

The questions found their way into the respective dimensions come in exploratory factor analysis that is discussed further under data preparation. For all the questions,

participants were asked to give their answers on a standard 5-level Likert-type scale (1 – strongly disagree to 5 – strongly agree). To collect the required demographics, the respondents were asked to fill in their age, education, and working experience in the current position.

The semi-structured interviews were concluded with two team managers. One of which manages a virtual team that has under 20 employees and the other one has over 20 employees. The semi-structured interview concentrates on getting insight into different tactics used by managers to create relations with team members virtually and motivating them to share knowledge. This gives further understanding of how virtual teams are doing things differently in knowledge management that may lead to more efficient productivity. These interviews will not be an input to the statistical analysis however it would be one of the main objectives is to offer more subject relevant solutions to increase productivity and provide the reasoning behind the regression results. The interviews are transcribed in Appendix 4 and 5.

For the quantitative analysis, 3 different hypotheses are developed, and hierarchical multiple regression analysis is concluded. These hypotheses convey what the thesis study is researching, and the hierarchical regression will provide the analysis results. The first two hypothesis are brought out in the literature view paragraphs and main one in preliminary data analysis. Work experience and education are present in the model as control variables.

The analysis was largely done in programming software called R and SPSS. R is open-source software that specializes in data science and overall data-related research. R is an open-source statistical programming language and therefore allows easy and quick changes to the code during analysis. The other software that was used is Statistical Products and Service Solutions (SPSS). SPSS does not work on programming language and uses a UI for selecting analysis purposes with different options. This makes SPSS easier to use for some analyses, however it is stricter than R regarding the plotting and overall flexibility.

2.2 Data preparation and preliminary data analysis

Before going into the regressions, some cleaning, aggregating of data, and preliminary analysis must be done. Preliminary analysis will describe demographic variables, provide correlation analysis between dimension, and bring up the possible issues on common method bias, omitted variable bias, multicollinearity, and overall measurement errors. It also brings out how the factors were formed through exploratory factor analysis and discuss the dimension's Cronbach's Alpha

Data cleaning

First, data is cleaned. More precisely, reverse scoring is done for the negatively worded questions where the numerical scoring scale runs in the opposite direction. For example, in productivity's perspective, having a lot of dependencies is results in negative productivity. Therefore, it must be reverse scored to fit in line with the research topic. The reverse scoring was done for questions 15 and 16.

Demographic variable overview

It is important to have a clear overview of who is in our sample. This is where the demographic variables come in. Table 10 concatenates all respondent demographic variables into one view grouped by their age.

Table 10: Respondent demographics grouped by age

		Level of education				Work experience (years)		
Age	Number of people	High school	Bachelor's	Master's	Doctor's	Below 2	2 to 6	6+
20-29	37	5	14	18	0	23	14	0
30-39	40	0	18	22	0	13	26	1
40-49	23	1	12	9	1	2	9	12
Total:	100	6	44	49	1	38	49	13

Source: Compiled by authors

Table 10 shows that all the respondents are between aged 20-49 with the biggest part of 40 people being aged 30-39. Out of the respondents, 6 people were with high school education, 44 with a bachelor's degree, 49 with a master's degree, and 1 with a doctor's degree. The high level of education (50% being master or above) is understandable since

the people in the sample are working in a unit that needs a high level of base knowledge and willingness to learn.

The work experience for the youngest age group is mostly below 2 with 14 of them being some years longer than 2. This is understandable since they are likely to come to work after their studies and they have not had as much time to work as other groups. Understandably, most of the middle-aged group have had more time to work and have already had 2 – 6 years' worth of work experience. The final group of 40-49 aged respondents has largely already been stably working for 6+ years. This distribution makes clear sense and there are no abnormalities to be seen.

Exploratory factor analysis with Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Cronbach's alpha

Exploratory factor analysis (EFA) allows us to use each question as a potential measure for every factor and this can be used to create knowledge sharing and virtual team dimensions. To find out if the data is good enough for EFA – KMO and correlation analysis was concluded. After the factors are created by the EFA, it is important to see the credibility of them with Cronbach's alpha.

The data points on the questions of virtual teams and knowledge sharing were separated and put into the exploratory factor analysis. The correlations between the research questions were around or above 0.3 which is one of the assumptions of EFA. The other assumption is the Kaiser-Meyer-Olkin (KMO) analysis that provides the information that the sample is adequate to be well suited for the EFA since both values were above 0.5. The KMO values for knowledge sharing questions were 0.64 and virtual teams 0.62 which can be seen in appendix 3. Productivity had a KMO of 0.60, however since the dimensions are not opened for productivity in the analysis, a further exploratory analysis was not necessary.

From the eigenvalues, it came out that variance in the data on both knowledge sharing and virtual teams allow having three factors on each variable. The factors, also known as dimensions in this thesis, were provided in the factor loadings. When the question had a higher relationship with the factor, with a minimum of 0.4, it was put into the relevant dimension. If a question did not exceed the minimum threshold then EFA was done again

without the questions that did not have a strong relationship with the factor. The dimensions were then investigated and provided a name based on the questions behind it.

To see the credibility of the dimensions, their Cronbach's alpha value was measured. Literature states that Cronbach's alpha is good to have above 0.70 (Bruin, 2006). The Cronbach's alpha value for the dimensions in the thesis starting starts from a low 0.43 and is up to a solid 0.79. However, when there is a low number of items and low sample size behind the factors, it is likely to have lower reliability. It should be noted that low Cronbach's value does not state that the data is unusable and does not mean that the dimensions should be taken out rather it meant that some or all of the items are not measuring the same dimension (Bujang et al., 2018). However, to be sure of the results, interviews are concluded that support the regression results.

Correlation analysis

Before the regression, it is also good to have an overlook of the correlation between the independent variables. Knowing the correlation allows us to find out if the dimensions are highly correlated then the shift in one variable will is also associated with a shift in another dimension(s). Being aware of this can be critical in interpreting the results correctly.

Pearson's correlation was concluded on the dimensions and independent variables. Pearson's correlation gives values between –1 and 1 that represent either a negative or positive correlation with 0 being no correlation. So, the value of 0-19 is considered very low, 0.2-0.39 as low, 0.40-0.59 as moderate, 0.6-0.79 as high, and 0.8-1 as a very high correlation. Table 11 is created to see Pearson's correlation coefficients between the dependent variable and independent dimensions. The significance level of the correlations can be seen from stars (* 10%, ** 5%, *** 1%).

Table 11. Pearson's correlation between knowledge sharing, virtual team dimensions, and employee productivity variable

	Productivity	KS Structure	KS Criteria	KS Motivation	VT Communication	VT Relationship	VT Environment	Education	W. Experience	Age
Productivity	1									
KS Structure	**0.461****	1								
KS Criteria	0.312**	0.233*	1							
KS Motivation	0.366**	0.225*	0.156	1						
VT Communic.	0.122	0.033	0.280**	0.086	1					
VT Relationship	**0.454****	**0.442****	0.284**	0.085	0.114	1				
VT Environment	**0.505****	0.374**	**0.535****	0.261**	0.127	0.364**	1			
Education	-0.061	-.218*	-0.094	0.105	-0.041	-0.137	-0.075	1		
Work Experience	-0.061	-0.008	-0.067	0.102	-0.034	-0.025	-0.049	0.174	1	
Age	0.087	0.108	0.059	0.169	0.111	-0.070	-0.058	0.070	**0.579****	1

Source: Compiled by authors

Table 11 shows that there is a correlation between some variables. The possible reason for the positive correlation with productivity and:

- Knowledge sharing structure (0.461**) is because task documentation is important in everyday work;
- Knowledge sharing criteria (0.312**) allows for efficient knowledge sharing procedures;
- Knowledge sharing motivation (0.366**) leads to good task documentation and employees do not want to keep the knowledge to themselves;
- Virtual team communication (0.122) meaning that quality virtual communication improves productivity;
- Virtual team relationship (0.454**) shows that relationship and team member support is important in raising productivity;
- Virtual team environment (0.505**) demonstrates that sharing similar objectives is good for an employee productivity;

Even if the correlation seems to be high, they are still below 0.6, so there should be no real concern regarding them having a high correlation.

There seems to be a case that work experience nearly has a high positive correlation with age (0.579**) which means that it would be best not to have these two variables in the regression at the same time. It does make sense that age is highly correlated with work experience since older people are more likely to have had more time to work.

Common Method Bias

Also, since the research is studying behaviors of the respondents, it is important to note if the data has signs of Common Method Bias (CMB). Common method bias can arise if the dependent and independent variables have common rater, common measurement context, common item context, or the characteristics of the items are similar themselves (Podsakoff et al., 2003). This means that the independent and dependent variables are collected from the same respondents at one point in time and may lead to provide positive/negative answers. This can potentially lead to measurement errors in the data. To see how serious is CMB for the data, Harman's single factor score is concluded on all the latent variables under research. Harman's single factor score loads all of the variables into one common factor and if the total variance of that factor is less than 50%, CMB is not present and affecting the data (Podsakoff et al., 2003).

The Harman's single factor score can be seen in appendix 2. From the analysis, it came out that the total percentage of the variance for the latent variables is 31.3%. Although it might be a lot of variances to be explained by a single factor, it is not a majority and is well below the 50% level when it should be a concern.

2.3 Multiple Hierarchical Regression

The analysis is performed with a regression model with productivity as the dependent variable and dimensions of knowledge sharing, virtual teams as independent variables. Education and work experience are used as control variables since age had to be eliminated from the analysis because of the high multicollinearity that is seen in table 11. The numbers are discussed under regression 1 and the reasoning behind them is under findings and discussion. Model 1 is the representation of what the regression was done, and main hypothesis looks at the influence of all knowledge sharing and virtual teams' dimensions on productivity.

Model 1: Virtual team dimension and knowledge sharing dimensions and control variables on productivity

$$\text{Productivity} = \beta_0 + \beta_1 KStructure + \beta_2 KS\ Criteria + \beta_3 KS\ Motivation + \beta_4 VT\ Communication + \beta_5 VT\ Relationship + \beta_6 VT\ Environment + \beta_7 WorkExperience + \beta_8 Education + \varepsilon$$

The main hypothesis claims that all virtual team and knowledge sharing dimensions will have a positive relation with employee productivity.

Regression 1: Knowledge sharing and virtual team dimensions on employee productivity

	Dependent variable: Productivity	
Knowledge Sharing Structure	0.114**	Standard error: (0.054)
Knowledge Sharing Criteria	0.002	Standard error: (0.058)
Knowledge Sharing Motivation	0.120***	Standard error: (0.044)
Virtual Team Communication	0.011	Standard error: (0.029)
Virtual Team Relationship	0.148***	Standard error: (0.056)
Virtual Team Environment	0.151***	Standard error: (0.056)
Work Experience	-0.036	Standard error: (0.044)
Education	0.015	Standard error: (0.049)
Constant	1.573***	Standard error: (0.308)
Observations	100	
R2	0.432	
Adjusted R2	0.382	
Residual Std. Error	0.286 (df = 91)	
F Statistic	8.661*** (df = 8; 91)	
p-value:	1.023e-08	
Note: Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1		

From the regression 1 results, all the knowledge sharing, and virtual teams' dimensions are significant except knowledge sharing criteria and virtual team's communication. This means that they do not have a relation to productivity. Adjusted R2 measures the goodness of fit and in this case, it states that 38.2% of productivity is explained by the

independent dimensions. For 8 variables, 38.2% of the adjusted R2 value is quite good. The p-value is 1.023e-08 which means that the model is significant, and the model fits the data well. The constant seems to be 1.573 units, which is the base measurement when all the other dimensions are 0. Even if the hypotheses cannot be accepted because of knowledge sharing criteria and virtual team's communication, we can say that the other four dimensions had as significant positive influence on employee productivity.

Now, for the interpretation of knowledge sharing dimension values. Firstly, one unit increase in:

- Knowledge sharing structure leads to 0.11 units (~7% from base value) increase in employee productivity; this means freedom of expression in team meetings and activities, getting intrinsic rewards, and implementation of expressed ideas increases productivity.
- Knowledge sharing motivation leads to 0.12 units (~8% from base value) increase in employee productivity. this indicates that it is quite important to motivate employees for documenting their knowledge to be usable by others. Also, they should be encouraged to take some initiatives for different tasks and be decision-makers for those tasks, this results in increasing productivity

Interestingly, knowledge sharing criteria does not seem to affect productivity as it is insignificant. This can also mean that those other variables have already been captured the information behind this variable. Understandably, employee motivation can be a bigger factor in changing productivity than the structure. If an employee is not motivated to participate in important decisions, it is lowering their productivity significantly.

For the virtual team dimension values, one unit increase in:

- Virtual team's relationship causes 0.14 units (~9% from base value) increase in employee productivity, this indicates that having enough communication with other team members helps in building relationships. Also, this helps in supporting each other as required while working on different tasks.
- Virtual team's environment causes 0.15 units (~9.5% from base value) increase in employee productivity, this demonstrates that task-management with the help

of other team members during tight deadlines, sharing similar goals, and working towards achieving them results in better productivity.

The virtual team's communication seems insignificant meaning that the questions behind the dimension do not affect productivity. This as well can mean that the information can already be captured in other variables. From the results, it comes out that the virtual team relationship is as important as the environment the employee is in. This means that a good level of support from team members and sharing similar goals is needed to keep productivity high.

The control variables of work experience and education seem to be insignificant. The reason behind it is further discussed under the paragraph of findings and discussion.

Additionally, the interviews support the regression results. The managers who the interviews were concluded provided various practices on how to keep the important dimensions higher in real life. The important knowledge sharing and virtual team practices that increase productivity are brought out under the section on discussion on findings.

2.4 Discussion on findings

The purpose of this study is to see the influence of virtual teams and knowledge sharing on employee productivity. The reasoning and possible explanations behind the results of the regression are discussed under the discussion on findings. The questions are used to bring out what is effective under the dimensions. The reasoning and possible way to increase these variables are taken from the interviews were used in appendix 4 and 5.

The increase in productivity for knowledge sharing structure is lower than other significant dimensions, but still notable. This means that feeling free to express opinions inside the team, noting that others consider those ideas, and getting intrinsic rewards from the work is important to be more productive. The financial industry where the study was done uses several ways to increase these actions. From the interviews, it came out that to increase the knowledge-friendly organizational structure, they:

1. Assign a mentoring person to newcomers;
2. Have face-to-face knowledge sharing sessions from time to time;
3. Have area experts in the same office with the newcomers to make knowledge gaining process faster;
4. Mandatory and non-mandatory training for beginners in the face of e-trainings;
5. Have up-to-date guidelines on how to behave during team meetings;
6. To criticize an idea, also provide a solution or proposal on how to make it better.

A positive effect has also been found between productivity and knowledge-friendly organizations done with survey data of 189 managers. It came out that organizational structure is directly related to productivity and it is important to have managers who consider others and motivate them to be better (Mills and Smith, 2010).

Knowledge sharing motivation shows the second-biggest increase in employee productivity from the overall variables. This means that it is important to be motivated to virtually document knowledge that can be used by others and employees should be encouraged to take initiative as well as participate in important decisions. To increase the knowledge sharing motivation amongst the employees, the interviewed financial industry managers are:

1. Providing the time and prioritization for the documentation for it to happen;
2. Keeping employees challenged with more demanding tasks to keep them interested;
3. Improving motivation by giving more salary increments for good work;
4. Doing performance development programs that provide employees a chance to grow;
5. Delegating as much as possible to encourage employees to take the lead on projects.

This is also supported by a study by Janz (1997) that concluded intrinsic motivation is an important element in improving performance, focusing more on effectiveness. The author had analyzed with 231 knowledge workers who worked in 27 different teams. In addition to the positive relation of motivation, her analysis found out that motivation tends to be higher when the teams are more developmentally mature and with high-quality goals (Janz, 1997).

A virtual team relationship leads to the second-highest increase in productivity. This means that it is important to have enough communication within the team to build a good work relationship and have enough support from the team members. Enough communication and support allow employees to work towards a common goal by supporting each other during their daily work if required. The measures that the financial industry managers use to improve the relationship-building among the team members are:

1. Having weekly meetings and allowing employees to talk with other team members;
2. Having physical meetings from time to time to increase the non-work relationship between team members;
3. Having certain guidelines on what to do and what not to do during the virtual meetings;
4. Having virtual water cooler meetings where people talk non-work-related things while using web cameras;
5. Managers should reach out to employees from time to time and ask how they are doing;
6. If something is unclear, let employees be free to express it and give contacts to people who can help regarding this;
7. If possible, allow people to work in flexible hours.

This was also mentioned by Andres that more interactions between team members enable us to build trust initially between each other which leads to stronger relationships. Also, such relationships will help to support each other during different tasks which will ultimately lead towards achieving a unified goal. Relationships will also enable information exchange and active conversations between team members, and this results in better productivity and process satisfaction (Khosrow-Pour and Andres, 2008).

The strongest increase in influence on productivity can be seen in the dimension virtual team environment. This is because an efficient virtual team environment leads to managing work well during stressful times and sharing similar goals and objectives with team members by working collaboratively to achieve them. The measures that the financial industry uses to improve virtual team environment are:

1. While overloaded with tasks, an employee should always be open to asking for help from other team members;
2. Translate company's vision to be applicable in the team for everyone to follow;
3. Have up-to-date guidelines on how to behave during team meetings;
4. Encourage going out of the office to different seminars and bringing back the key points regarding the knowledge behind it.
5. Discourage employees on having a private little task that they are only working on. Teamwork is important and leads to better overall results;
6. Try to harmonize goals for different cultures, even if they different aspects;
7. Allow employees to share their vision and experience.

This was also found out by Pangil and Chan, who stated that virtual teams' environment is a very important dimension to help in terms of having a good relationship with team members by establishing trust between each other and support each other during different work-related scenarios. This trust leads to an increase of efficiency inside the team (Pangil and Chan, 2014).

However, even when knowledge sharing criteria and virtual team communication are insignificant and may not lead to an increase in productivity, but both have a positive relationship with productivity, so it is still worth mentioning some of the processes that are related to these dimensions.

For knowledge sharing criteria, the documentation and knowledge on whom to approach with questions did not reflect an increase in productivity. Also, it came out that virtual communication questions on virtual teams do not show an impact on productivity. However, there are some notable points from the interviews that are reflecting these dimensions. It came out that the interviewed managers are:

1. Always encouraging employees to ask questions;
2. Using face-to-face meetings for large meetings and virtual communication for small meetings to keep productivity higher;
3. Using face-to-face meetings to improve work relationship and virtual teams to have more flexible location and adjustable time schedule.

This is also discussed by Bukowitz who mentioned that knowledge sharing criteria is needed in an organization for its employees to be able to efficiently share the explicit knowledge. Basic knowledge sharing framework need to exist on some level to share knowledge on different levels of hierarchy which will lead to growth in productivity (Bukowitz and Williams, 2000).

Both control variables, work experience, and education do not seem to be leading growth in productivity. This means that there does not seem to be a raise in employee perceived productivity when a person has a bachelor's (44 respondents) or master's (49) degree. It is difficult to conclude about doctor's (1) and high school (6) level of education since there are too few of them in the research.

Work experience also does not seem to be changing employee productivity as well. This is understandable since the questions were focusing on the employee perception of their productivity and it is understandable that a junior employee can feel that they are as productive as a senior. The minus for the work experience, even if not significant, can be because seniors are more likely to see the problematic gaps in the system which can lead to more poor ratings on some of the productivity-related questions.

Conclusion

This paper studies the influence of knowledge sharing and virtual teams on employee productivity in the case of a financial institution. Virtual teams and knowledge sharing are intensively researched and divided into dimensions. These dimensions allow deeper research on what are the exact areas in the variable that influences productivity the most. Available studies have not viewed on how these dimensions of knowledge sharing activities and virtual teams influence employee productivity in a financial institution and are more focused on the research of knowledge management.

From the research, it comes out that there is a positive influence between the dimensions of knowledge sharing and virtual teams to employee productivity. Both on knowledge sharing and virtual teams, 2 out of 3 of the dimensions are statistically significant. Overall, a strong virtual team's organizational structure seems to be a bit better in raising productivity than knowledge sharing activities.

The triangulation method allowed us to have results to be backed up by interviews there were concluded with two different team managers in the unit the research was done. The interviews also provided information on what practices do they use to facilitate a strong base of knowledge sharing a virtual team structure inside their team.

The dimension that seemed to raise productivity the most was the virtual team environment and the least was knowledge sharing structure. Interestingly, the virtual meetings did not seem to have an impact on the study. This could mean that in the future, productivity should stay the same in-home office when compared to the work office. That can mean that a shift to the home office and doing most of the meetings virtually would provide organizations to save money on a workspace and that could be used in other expenses.

Limitations:

The limitation of the study is that it only involved only 100 respondents that is a relatively low number to be concluded for the whole population. Furthermore, the research is only done to be financial industry-specific. It means that there is a possibility that the results will vary when done in other sectors. From the research, it also came out that the dimensions have a relatively bad Cronbach's alpha, however, it should be noted that the quantitative results were supported by the qualitative part of the analysis as well as previous literature.

As one of the limitations, further research should be done in researching the dimensions in different industries to see how they could be compared with the financial industry. Further research can also include more questions under dimensions, more dimensions overall, and larger sample size. With more studies it would be good to have a comparative analysis to see different aspects that occur in various industries.

Recommendations:

The main recommendation for increasing employee productivity is by improving knowledge sharing processes in the form of encouraging employees to feel free in expressing their opinions inside the team, inspire them to take initiatives and motivate them to share their knowledge with others. In order to do this, it is important to have face-to-face knowledge sharing sessions from time to time and setting up achievable goals in the performance development sessions.

Employee productivity can also be increased by having a good virtual team structure. It is important for the team members to share similar goals with colleagues and support each other. In order to improve the virtual team structure, it is recommended to translate company's vision to be applicable in the team, have up-to-date guidelines on how to behave during team meetings and always encourage employees to ask questions.

References

Ansari, M., Youshanlouei, H.R. and Mood, M.M., 2012. A Conceptual Model for Success in Implementing Knowledge Management: A Case Study in Tehran Municipality. JSSM 05, 212–222. https://doi.org/10.4236/jssm.2012.52026

Antikainen.R. and Lönnqvist, A., 2005, Knowledge work productivity assessment, *Proceedings of 3rd Conference on Performance Measurement and Management*.

Avolio, B.J., Sosik, J.J., Kahai, S.S. and Baker, B., 2014. E-Leadership: Re-examining transformations in leadership source and transmission. *The leadership quarterly* 25, pp. 105–131.

Andries, D. G. and Jan, S. (2012), The Effects of Training on Own and Co-worker Productivity: Evidence from a Field Experiment*. The Economic Journal, 122, pp. 376-399.

Hayward P. Andres, (2002),"A comparison of face-to-face and virtual software development teams", Team Performance Management: *An International Journal*, Vol. 8 Iss 1/2 pp. 39 - 48

Badrinarayanan, V. and Arnett, D.B., 2008. Effective virtual new product development teams: an integrated framework. *Journal of Business and Industrial Marketing*, pp. 242-248.

Beata Krawczyk-Bryłka, 2017. Comparative Study of Traditional and Virtual Teams. TASK Quart. 21, pp. 233–245. https://doi.org/10.17466/tq2017/21.3/o

Bell, B.S. and Kozlowski, S.W.J., 2002. A typology of virtual teams. Implications for effective leadership. *Group and Organization Management* 27, pp. 14–49.

Benson, R., Stacie, F. and Richard, B., 2007. Overcoming Barriers to Knowledge Sharing in Virtual Teams. *Organizational Dynamics* 36, pp. 259-273.

Benbasat, I., 1999, Empirical Research in Information Systems: The Practice of Relevance, University of British Columbia, pp.16

Bhatti, K.K. and Qureshi, T.M., 2007. Impact Of Employee Participation On Job Satisfaction, Employee Commitment And Employee Productivity. *International Review of Business Research Papers*, pp. 54–68.

Bjørn, P. and Ngwenyama, O., 2009. Virtual team collaboration: Building shared meaning, resolving breakdowns and creating translucence. *Information Systems Journal* 19, pp. 227–253.

Bruin, J. 2006. newtest: command to compute new test. UCLA:
Statistical Consulting Group. https://stats.idre.ucla.edu/stata/ado/analysis/.

Blaise, J.B., Erich, B.B. and Phillip, B., 2008. Nature of virtual teams: a summary of their advantages and disadvantages. *Management Research News*, pp. 99-110

Bukowitz, W. and Williams, R.L., 2000, The Knowledge Management Fieldbook, London: Financial time prentice hall, pp. 384.

Bujang, M. A., Omar, E. D. and Baharum, N. A. (2018). A Review on Sample Size Determination for Cronbach's Alpha Test: A Simple Guide for Researchers. *The Malaysian journal of medical sciences: MJMS*, 25(6), pp. 85–99. https://doi.org/10.21315/mjms2018.25.6.9

Carlucci, D. and Schiuma, G., 2006. Knowledge asset value spiral: linking knowledge assets to company's performance. Knowl. Process Mgmt. 13, pp. 35–46. https://doi.org/10.1002/kpm.243

Cascio, W.F. and Shurygailo, S., 2003. E-Leadership and Virtual teams, *Organizational Dynamics*, pp. 79.

Costa, A.C., Roe, R.A. and Taillieu, T., 2001. Trust within teams. The relation with performance effectiveness. *European Journal of Work and Organizational Psychology* 10, pp. 225–244.

Davenport, T.H., De Long and D.W., Beers, M.C., 1998. Successful Knowledge Management Projects. *Sloan Management Review* 39, pp. 43–57.

Davidekova M. and Hvorecky, J., 2017, Collaboration Tools for Virtual Teams in Terms of SECI Model, *Advances in intelligent systems and computing*, pp. 97-111.

Devine, D.J, 2002, A Review and integration of classification systems relevant to teams in organizations, *Group Dynamics: Theory, Research, and Practice*, pp. 291-310.

Derven, M., 2016. Four drivers to enhance global virtual teams. *Industrial and Commercial Training* 48, pp. 1–8. https://doi.org/10.1108/ICT-08-2015-0056

Donate, M.J. and Sánchez, P., 2015, The role of knowledge-oriented leadership in knowledge management pratices and innovation, *Journal of Business Research*, pp. 360-370.

Drucker.P.F., 1999, Knowledge Worker Productivity: The Biggest Challenge, *California Management Preview*, 41, pp. 79-94.

Gassmann, O. and Zed 2003, Trends and determinants of managing virtual R&D teams, pp. 234-262.

Glikson, E. and Erez, M., 2019. The emergence of a communication climate in global virtual teams. *Journal of World Business.* https://doi.org/10.1016/j.jwb.2019.101001

Ebrahim, N.A., Ahmed, S. and Taha, Z., 2009. *Virtual Teams: A Literature Review* 17.

Guzzo, R.A. and Dickson, M.W., 1996, Teams in Organizations: Recent Research on Perfomrance and Effectivness. *Annual Review of psychology*, pp.307-338.

Harry, M. and Paul, W., 2005. Virtual Teams and the Rise of e-Entrepreneurship in Europe. *Internal Small Business Journal*, pp.279-302.

Hendriks and Vriens, 1999, Knowledge Management: Innovation, Technology and Cultures - *Proceedings Of the 2007 International Conference, World Scientific*, pp. 384.

Hertel, G. and Geister, S., 2005, Managing Virtual Teams: A review of Current Empirical Research, *Human Resource Management Review*, pp. 69-95.

Hélie, S. and Sun, R., 2010. Incubation, insight, and creative problem solving: A unified theory and a connectionist model. *Psychological Review* 117, pp. 994–1024. https://doi.org/10.1037/a0019532

H.H Chen, Kang, X., Lee, A.H.I. and Tong, Y., 2008. Developing new produc ts with knowledge management methods and process development management in a network. Computers in Industry, 59, pp. 242-253.

Holsapple, C.W. and Joshi, K.D., 2000. An investigation of factors that in¯uence the management of knowledge in organizations. *Journal of Strategic Information Systems* 27, pp. 235-261.

Hung, Y.-T.C. and Ngyuen, M., 2008. The impact of Cultural Diversity on Global Virtual Team Collaboration – A Social Identity Perspective, in: A Social Identity Perspective, Proceedings of the 4th Hawaii International Conference on

Janz, B.D., Colquitt, J.A. and Noe, R.A., 1997, Knowledge worker team effectiveness: The role of autonomy, interdependence, team development, and contextual support variables. *Personnel Psychology*, 50(4), 877-904.

Joinson, C., 2002. Managing virtual teams. HR Magazine.

Khalil, C., Velarie and F., Thomas, H., 2013, Can Agile Collaboration Practices Enhance Knowledge Between Cross-Functional Teams?, Berlin, pp. 123-133.

Killingsworth, B., Xue, Y. and Liu, Y., 2016. Factors influencing knowledge sharing among global virtual teams. *Team Performance Management* 22, pp. 284–300. https://doi.org/10.1108/TPM-10-2015-0042

Krawczyk, B.B., 2017. Intercultural Challenges in Virtual Teams. Journal of Intercultural Management. 8. 10.1515/joim-2016-0017.

Khosrow-Pour, M., and P. Andres, H. (2008). Chapter IX, The Impact of Communication Medium on Virtual Team Group Process. In Innovative technologies for information resources management (pp. 145–163). IGI Global (701 E. Chocolate Avenue, Hershey, Pennsylvania, 17033, USA).

Lee-Kelley, L. and Sankey, T., 2008, Global virtual teams for value creation and project success: A case study, *International Journal of Project Management*, pp. 51-62.

Lin, T.-C., Cheng, K.-T. and Wu, S., 2014. Knowledge Integration in ISD Project Teams: A Transactive Memory Perspective. *Open Journal of Business and Management* 02, 260, pp. 260-371 https://doi.org/10.4236/ojbm.2014.24042

Martins, L.L., Gilson, L.L. and Maynard, M.T., 2004. Virtual teams: What do we know and where do we go from here? *Journal of Managament* 30, pp. 805–835.

Mihhailova, G., 2007. Virtual teams – just a theoretical concept or a widely used practice? The Business Review, 7(1), pp. 186–192.

Mills, A.M and Smith, T.A, 2010, Knowledge Management and organizational performance: a decomposed view, *Journal of knowledge management*, pp.158-171.

Nwelih, E. and Amadin, I.F., 2008. Modeling Software Reuse in Traditional Productivity Model. *Asian Journal of Information Technology*, pp.484-488 (11).

Pangil, F. and Chan, J., 2014. The mediating effect of knowledge sharing on the relationship between trust and virtual team effectiveness. *Journal of Knowledge Management* 18, pp. 92–106.

Paulin, D.T. and Suneson, K., 2012, Knowledge Transfer, Knowledge Sharing and Knowledge barriers - Three blurry terms in KM, *Electronical Journal of Knowledge Management*, pp. 81-91.

Peggy,M.B. and Martz, B. 2005. Making Virtual teams more effective:Improving relational links, Team performance management, pp. 200-2013

Philip L, H. and Johanna, H., 2008. Virtual teams: a leader's guide. Team Performance Management 14, pp. 86–101.

Podsakoff, P.M. and MacKenzie, S.B., Lee, J.-Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology* 88, pp. 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Precup, L., O'Sullivan, K., Cormican and Dooley, L., 2006. Virtual team environment for collaborative research projects. *International Journal of Innovation and Learning*, pp. 77-93.

Riege, A., 2005. Three-dozen knowledge-sharing barriers managers must consider. *Journal of Knowledge Management* 9, pp. 18-35. https://doi.org/10.1108/13673270510602746

Sarker, S., Ahuja, M., Sarker, S. and Hove-Kirkeby, S. (2011). The Role of Communication and Trust in Global Virtual Teams: A Social Network Perspective. *Journal of Management Information Systems*, *28*(1), pp. 273-310. https://doi.org/10.2753/MIS0742-1222280109

Sher, P.J., Lee and V.C., 2004. Information technology as a facilitator for enhancing dynamic capabilities through knowledge management. *Information & Management* 41, pp. 933–945. https://doi.org/10.1016/j.im.2003.06.004

Sheng Wu, C. S. Lin and Tung-Ching Lin, "Exploring Knowledge Sharing in Virtual Teams: A Social Exchange Theory Perspective," Proceedings of the 39th

Annual Hawaii International Conference on System Sciences (HICSS'06), Kauia, HI, USA, 2006, pp. 26b-26b, doi: 10.1109/HICSS.2006.177.

Schwartz, D.G., 2006, Encyclopedia of knowledge management, Idea Group Reference, pp. 897.

Stray, V., NB. Moe and A. Bai, 2018, How Agile Teams Regard and Practice Universal Design During Software Development, pp. 171-183.

Skyrme, D. and Amidon, D., 1997. The Knowledge Agenda. *J of Knowledge Management* 1, pp. 27–37. https://doi.org/10.1108/13673279710800709

Srivatsava, S.K. and Kailash, B., 2011. Role of Motivation in Higher Productivity, *Global Jornal of Business Management*, pp. 105-116.

Stough, S., Eom, S. and Buckenmyer, J., 2000, Virtual teaming: A strategy for moving your organization forward into the new millenium. *Industrial management and data systems*, pp. 100.

Stylianou, V. and Savva, A., 2016, Investigating the Knowledge Management Culture, Universal Journal of Educational research 4, pp. 1515-1521.

Townsend, A.M., DeMarie, S.M. and Hendrickson, A., 1998. Virtual teams: Technology and the workplace of the future. *Academy of Management Executive* 12, pp. 17–29.

Tavoletti, E., Stephens, R.D. and Dong, L., 2019, The impact of peer evaluation on tem effort, productivity, motivation and performance in global virtual teams, *Team performance management*, pp. 334-347.

Van den Hooff, B. and de Ridder, J.A. (2004), "Knowledge sharing in context: the influence of organizational commitment, communication climate and CMC use on knowledge sharing", *Journal of Knowledge Management*, Vol. 8 No. 6, pp. 117-130.

Yoon, Y. and Guimara Kanawattanachai, P. es, T., 1995, Assessing expert systems impact on users' jobs, *Journal of management systems*, 12, pp. 225-249.

Yoo, Y. and Kanawattanachai, P., 2007, The Impact of knowledge coordination on virtual team performance over time, *MIS quarterly*, pp. 783.808.

Zaccaro, S.J. and Bader, P., 2003. E-Leadership and the Challenges of Leading E-teams: Minimizing the Bad and Maximizing the Good. Organizational Dynamics 31, pp. 377–387.

Zakaria, N., Amelinekx, A. and Wilemon, D., 2004. Working together apart? Building a knowledge sharing culture for global virtual teams, 13. *Creativity and Innovation Management*, pp. 15-29.

Zigurs, I., 2003. Leadership in Virtual Teams: Oxymoron or Opportunity?, *Organizational Dynamics*, pp. 339-351.

3. APPENDIX

Appendix 1. Questionnaire (Lurey, Raisinghani, 2000)

Variable: Virtual Teams

Dimension: Relationship Building (Variable VTRelationBuild)

1. I have enough communication within my team to build a good work relationship

2. I have enough support from my team members

Dimension: Virtual communication (Variable VTCommunication)

3.My virtual team meetings tend to be more productive than face-to-face meetings

4.Virtual conversations helped me to communicate more effectively with my team members

Dimension: Virtual Team Environment (Variable VTEnvironment)

5. I manage my work well during stressful times

6. I share similar goals and objectives with my team members

Variable: Knowledge Sharing

Dimension: Explicit knowledge sharing criteria - Knowledge articulation, awareness, access, guidance, and completeness (Variable KSCriteria)

7. The organization has good documentation for most of the tasks

8. I know whom to approach in the case if any questions arise during my daily work

Dimension: Knowledge-friendly organizational structure (Variable KSStructure

9. I feel free to express my opinions inside my team

10. My opinions are considered in team meetings

11. I get intrinsic rewards and satisfaction from my job

Dimension: Knowledge Sharing motivation (Variable KSMotivation)

12. I am motivated to virtually document my knowledge to be used by others

13. I am encouraged to take initiatives and participate in important decisions

Variable: Productivity (Variable Productivity)

Dimensions: Quality and Quantity

14. I complete my tasks on time according to planned targets

15. There are a lot of dependencies to complete my tasks **(Reverse scored)**

16. I often rectify my work because of the mistakes in the dependency tasks **(Reverse scored)**

Dimension: Employee Motivation

17. I feel satisfied with my work performance

18. I find that I am challenged by my work

19. I am ready to work longer hours to complete my tasks on time

Dimension: Personal development

20. I want to learn new things related to my job

21. My job allows me to develop my knowledge and core skills.

22. I am using my problem-solving skills during my daily work

Dimension: Personal skills

23. I give useful information to my group members to solve problems

24. I am ready to adapt to the organizational changes

25. I am competent with the tools my organization works with

Removed KS and VT questions by the Exploratory Factor Analysis:

I can easily access the knowledge documented by others when needed

I am virtually documenting my knowledge to be used by others

I exchange new and useful information with my group members

I feel self-rewarded when I share my knowledge

I am encouraged to take initiatives and participate in important decisions

I actively participate in virtual meetings

26. **Age (Variable: Age)**

20-29, 30-39, 40-49, 50-59, 60+

27. **Education (Variable: Education)**

High school graduate, Bachelor's degree, Master's degree, Doctorate

28. **Working experience in a current position (Variable: WorkExperience)**

Below 2 years, 2-6 years, 6+ years

Appendix 2. Harman's single factor score results to measure Common-Method Bias

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.793	39.904	39.904	2.191	31.300	31.300
2	1.092	15.605	55.509			
3	.943	13.471	68.980			
4	.775	11.075	80.056			
5	.539	7.695	87.751			
6	.475	6.780	94.530			
7	.383	5.470	100.000			

Extraction Method: Principal Axis Factoring.

Appendix 3: Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy on knowledge sharing and virtual teams

Knowledge Sharing:

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.645
Bartlett's Test of Sphericity	Approx. Chi-Square	89.976
	df	21
	Sig.	.000

Virtual Teams:

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.599
Bartlett's Test of Sphericity	Approx. Chi-Square	110.346
	df	15
	Sig.	.000

Appendix 4: Interview with manager above 20 employees

I – Interviewer

R - Respondent

Interview

I - Hello, thank you for accepting my meeting request to give your opinion on few topics which we will discuss during next 30 minutes.

I will give a short overview on what are we doing and so on, basically our main idea is to see the impact of knowledge sharing and virtual teams on employee productivity in

different teams. So, my team member and I decided to do some interviews in two sections. One is the team, which is having more than 20 people and the other team with less than 20 people.

Going further, in this interview, I will focus on mainly what are the ways you are currently using in your team for internal knowledge sharing practices and relationship between your co-located team members. Also, since our unit is highly decentralized, it would be interesting to know what kind of knowledge sharing practices being used and followed during your everyday work. Your opinions would help us as a support for concluding our analysis results with some constructive suggestions to improve or change the current practices to achieve better results and improve employee productivity.

I - *What are the different ways of knowledge sharing practices you use inside your team?*

R - So one option is we use one-one mentoring sessions quite often. For example, when a new person joins the team then there is someone always assigned in mentoring that person. And then also another option is just consulting more experienced colleagues, from a different area or shared area because they have good experience and they can also support and answer some questions. Then also, previously we used to have knowledge sharing sessions when we had the team events. For example, last meeting that we had was, uh, which was last year where we talked about testing practices and more experienced colleagues shared their visiona and experience in this and way to change the test practices in future. Also, we had some question and answer sessions between team members during team events. Also, planning something similar for this year as well, but for obvious reasons, it may not happen near soon due to COVID-19 regulations. So, this is probably what we have for mostly an inside our team.

I – *Do you also have good documentation available*

R - It really depends on the area and the people in this area, if they had some time to prepare such documentation then they will document the information, if no time then mostly documentation will not happen. I know that there are some old documentations

still available for some areas, but in the other areas, there is no or very limited documentation available. But again, then the question come here is, whether documentation was updated with some new data or not? Also, we have some old documentation regarding service validations, incidents creation and bug registrations. Overall documentation is there, but it is not updated enough because of the time limitations and other prioritizations.

I - *I remember that you said most of the things that happened on a consultation basis when the new person joins. But did you see any internal development after implementing that practice? are the new joiners becoming independent?*

R - It's hard to evaluate this time period because we say when we hire someone that it is okay not to feel confident for the first year. This would be this minimal time that is needed. But of course, this mentoring and consultancy is really helping. But as you said, actually, that we are located in different countries then what I have noticed is that if your mentor is in the same country as you are in the same office, then of course, this knowledge gaining process becomes much faster and faster.

I - *How do you keep the core skills of your employees developing or encourage employees to develop core skills?*

R - I think this all comes mostly with like practice with different tasks that they perform every day. Of course, we also have some mandatory trainings that needs to be completed in the internal e-training portal. But I think that most of the learning and the competence comes with the experience by performing tasks. Also, there are cases when even people who have been working for quite some time seeks assistance or advice from someone else with services.

I - *How do you encourage the communication between your team employees, especially when most of your team is scattered in different places?*

R - Yeah, this is a good question. And I do see that there may be some struggles that we are experiencing. How we encourage is that we, of course, have our team meeting on a bi-weekly basis where everyone has a chance to talk about different questions and discuss some other important things, common topics and so on. But on the like day to day basis I think that the communication mostly is happening inside one country where employees are in one physical location and they talk constantly with each other in their respective offices. So, this is how it's mainly happening. But, um. Yeah. How do I encourage. Well, I am always encouraging by asking questions about if they need some help and see that if they have some issues and some things that we need to address and ask for some advice to do certain things. I know that maybe if we talk about maybe some cultural aspects might be an obstacle for this internal communication because Baltic people are quite cold and independent.

I - *Have there been any changes in these practices after the quarantine because of COVID-19? If yes, what were the changes?*

R - I don't know. It's hard for me to say because I reach out to everyone on a bi-weekly basis and more often even now, just because to check how the person is doing and understand the struggles they are currently facing. I think that maybe in some cases there could be even more communication and those individual consultations because you are really like on your own at home, this is because you miss the opportunity to ask physically while you sit together with your colleagues in the office. Also, you have still some other tasks and work to do but when you are in office, you concentrate only on work related tasks. You maybe sometimes don't ask only your team members in this virtual team but ask someone who has some experience with a task. But here you'll have to ask someone outside the team, and I know in some cases there is even more consultations needed. This is also quite individual. But of course, I would say there is very limited impact due to COVID 19. Overall, there is more communication and consultations than usual between the team members.

I - *Have there been any changes in these practices after the quarantine because of COVID-19? If yes, what were the changes?*

R - I think that it's not really. I think what has changed is the way that we work. And I mean, now we have all those flexible hours to work, maybe we started to plan our work differently, but the amount of work did not change for us. And I think we're working exactly as we did before. Interestingly, we have more tasks now, I see that the team is performing as usual. There are no issues. So, we will continue working the same way as we are working now. Also, I know that some people started to work maybe in different hours more in the evening or more early mornings, depending on the family situation as well. So, I have not noticed that we'll maybe have any changes in the work practices.

I - *What are the ways to keeping your employees motivated?*

R - I think, from organization perspective, we have stock bonuses, salaries review which happens every year. These are the things we use for motivating our employees financially.

I – *Do you think face-to-face meetings are more productive than virtual? If so, what can be the reasons behind it?*

R – During the face-to-face meetings, personal communication can be more effective, because when you are having a meeting on site, then you are really into this meeting with focus. This doesn't allow the multitasking on different tasks which is quite usual during virtual meetings. This is the main reason why I support face-to-face meetings more. Also, in face to face meetings there is an opportunity to get instant feedback with verbal and non-verbal means of communication. But I guess that depending on the size and purpose of the meeting, virtual meetings can be also more productive.

I – *Thank you for your time in answering all my questions!*

R- Thank you. Have a nice weekend. Bye!

Appendix 5: Interview with manager below 20 employees

I: Hi! Thank you for helping with my thesis and accepting this interview. So, first of all, I will go over on what my study is focusing on and what will this interview contribute in.

I: So, my thesis is researching relationship of knowledge sharing and virtual teams on employee productivity. I decided to do the study in this unit since it is highly decentralized, and knowledge driven. This interview would help me to understand different methods that the team managers use to improve internal knowledge sharing and increasing the relationship between the members of virtual teams.

Q1: *What are the different knowledge sharing practices you use inside your team?*

R: When it comes to knowledge sharing, we have a weekly meeting that is only meant for internal discussion and knowledge sharing. That slot is usually made up about subjects and topics where people inside the team are trying collect input and trying to share knowledge. That is one kind of practice. Little bit more on less frequent topics is that every 6 months we try to get together in team for a full day session where everyone has a slot to present a topic, so everyone sees what each person is working on. Those would be the primary ones. We also have some product demos for a large application where one of our product managers every second week he comes into the meeting and tells what they have been developing during the time.

I: Q2: Thank you, having many knowledge sharing processes is good. *Second question would be on how long would an average new employee become independent, considering the factors of up-to-date documentation and personal consultation?*

R: Fully independent would take some time. This would vary a lot from one person to another person. I guess this would vary from few weeks up to couple of months. Onboarding a new person must be done with different parameters on who they are and what area do they come from. Second, what topic should they be working on. If they

were to cover the full scope of the team then it would take probably a few years. IF we limit the scope, it would be around 3-4 months. I wouldn't say it was black or white. As soon as someone becomes independent, it is my task to challenge them for a more demanding task. This would keep them more motivated and developing.

I: Q3: This end would be a good to introduction for the next question. *So, how do you keep you're the core skills of your team developing and how do you encourage the team members in developing?*

R: We have this performance development program which is a chance and possibility for the employees to grow. What I have learned as a manager is that the best way to keep people happy is by challenging them in perfect level. If you overchallenge someone then they might have a hard time and the task can become difficult. However, if you underchallenge someone then the work becomes dull and boring, right? So that is kind of my challenge as a manager to keep the challenge level in the sweet spot for the employee where they feel that they are still learning, and they are getting new skills. I think to stay on the same level is bad since what is actually happening is that everyone else are developing, you're declining in a relative sense. So, we have the performance developing and have a yearly target. I also have regular meetings regarding the developing every quarter to make sure that the employees are indeed following the developing process and follow up the results. I try to get them to step in and encourage them to take the lead on things and I try to delegate for them as much as possible. Try to have them feel motivated and part of the solution in driving the topics. I think these are at least a few major ideas from the top of my head. But I think it is a really good question and I think it is part of every manager struggle.

I: Q4: That is true, every manager should be closely related to their employee's development. *Now, moving ahead from knowledge sharing topics to managing virtual teams. How do you encourage communication in your team, especially when most of the team is scattered in different locations?*

R: Well, we have Skype of course and that is one way. We also have bunch of guidelines on how we should behave. That is a team principle that we go through every six months. That is a reminder on how the team should behave online and how you should treat others. And then… can you repeat the question, so I don't get too far off track.

I: *Maybe I'll specify that how do you keep your team members cohesive. That they feel free to talk or ask help if anyone in the team has questions and so on.*

R: Ah, well… I think that is a challenge in today's climate. I think it is hard. We try to live by the keywords of our company, and we've tried to translate this to what It means in our team. That if someone presents an idea, we should be open and try to understand it before we give criticism. We also have an idea that if we criticize something, you should already have a solution or a proposal on what would you do. Since it is easy to criticize and come with negativity however coming up with something productive is better for the organization. So uh, but I'm not really sure if that answers the question. We have a weekly meeting where everyone in the team goes around for couple of minutes and present their main topics. And when they do that I try to find the coupling within the team and if someone works on this but is unclear on what they should do with x, y, z, and when I hear that, I can connect them with someone inside the team. I will forward them to talk to that person because he/she has already been working on it. Then I try to find the connections inside the team and try to connect people to keep them from working alone in some kind of private little task. I guess that is one way. As a manager, it is important for me to keep track of what people are doing so I can understand on who needs to talk to who and when. We also have virtual water cooler conversations that allow to speak on off topic work related things. However, we don't have much of them, but I've noticed that they the relationships between team members.

I: Q3. I agree with you, knowing what team is working on is important in keeping track of the productivity. So, furthermore to virtual communication practices. *After the rise of COVID-19, has anything changed?*

R: A lot of changed. Especially in the offices, people used to be together. We are still located in different physical locations but a lot of us are in the same location. So now it has been even more challenging I think that people are mixing working time with office hours and computer is always standing in the kitchen. So, after working hours when people should be with their families, it is hard to keep from working when people are always seeing their laptop. So, it is easy to start working and sending e-mails. I guess that is okay for short time period, but I really am longing for the situation become more normal again. I am seeing some positive signs on that, but I think that would be very nice. It has worked very good for us, we have had some technical hiccups but on an overall level we have done great. I wouldn't want this situation to be permanent.

I: Q4. For the next question. *In addition, in keeping your employees challenged with different tasks, what are the other ways of motivating them?*

R: To talk about the future and what I see coming ahead, for our team, what I see as a potential next step. I try to talk to them about that on where they see themselves in couple of years' times. I also talk about the division for the team and different objectives inside the team and where I kind of see the organization going. Another aspect is of course talking about the education, both externally and internally. Right now, we don't have very much physical education but that is going to be in going forward and I think this is one of the things that has mattered for different team members. So that employee can go out in the office, learn something new and bring the knowledge back. When it comes to benefit and such types of things, I think it can definitely be motivation to some level. But studies have shown that if you reach certain level, the margin value decreases. But that is of course also interesting for an employee. That is couple of topics at least, I hope that keeps you motivated.

I: Q5: *So last but not least, do you think face to face meetings tend to be more productive than comparing to virtual meetings?*

R: Well, I feel that if I am presenting something – an idea or topic that I have worked on for a while. If I present that for 10 people who are sitting in the same room as I am, then

I can see on how they react through the message and I can follow their faces and their reactions. On skype that is a bit harder. You usually have 90% of the people muted and couple of people speaking at the same time. So, I think that is a major challenge in virtual meetings are to understand on how well the message has been communicated and how well have the people understanding message. But on the same time, if virtual meetings are done in smaller groups of people and you get them react and presenting the screen at the same time is working great. I wouldn't say that one of them are more productive, it all depends on the situation. I guess it depends on the topic and what kind of the meeting it is.

I: Hmm, that is true. But this is it from my side. Is there anything you would like to add regarding these questions?

R: Hmm… I cannot think about anything certain currently. I think it a challenging time for a lot of organizations and I think as an organization, we have dealt well with these challenges, especially the coronavirus problem. I am happy with what we have done and what the team has done, and I am waiting things to normalize.

I: Okay, I guess this is it for now. Thank you for helping me with this interview, it has been a great input. Thank you!

R: It's been my pleasure. Thank you and goodbye!

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