Impact of individual virtual competence on work outcomes in virtual IT projects

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Acknowledgments

Abstract

As the world becomes more globalized and information technology develops more rapidly, companies are increasingly exploring the benefits of using virtual teams to work on projects that allow them to achieve their objectives. This phenomenon though keeps raising questions regarding the best practices in selection and management of employees whose work would be mostly conducted in virtual settings instead of traditional co-located teams. We have investigated the conditions of virtuality, identifying its benefits and challenges and came up to a conclusion that in order to be an effective virtual team member, a special set of skills and abilities may be needed.

The central question of this study is:

What individual knowledge, skills, and abilities (KSAs) that comprise virtual competence (IVC) should the virtual project team members possess, which could contribute to overcoming challenges of virtual environment?

To answer this question a variety of theories on a virtual team, professional competencies, team management and project management were examined. Quantitative research has been utilized to measure the relationship between conceptualised construct of individual virtual competence and individual work outcomes in a project that is conducted by distributed global teams. Data on the skills of the individuals conducting their work in virtual IT project settings were collected with an online survey which was distributed among the chosen sample. The results of the survey indicated that the most important characteristics that contribute to overcoming challenges of virtuality are self-efficacy, social, and media skills, which also have a positive reflection on the individual work performance and job satisfaction. There are also interesting results regarding the effect of demographic characteristics on variables when compared with the results from the similar study conducted with a different group of respondents. In the end, a revised model of individual virtual competence is proposed that can shed some light on its impact on job performance and job satisfaction of an individual working in virtual project teams.

Keywords: Virtual Teams, Management, Project Management, Success Factors, IT, Virtual Competence, Global Virtual Teams

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Abbreviations

ICT	Information and Communication Technologies
IPMA	International Project Management Association
IT	Information Technology
IVC	Individual virtual competence
PM	Project Management
PMI	Project Management Institute
SD	Standard deviation
VIS	Virtual intercultural skill
VMS	Virtual media skill
VSE	Virtual self-efficacy
VSS	Virtual social skill

1.Introduction

Project management nowadays is a rapidly developing discipline, attracting more and more attention from both the professional community and academic researchers (PMI, 2016). According to Jugdev & Mathur (2006, p. 604), Project Management brings competitive advantages to companies to thrive in the modern rapidly changing world and could be considered as an asset to a company. A project is defined as "a temporary endeavour undertaken to create a unique product, service, or result" (PMI, 2008).

In a modern world, an advancement of technologies along with globalization has opened an opportunity to execute projects in virtual settings across time, cultures and geographical boundaries (Eberlin, 2008, p. 29). Filev (2013, p. 1) states, that today 83 percent of employees in organizations are working virtually and organizations are becoming more global. The project teams do no longer work within one office or in one country, they become more spread in terms of geographical location, and academic literature provides evidence that virtual projects surpass traditional projects in achieving goals within limited resources (Apulu & Latham, 2011, p.3). According to Duarte & Snyder (2006, p. 148), organizations which could leverage the opportunities of virtual teamwork increase the efficiency and achieve better results.

Raisinghani et al. (2010, p.1) claim that an interest in virtual project management will be growing in the upcoming years due to increasing globalisation, magnified by the cost of travelling, acceleration of processes and higher expectations for project outcomes, which emphasizes the relevance of the current research.

Lipnack & Stamps (2000, p. 18) define a virtual team as: "A group of people who work interdependently with a shared purpose across space, time, and organisation boundaries using technology". Garcia et al. (2010, p.430) state that virtual project management is project management of dispersed team through information technology (IT) to communicate and exchange information with team members and manage stakeholders. The complexity of virtual project management increases because of "*problems of linguistic differences, geographical dispersion, different time zones and the cultural diversity of the team members*" (Garcia et al., 2010, p. 430)

Traditional and virtual teams are similar in many ways, though the main differences are that team members in traditional teams are located at the same place and work face-to-face, while collaboration among virtual project team members mainly takes place through the use of electronic communication technologies (Lipnack & Stamps, 2000, p. 24).

Although virtual project teams present many advantages to organisations, there is a number of challenges stemming from working virtually. The majority of researchers discussed challenges that result from three core aspects of virtuality, which are the geographic dispersion, technology use, and cultural differences (Schulze & Krumm, 2017, p.69; Scott & Wildman, 2015, p.28; Garcia et al., 2010, p. 430; Kayworth & Leidner, 2000). The negative impact of team virtuality is most commonly studied in regards to team communication, trust and conflicts, which in a long run affect the overall performance and functioning of a team.

One potential way to address the challenges resulting from the aspects of virtual settings is by considering individual characteristics of team members as the leverage for effective team work (Krumm et al., 2013, p.34). Given the novelty of virtual project settings, gaps in approaching these settings need to be addressed on an individual level no less than on organisational level. Individual characteristics of employees play a crucial role in virtual projects in determining the team performance (Schulze & Krumm, 2017, p.1). In their study, Hoegl and Gemuenden (2001, p.438) stress that success of a team that comes from outstanding team performance impacts the overall project success, making skills, knowledge, and abilities of every team member extremely valuable in their contribution to the overall company success. Therefore, as virtuality results in challenges in the work of global distributed teams, the individual characteristics that can minimise the effect of these challenges, require special research attention (Wang & Haggerty, 2011, p.300).

By taking into consideration all the factors mentioned above, we suggest that virtual team members working in project settings need to acquire specific "virtual" competence to be more productive and satisfied and to ensure successful project team performance and the overall project success. Following this concept, by establishing standards for selection of team members and focusing on their development, organisations can contribute to the successful performance of virtual project teams that would be in line with organisational goals.

The main aim of this degree project is to enhance the knowledge in the area of virtual project teams by exploring and explaining skills, knowledge, and abilities of team members that are related to working virtually while providing additional information about the topic. We investigate the existing literature on this topic and identify a set of competencies that could help overcome issues existing in global virtual project teams.

Many studies about virtual teams discuss the concept of virtuality as an input (e.g. Peñarroja et al, 2013, p.967) or a moderator (e.g. Andressen et al., 2012, p.68), but very little has been investigated on the specific skills, knowledge, and abilities that should be developed by an individual to minimise the negative effects of this concept (Gilson et al., 2015, p.1317; Schulze & Krumm, 2017, p.84). Moreover, the existing body of knowledge that addresses KSAs of virtual team members is very heterogeneous in approaches: some studies investigate skills and knowledge required to overcome specific challenges (e.g. better developed cross-cultural skills contributing to successful communication in virtual team settings, Kayworth and Leidner, 2001), while others specified them in competency modelling approaches (Marković et al., 2015; Wang & Haggerty, 2011). The current study follows the later approach in determining the set of skills and abilities that would constitute to a construct of a virtual competence.

The research gap identified in the literature relates to the lack of research on the virtual competence of the project team working in IT field and its relation to the positive outcomes of the project (Wang & Haggerty, 2011, p.300). The reviewed literature was applying the concept of virtual competence to a broader range of industries and work contexts, but not to virtual teams working on IT projects.

Therefore, the research question of our study is the following:

What individual knowledge, skills, and abilities (KSAs) that comprise virtual competence (IVC) should the virtual project team members possess, which could contribute to overcoming challenges of virtual environment?

The corresponding objectives of this study are:

- To enhance the knowledge in the area of virtual project teams by exploring and explaining the individual skills, knowledge, and abilities of team members that are related to working virtually.

- To identify what kind of impact does individual virtual competence have on work outcomes in the global virtual IT project environment and to provide suggestions to project managers working with global virtual teams based on the findings.

Project team members who have experience working in virtual settings will be the subject of our research. They will be approached and asked to participate in the survey to provide the data for conducting the further analysis. In order to receive more comparable results, the research will focus on the people in one specific industry, namely Information Technology industry. Previously, the majority of virtual teams studied have been composed primarily of knowledge-intensive workers without any focus on specific industries or sectors (Gilson et al., 2014, p.1323; Connaughton & Shuffler, 2007, p.388). As specific industries might have a higher degree of virtuality and more contact with clients and team members from different cultures, we expect the chosen industry to satisfy both of these important criteria to ensure validity of the study. In addition, our work background in IT field could help getting the access to the wider pool of participants in the study. The research's focus on one industry will increase the homogeneity of the data but could provide valuable insights that could be further applied and validated in other industries.

We expect the results of this study to be significant in drawing suggestions for project managers and human resource specialists. The viewpoint in understanding differences in individual work outcomes will be provided and insights on how to leverage the development of individuals' capabilities to improve work outcomes will be given. In addition, the study contributes to the existing knowledge in the field of project management in virtual settings by expanding the understanding of individual KSAs and their contribution to the performance and satisfaction of an individual.

1.1. Structure of the study

Chapter 1: *Introduction* - The chapter describes the background of the study by emphasizing the relevance of the research in project management discipline in general and urgency of studying virtual teams in particular. It discusses the research question, aim and objectives which guide the study. It also provides argumentation why IT industry was chosen as a targeted research industry along with considering possible further practical and theoretical implications.

Chapter 2: *Methodology* - The chapter discusses various methodological approaches to conduct a research and provides argumentation for the chosen objectivist ontological stance and the positivist epistemological stance along with the consequent deductive research approach and the quantitative research method.

Chapter 3: *Theoretical framework* - The chapter discovers concepts which surround and influence the virtual project work. First of all, the chapter introduces the project management discipline in general, further project success is discussed as the ultimate goal of any project along with the role of team members in achieving project success; then the concept of virtual teams is introduced followed by the concepts of virtual project, virtuality and discussion about benefits and challenges of working in virtual project settings. Finally, the theoretical concept of a virtual competence, a modified conceptualized model of influence of the individual virtual competence on the individual work outcomes and formulated hypothesis are presented and discussed in the last part of the chapter.

Chapter 4: *Practical method* - The chapter discusses different research designs and provides argumentation for the chosen descriptive research design. It describes the questionnaire design, including the constructs from the academic literature which were the ground for building questions in the questionnaire. The chapter also describes the conducted pre-test, explains the chosen non-probability sampling technique and considers the ethics of the research.

Chapter 5: *Data analysis and findings* - The chapter describes the statistical analysis of the data gained through the questionnaire which was described in the previous chapter. It outlines the results of the measurement of Cronbach's Alpha, descriptive statistics and regression analysis which are the foundation for the discussion in the following chapter.

Chapter 6: *Discussion and conclusions* - In accordance with the results which were received in the previous chapter, this chapter elaborates on the findings and provides argumentation regarding their practical, theoretical and societal implication along with the discussion about the research credibility, its limitation and suggestions for further research.

2. Methodology

The chapter outlines the philosophical and methodological stances that underpin this research project. It starts with the discussion of ontological and epistemological choices, followed by the description and analysis of the research approach, research strategy, and research design.

2.1. Research philosophy

The research philosophy consists of the assumptions regarding the worldview of the researchers and defines the research strategy and research methods to deliver this strategy (Saunders et. al, 2009, p. 108). Saunders et al. (2009, p. 108) mention that research philosophy particularly reflects the relationships between knowledge and the way it has evolved along with a researcher's views on what is significant and valuable. O'Gorman & Macintosh (2014, p. 52-53) comment that it is essential for researchers to choose a philosophical stance of whether the external reality is objective and exists regardless of the perception of an individual or it exists only in one's mind, thus subjective in its nature.

The main idea of applying a research philosophy to a study is to consider different philosophical and strategic alternatives of how to develop a study and to choose the most suitable methodology (Johnson & Clark, 2006, cited in Saunders et. al, 2009, p. 108). Saunders et. al (2009, p. 109) argue that the choice of the most appropriate research methodology predominantly depends on the research question(s) of a study.

Two main considerations which constitute to a philosophical stance of a research are ontology and epistemology (Saunders et. al, 2009, p. 109). The following chapter discusses our philosophical stances that influence the research strategy and the research design of the present study.

2.1.1 Ontology

Saunders et. al (2009, p. 110) describe ontology as a philosophical study about the nature of reality. The core discussion of an ontological study is whether the social entities are objective entities, existing regardless of a social actor, or they should be considered as social entities which stem from perception and consequent actions of a social actor (Bryman & Bell, 2015, p.32; Saunders et. al, 2009, p. 110) and "cognitively constructed on an individual basis" (Long et. al, 2000, p. 190). Ontological assumptions could be divided into two fundamental categories: objectivism and subjectivism (O'Gorman & Macintosh, 2014, p. 56; Saunders et. al, 2009, p. 110), in the academic literature the second category is sometimes called constructionism (Bryman & Bell, 2015, p.32).

The subjectivism perspective implies that reality exists as an interpretation of a social actor and a nature of social phenomena is transformative (Bryman & Bell, 2015, p. 34; Saunders et. al, 2009, p. 111). Subjectivism considers reality as multiple because each individual has its own experience and perception of it (O'Gorman & Macintosh, 2014, p. 56). O'Gorman & Macintosh, (2014, p. 57) discuss vulnerability of an entirely subjective approach, pointing out that adherence to this approach requires some general

statements, in other words, it requires some objectivity, furthermore, we claim that some things in the world possess observable inherent characteristics which define them. Objectivism is a philosophical position, claiming that social entities exist externally to an individual's perceptions and actions (Saunders et. al, 2009, p. 110), they could be measured or tested even when a social actor does not observe them and "it is possible to establish and explain universal principles and facts through robust, replicable methods" (O'Gorman & Macintosh, 2014, p. 56-57). Diesing (1966, p.125) highlights that objectivists do not focus on the interpretations of the reality by social actors, the knowledge about them should be scrutinised and verified. Objectivists claim that scientific study should concentrate on solid methods, which examine observable facts rather than their meanings (Diesing, 1966, p.125).

While O'Gorman & Macintosh, (2014, p. 52-53) outline that once the philosophical stance is chosen a researcher should remain within it, otherwise ambiguity in a philosophical stance could lead to dualism and contradiction, there is an alternative view on the approach to research philosophy, stating that choosing and strictly staying within one or another position is unrealistic (Saunders et. al, 2009, p. 109) and "one's orientation toward research can rarely be confined to only one category, and in fact could vary over time" (Long et. al, 2000, p. 192).

In the current research we refer to an existing virtual competence model, explored in the study of Wang & Haggerty (2011, p.302). As the result of the thorough literature review the fourth dimension of virtual competence, namely virtual intercultural skills, was added. The present research aims at revealing interdependencies among virtual competence of virtual project team members and individual performance of virtual team members within the context of IT companies. Since we want to quantify and measure the impact of independent variables of individual virtual competences on dependent variables of individual work performance and individual work satisfaction through statistical methods and we do not take into account interpretation of the phenomenon, our ontological position is objective. Although our dependent variables, which are perceived individual work performance and perceived individual work satisfaction, could be considered as relative to the subjectivist perspective, we test the existing conceptual model and we believe that the construct of individual virtual competence has some impact on individual outcomes; therefore, the distinct virtual competence exists as an objective phenomenon. The objectivist ontological position allows incorporating our final virtual individual competence model of virtual project team members of IT projects into a broader context. Moreover, the objectivist position provides a better perspective in order to answer the research question of the study more accurately and to identify common patterns in the studied phenomenon.

2.1.2 Epistemology

Epistemological assumptions relate to ontological assumptions and consider the theory of knowledge, particularly what knowledge could be regarded as justifiable in a particular research field (Bryman & Bell, 2015, p. 26; Saunders et al., 2009, p. 112). Long et al. (2000, p. 190) add to the discussion of epistemology, outlining that it deals with the basis of knowledge and the way it can be conveyed to others. One of the core issues raising debates around epistemology is whether the social sciences and natural sciences should be studied in the same manner (Bryman & Bell, 2015, p. 28). There are two opposite approaches to deal with this issue, namely positivism and interpretivism

(O'Gorman & Macintosh, 2014, p. 60), besides these two approaches authors highlight such epistemological standpoints as realism (O'Gorman & Macintosh, 2014, p. 61; Saunders et al., 2009, p. 114-115) and action research (unified term for several research approaches aiming at changing the studied situation) (O'Gorman & Macintosh, 2014, p.63).

The interpretivist approach declares that research methodologies in natural and social sciences differ (Bryman & Bell, 2015, p.28). Rather than examine factors which influence human action, interpretivism aims at understanding human behaviour through studying the subjects of social science (Bryman & Bell, 2015, p.28). Interpretivism explores the complexity of social phenomena through an interpretive understanding of a social actor (Bryman & Bell, 2015, p.28; O'Gorman & Macintosh, 2014, p. 65). This approach considers various realities originated in distinct perceptions of individuals, the context of the phenomenon and its understanding by the observer along with the interrelationships between the researcher and the researched subject (O'Gorman & Macintosh, 2014, p. 65).

The positivist approach is traditionally assigned to natural science research (Saunders et al., 2009, p. 113). From the positivist perspective, researchers focus on facts rather than perceptions and interpretations, and "such facts are consistent with the notion of 'observable social reality" and the approach is applicable to social science likewise researchers use it in natural science (Saunders et al., 2009, p. 113). O'Gorman and Macintosh (2014, p.60) admit that there are three assumptions regarding the positivist approach in social science:

- the same methodology which is used for natural science could be applied to research in social science
- the results of the research in social science will reflect the relationships among phenomena
- the results of social research are objective.

A researcher is considered to be external to the data gathering process and independent from the process and the results of the research. A researcher does not affect and is not affected by the researched subject (Saunders et al., 2009, p. 114). According to Saunders et al. (2009, p. 113), adepts of the positivist approach use credible observable data and through testing the hypotheses, which frequently ground on the existing theories, then confirm or reject the hypotheses, thus contributing to the further knowledge development.

The realism position argues that the reality exists independently of the human perception (Saunders et. al, 2009, p. 114). Bryman and Bell (2015, p.29) highlight two similarities between realism and positivism. First of all, both approaches consider reality as external to researcher's perceptions (Bryman & Bell, 2015, p.29). Secondly, these approaches assume that a method to collect and analyse data for both natural and social science could be the same (Bryman & Bell, 2015, p.29). However, the main distinction between realism and positivism is that positivists believe their perception of reality accurately reflects reality, while realists consider their perception of reality as the way to comprehend the reality (Bryman & Bell, 2015, p.29). Saunders et. al (2009, p. 114) distinguish direct realism and critical realism. Direct realism claims that our perception of the world accurately reflects reality, while critical realism argues that our

perceptions of the things are not necessarily the things as they are (Saunders et. al, 2009, p. 115). O'Gorman and Macintosh, (2014, p. 61) discuss that there is objective reality external to the researchers and the researchers are able to understand the reality within the constraint of their perceptions.

We intend to test existing theory regarding the impact of individual virtual competence on individual performance and satisfaction, therefore the positivist approach is applied to the current research. We assume, that their beliefs and values, as well as data gathering and analysis processes, do not influence the results of the study. Following the positivists approach, we believe that the theory could be tested by gathering quantitative data through statistical data analysis using and further generalisations. We do not intend to investigate a social phenomenon and its interpretations and to build a theory based on the observations, therefore the interpretivist approach is not applicable to the current study. The reality is assumed to be external, thus, the realist approach is not appropriate for the current study.

2.2. Research approach

Research approach reflects which role a theory plays in a research (Bryman & Bell, 2015, p. 23). There are three main approaches to conduct a research, namely deductive, inductive (Burns & Burns, 2009, p. 35; Saunders et al., 2009, p. 113) and the third abductive approach, which researchers have started to apply more frequently especially in the field of social science (Mingers, 2012, p. 860). Traditionally deductive approach is linked to the positivist position and inductive approach refers to the interpretivist stance (Burns & Burns, 2009, p. 36), though recently academic scholars consider this strict connection oversimplified (Saunders et al., 2009, p. 124). The deduction is a scientific approach which is dominantly applied for natural science studies and aims at testing and developing the existing theories (Saunders et al., 2009, p. 124). Therefore, a solid ground in a particular research field is required to build the further hypotheses (Saunders et al., 2009, p. 125). Basically, the deductive approach could be presented in five-steps strategy: based on an existing theory hypotheses are built to test the relationships among two or more variables; the presumed relationships among concept and terms are set; the hypotheses are tested and either accepted or rejected and the initial theory is modified if necessary based on the results of the analysis (Robson, 2002, cited in Saunders et al., 2009, p. 124-125). Generally, the quantitative research design is used with deductive approach, when quantitative data is collected and then statistically measured (Bryman, 2015, p.25). Though the deductive approach allows "to think precisely, to evaluate information, and to apply logical analysis at a very high level" (Burns & Burns, 2009, p. 10), it is criticised for ignoring alternative explanations and even though new theories could be suggested as the result of deductive approach, "these would be within the limits set by the highly structured research design" (Saunders et al., 2009, p. 126).

Contrary to the deductive approach, the inductive approach aims at building a new theory based on the collected and analysed data (Burns & Burns, 2009, p. 25). The induction assists in exploring social phenomena by firstly observing them with subsequent analysis of data (Burns & Burns, 2009, p. 35). Following the data analysis, the inductive approach aims at producing a theory which will incorporate the meanings which social actors ascribe to the phenomena in a research context (Saunders et al., 2009, p. 127). It harmonises with qualitative research design when researchers choose

relatively small samples of data and analyse it using different qualitative techniques, taking into account a context where social phenomena take place (Saunders et al., 2009, p. 126). The inductive approach is used when research field has scarce data about a phenomenon and requires more comprehensive exploration of a problem (Saunders et al., 2009, p.127).

Bryman & Bell (2015, p. 23) discuss that differences between approaches are more diffuse in fact and the approaches overlap at some point, for instance, as the result of deductive approach findings are applied to a broader context of the existing theory, which reflects the inductive approach, at the same time the theory built as the result of the induction could be additionally tested through further data collection and analysis. Thus, the third abductive approach is applied to research in social science and aims at combining both deductive and inductive approaches (Bryman & Bell, 2015, p. 27; Saunders et al., 2009, p.157). Mingers (2012, p. 860) outlines that the abductive approach allows exploring and explaining the phenomena which do not coincide with the existing theories through creativity and imagination. According to Mingers (2012, p. 860) the abductive approach aims at innovating and generating new ideas which are the main goals of scientific work.

For the current study the deduction was chosen as the most appropriate approach. The choice was determined by the research questions and derives from the objectivist ontological stance and the positivist epistemological stance. In accordance with the deductive approach, the study is grounded in the existing theory of individual virtual competence, which was modified as the result of thorough literature review. The constructs of individual virtual competence receive a significant attention from the scholars in the academic literature. We intend to test the existing model in a global virtual project environment, and after the thorough literature review, the fourth dimension of virtual intercultural skills, which was discussed in the academic literature as potentially substantial construct of individual virtual competence, was added to the initial model. The study aims at testing the revised existing theory in global virtual IT projects context, particularly its goal is to measure the impact of individual virtual competence on individual work outcomes in a virtual project environment, therefore the deductive approach is the most suitable for the present research.

2.3. Research Method

Data collection is crucial for administering a study. There are two main data collection methods: qualitative and quantitative; as the name suggests the former is more concerned with numerical data while the latter with words (Saunders et al., 2009, p.151). Both methods are utilised to collect data and draw conclusions regarding a specific sample, but these two methods are different in terms of their research philosophy and approach (Bryman & Bell, 2015, p. 37). The use of a quantitative method is more common when there is countable and quantifiable data available, while a qualitative method is more frequently used when detailed information is requested (Saunders et al., 2009, p.151). The goal of using a qualitative research is mainly to understand the motivation of the research subjects, reasons for social phenomena and detection of trends in opinions. On the contrast, the quantitative research allows testing hypotheses composed and verified from concepts in previous theory (Bryman & Bell, 2015, p. 161). According to Ghauri and Grønhaug (2010, p. 105) quantitative studies tend to focus on facts and reason, be result oriented, has controlled measurement, and

follow a logical approach, while qualitative studies are process oriented, mostly focus on respondent's viewpoint, and observation and measurement usually done in natural setting.

Following the objective ontology and the positivist epistemology tradition described above, we would be gathering primary data in the form of quantitative questionnaires in order to gain an understanding of how virtual competence of project team members in dispersed virtual teams affect their work outcomes. According to O'Gorman and MacIntosh (2015, p.155-156), quantitative studies have four common characteristics: they rely on positivist principles; systematic logic and linear path; hard data provided in the form of numbers; they usually verify or falsify a relationship or hypothesis proposed by researchers. The numeric data gathered will be used to conduct statistical tests to explore the relationship between the variables. The present study begins with a literature review that provided a foundation for the creation of hypotheses and establishing a research model. This deductive research approach implies the usage of the quantitative method (Bryman & Bell, 2015, p.37). In addition, statistical techniques will be assisting in quantifying the constructs so that the findings can be considered representative.

2.4. Literature selection

Saunders et. al, (2009, p. 75) suggest to plan a strategy for literature search by defining the parameters of the search, keywords and terms, databases and search bases and criteria to define credible and relevant literature sources. For the search of the relevant literature, it is necessary to define relevant concept and keywords (O'Gorman & Macintosh, 2014, p. 36). O'Gorman and Macintosh, (2014, p. 36) discuss that generally even after thorough literature search in a particular field, the results will probably not cover all the existing literature on the topic.

To find the most recent and relevant academic articles on virtual project teams and individual virtual competence first search engines accessible at the Umeå University's library in Umea, Sweden and Heriot-Watt University database in Edinburgh, UK and the last editions of recognisable highly-ranked project management journals, particularly International Journal of Project Management, Project Management Journal, International Journal of Managing Projects in Business were used. The search was conducted using the following keywords and their combinations: *global virtual team, global virtual project, virtuality, virtual competence, individual work outcomes, virtual KSA, project success, virtual project success, culture.* We also searched for the recent articles about virtual teams in the project environment and global projects on the websites of project management professional associations such as Project Management Institute and International Project Management Association. Databases such as SCOPUS, Web of Science, Google Scholar were accessed to search for the relevant articles and to verify their credibility. Webster and Watson (2002) suggest three approaches to find appropriate articles for the literature review, first, by searching for articles in leading journals, second, going backward and check the articles which are cited in this article, and finally, going forward and check in journal database the quantity of citations which are made to the present article in order to evaluate its scientific significance. Though it is important to remember that for some recent articles the number of further citations could be relatively low due to the duration of its

availability. Both forward and backward searching strategies were applied while searching for the credible academic literature for the current study.

3. Theoretical framework

In this chapter we will discuss the theoretical background of our study. We will start by reviewing what is project management, types projects and teams that exist. Then the focus will be on the virtual teams and projects specifically, determining their challenges and requirements for success. Finally, the notion of virtual competence will be reviewed, leading to the presentation of the conceptual model and hypotheses that are relevant to our study.

3.1. Projects and project management

Academic literature outlines that companies achieve their strategic goals, innovate and create value through projects (Gardiner, 2016, p. 1; Jamieson & Morris, 2004, p. 5). Effective and efficient project management could bring a competitive advantage to an organisation (Gardiner, 2016). Sedlmayer (2017, p. 1) states, that: "more than one-third of economic value added today is realised in projects". The projects are temporary in their nature, they have definite beginning and they end if the project objectives are reached, if it is obvious that the project cannot be accomplished or if the need in a project does not longer exist PMBOK (2013, p. 3). Project management allows organizations to introduce and appropriately manage changes, the number and complexity of projects are increasing which requires advanced project management skills, competencies and approaches, thus, an interest in the field will grow in the future (Sedlmayer, 2017, p. 1).

Development of informational technology has shaped the approaches to project management and enabled execution of projects globally in virtual teams. Such modern modes of communication as videoconferencing, instant messaging and chats, emails, file transfers, groupware are available to support exchange of information during the project execution (Thissen et al.,2007, p. 30). Eberlein (2008) explains, that due to increased globalisation and competition, companies have to integrate their business processes, which leads to changes in approaches to project management and compels dispersed project teams to cope with challenges of operating in international environment (Eberlein, 2008, p. 29).

3.2. Project success

In the recent years, the failure rate of the projects declined, though 49% of projects are still executed with delay, 43% of projects exceed initial budget and more than 30% of projects fail to meet company's goals and business objectives (PMI, 2017).

The achievement of project success is a prior responsibility of a project manager, though an academic literature lacks an accepted definition of project success (Cooke-Davies, 2002, p.1) Along with emergence and development of a project management discipline, there have been multiple attempts to find a reliable definition of project success (Ika, 2009, p.7). Defining of project success could be difficult for several reasons. Different group of stakeholders have diverse perceptions of what to consider a successful project (Pitno & Slevin, 1988, p. 69; Muller & Jugdev, 2012, p. 768), as the discrepancies in values, experiences and expectations regarding project outcomes could cause conflicting perceptions of project success among project stakeholders (Rad, 2003, p. 23). For instance, a client is more concerned if project outcomes meet objectives and

requirements (Rad, 2003, p.25), and a project is evaluated based on the successful achievement of the results (Shatz, 2006, p. 98). From a project team perspective, while evaluating project success, the means how the project objectives are achieved sometimes become more important (Rad, 2003, p. 24). Table 1 outlines the main dimensions of project success which are considered by different scholars in the academic literature.

Table 1: Project success criteria developed by the authors

Author	Project success criteria
Al-Tmeemy et al., (2011)	Project management success (cost, time, scope)
	Product success
	Market success
Atkinson, (1999)	Project management success (cost, time quality, efficiency)
	Benefits for the company
	Benefits for stakeholders
Cooke-Davies, (2002)	Project management success (cost, time, scope)
	Project success
	Corporate success
	Team success
Ika, (2009)	Project management success
	Project, portfolio, program success
Muller & Jugdev, (2012)	Project success
	Organisational success
	Team success
Pitno & Slevin, (1988)	Project success (time, cost, scope)
	Client satisfaction
Rad, (2003)	Scope, quality, time, cost
	Client satisfaction
	Team satisfaction
Shatz, (2006)	Time, cost, scope
	Stakeholders' satisfaction
	Team satisfaction
Shenhar et al., (2001)	Project efficiency (time and cost)
	Impact on the customer (product quality, customer satisfaction etc.)
	Business success (market share, profit)
	Preparing for the future (innovation)

Traditionally, project success was measured in terms of three dimensions of scope, time and budget, so-called "golden triangle" (Atkinson, 1999, p. 338). Ika, (2009, p.14) argues that dominance of a "golden triangle" is more typical for project success measuring in engineering, construction and information technology industries, while "softer" industries and public sector shift to a more complex definition of project success and pay more attention to portfolio and program success. Academic literature then discovers 'golden triangle' of time, cost and budget as parts of project management success and distinguishes it from project success (Al-Tmeemy et al., 2011; Atkinson, 1999; Cooke-Davies, T., 2002; Ika, 2009; Muller & Jugdev, 2012; Pinkerton, 2003).

Further project success model development led to incorporating other dimensions of project success such as product success, including customer satisfaction and fulfilment of the necessary technical and functional requirement, market success, which embraces increasing of the market share, establishing a good reputation for the company, contributing to the achievement of the company strategy and gaining competitive advantage along with preparing for the future by creating a new product, technology or market through project. (Al-Tmeemy et al., 2011, p.346; Shenhar et al., 2001, p. 712). Muller and Jugdev, (2012) outline that project success measurement criteria include an impact of the project outcomes on a customer and benefits a project brings to an organisation. Project Management Institute considers a project's contribution to a company's strategy as a part of project success (PMI, 2017).

Dimensions of time, cost and scope are short-term aspects of project success. Evaluation of customer satisfaction or alignment of a project to company strategy might require longer time frame (Collins & Baccarini, 2004, p.3). Turner and Zolin (2012) support this idea, stating that project stakeholders could judge regarding project success or failure only after six months or a year after the project implementation (Turner & Zolin, 2012, p.88). Atkinson (1999) in his evaluation of project success refers to the three stages of a project. The first stage is a delivery stage and at this stage project management success is more important, thus project success is measured based on "golden triangle of time, cost and scope Atkinson (1999, p. 339). Two following stages are post-delivery stages and the project success should be appraised by the benefits a project brings to a company on the second stage and the value which a project creates to a wider range of stakeholders (for example, customers, community) on the third stage respectively Atkinson (1999, p. 339).

In more recent academic literature such dimension of project success as team success is emerging more and more frequently (Cooke-Davies, 2002, p. 5; Hoegl & Gemuenden, 2001; Muller & Jugdev, 2012, p. 768; Müller & Turner, 2007, p. 307; Shatz, 2006, p. 2). Hoegl & Gemuenden, (2001, p.438) highlight that team success has an important impact on overall project success. The authors provide a model of a team success, stating that it could be measured by team performance and team satisfaction (Hoegl & Gemuenden, 2001, p.439). Team performance embraces team effectiveness and team efficiency, while team satisfaction reflects satisfaction from the project work and possibility to gain new knowledge and skills (Hoegl & Gemuenden, 2001, p.439). According to Armstrong, (2007, p. 84), performance generally relates to the accomplishment of goals and achievement of desirable outputs. Herzog (2001, p.30) in his study on collaborative project teams highlights that satisfaction of all stakeholders, including users and project team, is essential for measuring project success and managers should consider skills and competencies of team members to achieve project success. Müller and Turner (2007, p.307) believe that project team members satisfaction, which is based on their work experience on a project and fulfilment of their needs in the result, is a necessary criterion to measure project success and simultaneously, an influential factor leading to project success. Ebrahim et. al, (2009) state that self-management competencies of virtual team members, for instance, self-motivation and self-regulation, become fundamental factors for a success of virtual projects due to a dissimilar level of managerial control comparing to collocated teams.

There is a gap in the academic literature on what to consider a virtual project success, and filling this research gap is beyond the scope of the current study. Therefore, for the

purpose of this study, models of success of traditional collocated project are considered to be applicable for measuring success in a virtual project.

As the study is focused on project teams and effective collaboration within them, we would be particularly interested in performance and satisfaction within teams as outcomes determining team success as a whole. Although, not much information in the literature is available on this topic, it is essential to know how team members evaluate project results and team work because their "inside views" could provide valuable suggestions for improvement in the future projects conducted in virtual settings.

3.3. Virtual teams

According to Prabhakar (2008, p. 5), project teams can be considered as one of the most important factors contributing to project success. IPMA Individual Competence Baselines (2015, p. 80) defines teams as: "groups of people working together to realise specific objective", stating that teams usually consist of professionals from different disciplines and the main goal of a team leader to establish smooth communication and cooperative team relationships. PMBOK (2013, p. 34) determines project teams as a group of individuals, which basically consist of project manager, project management staff and other project team members who work in collaboration to achieve project objectives. The Tuckman model (Tuckman, 1965) on team development, describing four stage such as forming, storming, norming and performing is considered one of the fundamental models for project team development.

The changes in the modern business environment have resulted in the emergence of virtual project teams which consist of global, multi-generational and multi-functional team members, who possess various skills and competencies (Carte et al., 2006, p. 324). Martins et al. (2004, p. 819) in the review of the literature on virtual teams, discover that currently almost all teams are virtual to a certain extent. Duarte and Snyder, (2006, p.300) highlight that development of informational technology allowed to leverage virtual teams to execute projects in various sectors, for example, construction and engineering, research and development, product development, software design and development and others. Virtual project teams work towards accomplishment of project goals despite geographical dispersion (Schumacher & Poehler, 2009, p.2205). In such teams, communication often occurs through technological tools (Carte et al., 2006, p.329; Hertel et. al, 2005, p.71; O'Neill et al., 2009, p.145) such as e-mail, instant messaging, text messages, conference calls, online meetings, and video conferencing (Lipnack & Stamps, 2000, p. 27).

Academic literature provides different definitions of virtual teams, though there are some similarities. According to IPMA Individual Competence Baselines (2015, p.71), a virtual team "consists of individuals who work across time zones, space and/or organisational boundaries. Lee-Kelley and Sankey (2008, p. 53) define virtual teams as "employee teams working together on projects from geographically distant locations, using electronic communication media". Ebrahim et al. (2009, p. 2655) contribute to the concept of virtual teams: 'small temporary groups of geographically, organisationally and/or time dispersed knowledge workers who coordinate their work predominantly with electronic information and communication technologies'. PMBOK (2013, p. 272) describes virtual teams as: "groups of people with a shared goal who fulfil their roles with little or no time spent meeting face to face", highlighting the main advantage to acquire appropriate project team members despite their geographical location. Webster

& Wong, (2008, p. 42) distinguish between virtual teams and semi-virtual or "hybrid teams". Virtual teams, from the authors' point of view, are teams with all the members dispersed in different locations, while in semi-virtual teams, part of a team is collocated and other team members work remotely (Webster & Wong, 2008, p. 42). White (2014, p. 111) formulates, that virtual teams exist when "more than one individual of a team perform his or her work from a remote location, different time zone or a different national culture than other team members". Synthesizing the above discussion regarding the main features of virtual teams, the Figure 1 which reflects the dimensions comprise the concept of virtual teams is presented below.
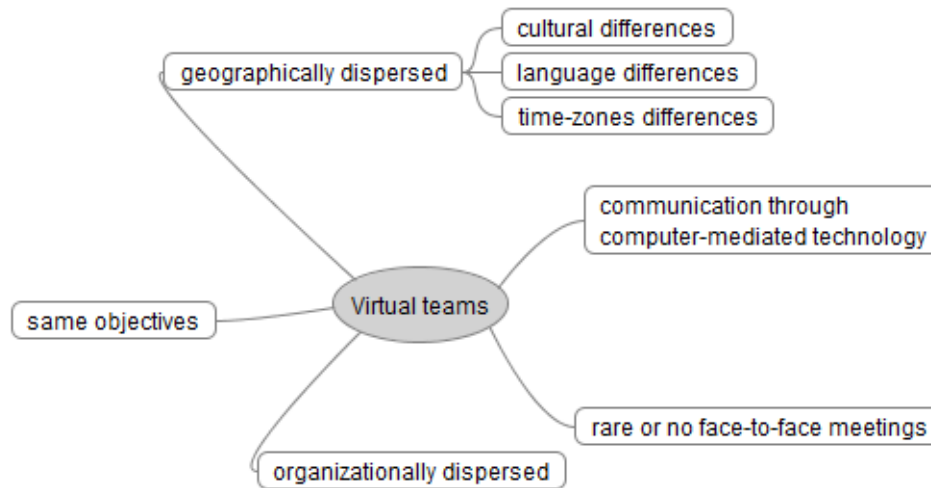
Figure 1: Concept of virtual teams (developed by the authors)

For the purpose of this study, virtual team is defined as a group of geographically or organisationally dispersed individuals, relying primarily on informational and telecommunication tools with limited or no face to face interactions and operating to achieve common objectives (Ebrahim et al., 2009, p.2655; Hertel et al., 2005, p. 71).

3.4. Virtual projects

Working in virtual teams is widely spread in a modern business environment. As Kerzner (2009, p. 352) claims that traditionally projects were executed by a collocated team when all team members could have face-to-face meetings in a conference room to examine the progress and current issues. Globalisation and development of technology have shaped the way projects are executed, adding more flexibility and complexity to the project work. (Carte et al., 2006, p. 323; Lipnack & Stamps, 2000, p. 27). Nowadays, the projects are becoming global and more complex and team members are located in different cities, countries or continents and communicate across geographical and cultural boundaries through the information and communication technology (Carte et al., 2006, p. 323).

Larson and Gray (2011, p. 533) distinguish four main types of projects: domestic (a project is executed in a resident country for a local company), overseas (a projected is executed abroad for a local company), foreign (a projected is executed abroad for a foreign company) and global (integrates professionals from different countries, continents and cultures to execute a project for a company). Binder et al. (2009, p. 1) explore virtual projects, categorising all projects into three groups: collocated, virtual and global projects. Table 2 summarise main characteristics of each group of projects.

Table 2. Characteristics of Global Projects (Binder et al., 2009, p. 2)

Characteristics	Co-located Projects	Virtual Projects (except global)	Global Projects
Locations	One	Many, in the same country	Many, in different countries
Native languages	Usually one	Usually one or few	Usually many
Time zones	One	Skewed working hours	Skewed or asynchronous working hours
Cultural differences	None or low	Medium	High
Organisations	One to many	One to many	Many

According to Binder et.al (2009, p.2), global virtual projects are executed in virtual settings, as members of project teams are located across geographical borders, cultures and organisations. Knight and Reed (2010, p.19) discover that project completion depends on the environment where a project is executed. The authors conduct a study of 150 information technology companies and conclude that virtual environment increases the possibility of issues with project completion (Knight & Reed, 2010, p. 27)

Virtual project management is the management of geographically dispersed virtual teams with the use of technology as a core for communicating, knowledge and information sharing (Leuthold et. al, 2012, p. 110). Martinic et. al (2012, p. 153) state, that although different approaches to project management exist there is no established methodology how to manage projects executed by virtual teams in a virtual environment. Traditional project management provides an effective set of tools to plan, control and monitor the implementation of the project, though it could be insufficient for managing virtual projects due to a higher level of their ambiguity (Martinic et. al., 2012, p. 153).

3.5. Benefits of working virtually

Many advantages are associated with virtual project work. First of all, for global or distributed projects, project organisations have an opportunity to hire talented and skilful professionals worldwide (Bergiel et. al, 2008, p.101; Filev, 2013, p.1; Gilson et al., 2015, p.1314). Virtual teams which are implemented and managed appropriately, could increase effectiveness and provide better customer service due to increase in the length of a workday and the speed of the response to a market (Ebrahim et al., 2009, p. 2655).

Working in virtual project teams also allows reducing travel and relocation costs, overhead costs related to using an office space, thus increasing profit margin for

organisations (Cascio, 2000, p. 81) At the same time, virtual teams are able to increase flexibility and benefit from diversity in terms of skills, knowledge and experience of team members (Schiopoiu Burlea, 2007, p. 115).

Virtual work could also have a significant impact on improving the environment through the reduction of pollution, energy cost and commuting traffic (Bailey & Kurland, 2002, p. 384). Society could also benefit from virtual work because this type of work allows hiring people from regions with high level of unemployment or undeveloped infrastructure thus contributing to the economic development of these regions (Krumm & Hertel, 2013, p. 80).

For virtual team members, a possibility to work virtually opens broader professional opportunities, reduces time and cost of travelling to the workplace, helps to sustain a work-life balance, providing greater flexibility and freedom, and overall increases motivation (Bergiel et. al, 2008; Cascio, 2000, p.81; Krumm & Hertel, 2013, p.80). A possibility to work virtually is particularly essential for people who have different types of constraints, for example, mobility limitation due to physical disabilities or family commitments.

3.6. Virtuality as a condition

As conventional teams tend to shift further towards operating virtually, it is very important to establish and define the concept of virtuality. In the existing body of literature two main approaches defining virtuality are present. According to the first one, virtual teams are contrasted with conventional teams (Takeuchi et al., 2013, p.18). The team in studies that focused on this approach has been classified in a dichotomous manner, which means it would be either virtual or co-located (Maznevski & Chudoba, 2000, p.474; Takeuchi et al., 2013, p.18). According to Schweitzer and Duxbury (2010), this way of treating virtuality is oversimplified (p.275).

The second approach considers teams to be located on the continuum of virtuality that would range from co-located teams to completely virtual (Martins et al., 2004, p. 807-808; Leenders et al., 2003, p.70; Gibson & Gibbs, 2006, p.452). Schweitzer and Duxbury (2010, p. 275) define team virtuality in terms of being "not a condition, but a degree: the greater the extent of each characteristic, the more virtual a team becomes'. This approach to virtuality is the most common in the recent literature (Kirkman & Mathieu, 2005, p.702; Leenders et al., 2003; O'Leary & Cummings, 2007, p. 434). Virtuality defines any team in terms of different dimensions such as, for example, the extent of reliance on technology-mediated communication to facilitate work processes (Kirkman & Mathieu, 2005, p.702). Except of the level of technology support, two more dimensions have been included in the framework of team virtuality, which are degree of time apart on task, and degree of physical distance, have been included in the framework of team virtuality (Kirkman & Mathieu, 2005, p. 706-708; O'Leary & Cummings, 2007, p. 435-439). Taking into account all the previous research, Hosseini et al. (2015, p.395) conceptualised virtuality of any team as "a holistic phenomenon that reflects to what degree deviations from face-to-face team conditions affect the quality of communications within the team in comparison to a face-to-face team."

Virtuality explains to what degree teams utilise technological advances to communicate with each other and coordinate their work activities (Kirkman & Mathieu, 2005, p. 702).

According to this approach, virtuality refers not only to a team's frequency of use of technology-mediated communications, but also to the informational value provided by the virtual technology, and synchronicity of communication (i.e., the richness of information exchange depends on the virtual media (Peñarroja et al, 2013, p.968; Schaubroeck, 2017, p.636). In this light, the poorer a medium is in terms of richness of communication, the higher the level of virtuality (Peñarroja et al, 2013, p.968;), which means that video conference would be considered as low in virtuality.

Although the amount of utilisation of virtual projects is constantly increasing, there are not many teams that consist of all members never meeting each other face-to-face and scattered on an individual level. Even in large-scale projects (e.g. the development of a new warship), with specialists located around the globe, co-located individuals are often doing chunks of work (Leenders et al, 2003, p.80). As the level of virtuality and virtual communication can differ between team settings and tasks, for the purpose of a current research, we consider globally distributed project teams that experience medium to high level of virtuality in their daily life due to large distances and lower budgets; and this leads to a higher dependence on communication tools (Verburg et al., 2013, p.69). It is in line with the definition provided by Martin et al. (2004, p. 808) which states that the technology can be used in various degrees and still be considered a virtual team.

Schulze and Krumm (2017, p.67) suggest that further research is needed to elaborate on challenges specific to the dimension of virtuality in order to reveal which knowledge, skills, abilities (KSAs) are required for virtual project teams to be efficient.

3.7. Challenges of working virtually

Negative aspects of virtuality occur in many companies that conduct project work. Acknowledging a great amount of research in the field of virtual teams, we outlined the problems associated with the aspects of virtuality and their impact on team work mediators and results, focusing primarily on meta-analyses and reviews of virtual collaboration. Nevertheless, given the insights received at this stage, we also carefully studied the related primary studies. An overview of the results is provided in Table 3.

One of the most recent meta-analyses have listed the effects of virtuality on virtual teams (Ortiz de Guinea et al., 2012). It showed that dimensions of virtuality adversely affect communication frequency, productivity, knowledge sharing, satisfaction and team conflict (Ortiz de Guinea et al., 2012, p.306). With regard to aspects of virtuality, in particular, the vast majority of research focuses on three major ones: the use of information and communication technology, cultural differences and geographical / temporal dispersion. Table 3 summarizes main academic studies which explore an impact of virtuality on different work factors in accordance with three dimensions of geographical, cultural and technological challenges.

3.7.1 Technology

Use of information and communication technology in project teams can be challenging with regard to effective communication (Jarvenpaa & Leidner, 1999, p. 811; Kuruppuarachchi, 2009, p. 31; Montoya-Weiss et al., 2001, p. 1252-1254); cohesion (Powell et al., 2004, p. 10; Hertel et al., 2005, p. 88), relationship building (Powell et al., 2004, p.10; Pauleen & Yoong, 2001, p.210); conflict management (Hinds & Bailey,

2003, p.617; Hertel et al., 2005, p. 77), coordination and information exchange (Powell et al., 2004, p.11), trust (Robey et al., 2000, p.53; Powell et al., 2004, p.10), and team identification (Curşeu et al., 2008, p. 638-639; Powell et al., 2004, p.17; Robey et al., 2000, p. 53; Scott & Wildman, 2015, p. 21; Hertel et al., 2005, p.86); and can adversely affect overall team performance (Kirkman & Mathieu, 2005, p. 709-711; Curşeu et al., 2008, p. 635-639).

Among challenges mentioned in relation to the use of technology in virtual teams, inappropriate task-technology fit (Powell et al., 2004, p.12), asynchronicity of communication (Espinosa et al., 2015, p.163) and loss of communication richness (Hertel et al., 2005, p.82; Schaubroeck & Yu, 2017, p.637). Kayworth and Leidner (2000, p.187) suggest that members of teams feel more satisfied and show better performance if they rely on a variety of technologies to accomplish required tasks. According to Espinosa, et al. (2006, p.349) ICTs include synchronous (e.g. video conferencing) and asynchronous (e.g. e-mail) communication technologies. There is a lack of consistency regarding the effect of different types of ICT. While some authors highlight that asynchronous communication can restrict the frequency of messages and increase uncertainty (Panteli & Fineman, 2005, p.349), others suggest that communicating with synchronous and asynchronous technologies is effective in reducing coordination issues when team members have intersecting working hours and that asynchronous communication allows teams to "exchange information more efficiently due to reduced interruptions" (Espinosa et al., 2015, p.163). Computer-mediated communication systems that are low in information richness diminish team's ability to plan its work, exchange ideas, and reach an agreement on issues (Kayworth & Leidner, 2000, p.186).

Table 3: Key virtuality aspects and their impact on team mediators associated with each aspect

Geographic dispersion		Cultural differences		Technology use	
Trust	Ebrahim et al. (2009); Saafein, & Shaykhian (2014); Zakaria et al. (2004)	Team relations	Lee-Kelley & Sankey (2008); Pauleen & Yoong (2001)	Communication	Jarvenpaa & Leidner (1999; Kuruppuarachchi (2009); Montoya-Weiss et al. (2001);
Team identification	Ebrahim et al. (2009);	Communication	Jarvenpaa & Leidner (1999); Kayworth & Leidner (2000); Barczak & McDonough (2003); Maznevski & Chudoba (2000); Scott &Wildman (2015)	Conflicts	Hinds & Bailey (2003);Hertel et al. (2005)
Conflict	Hinds & Bailey (2003); Scott & Wildman (2015);	Conflicts	Hinds & Bailey, 2003); Schaubroeck & Yu (2017); Scott & Wildman (2015); Gibson et al.(2014)	Coordination	Powell et al. (2004)
Performance	Hinds & Bailey (2003); Espinosa et al. (2015); Cramton & Webber (2005); Pauleen & Yoong (2001)	Team identification	Ebrahim et al. (2009); Au & Marks, (2012)	Trust	Robey et al. (2000); Powell et al. (2004)

Geographic dispersion		Cultural differences		Technology use	
Coordination	Herbsleb et al. (2000); Cramton & Webber (2005);	Cohesion	Gibson et al. (2014)	Information exchange	Powell et al. (2004)
Communication	Jarvenpaa & Leidner (1999); Herbsleb et al. (2000); Cramton & Webber (2005); Herbsleb & Mockus (2003); Scott &Wildman (2015); Lee-Kelley & Sankey (2008); Zakaria et al. (2004)	Team functioning	Pauleen & Yoong (2001); Barczak & McDonough (2003); Lee-Kelley & Sankey, (2008)	Cohesion	Powell et al. (2004); Hertel et al. (2005)
Motivation	Hertel et al. (2005)	Knowledge sharing	Klitmøller & Lauring (2013); Baba et al. (2004)	Team identification	Robey et al. (2000); Hertel et al. (2005); Curşeu et al., (2008); Powell et al., (2004); Scott & Wildman, (2015)
Team innovation	Gibson & Gibbs (2006)	Trust	Ebrahim et al. (2009);	Relationship building	Powell et al. (2004); Pauleen & Yoong (2001);
Knowledge sharing	Baba et al. (2004);	Coordination	Powell et al. (2004)	Team performance	Kirkman & Mathieu (2005); Curseu et al., (2008)
Cooperation	Metiu (2006)	Team innovation	Gibson & Gibbs (2006)		

3.7.2 Geographic dispersion.

The reviewed studies indicated that geographic dispersion can be a challenge for effective communication (Lee-Kelley & Sankey, 2008, p. 61; Zakaria et al., 2004, p. 16-18; Scott & Wildman, 2015, p.21; Jarvenpaa & Leidner, 1999, p. 793; Herbsleb et al., 2000, p. 320-321; Cramton & Webber, 2005, p.763; Herbsleb & Mockus, 2003, p. 491-493), trust development (Ebrahim et al., 2009, p. 2659-2660; Saafein, & Shaykhian, 2014, p.1; Zakaria et al., 2004, p. 22;), motivation (Hertel et al., 2005, p.84), conflict management (Hinds & Bailey, 2003, p.617; Scott & Wildman, 2015, p. 23-25), coordination (Herbsleb et al., 2000, p. 321-322; Cramton & Webber, 2005, p.763), relationship building (Pauleen & Yoong, 2001, 216-217; Gibson et al., 2014, p. 232-233), knowledge sharing (Baba et al., 2004, p. 575-577), team identification (Ebrahim et al., 2009, p. 2660), team innovation (Gibson & Gibbs, 2006, p.471), cooperation (Metiu, 2006, p.432), and team performance itself (Hinds & Bailey, 2003, p.626; Pauleen & Yoong, 2001, p.217; Espinosa et al., 2015, p.183; Cramton & Webber, 2005, p.762;).

A more detailed analysis of the geographical aspect showed difficulties in organizing effective work due to spatial and temporal dispersions. Spatial dispersion denotes "any physical dispersion of team members, such as different geographic locations or different workplaces at the same geographic location" (Martins et al., 2004, p.808), which can be complex in relation to coordination (Espinosa et al., 2015, p.156), increase diffusion of responsibility and dehumanization (Espinosa et al., 2015, p.157), and decrease the efficiency and effectiveness of communication (Yang et al., 2015, p.1466).

Spatial distribution that leads to cultural heterogeneity, also leads to the fact that the distributed team often has team members in different time zones. In support of this statement, Hosseini and Chileshe (2013, p.1105) note that virtual teams may experience temporal boundaries. Therefore, temporal dispersion refers to overlapping working hours and differences in time zones that team members must cross to cooperate with others remotely, which can lead to poor information availability, delays (Herbsleb & Mockus, 2003, p. 484), as well as coordination problems due to overlapping working time (Yang et al., 2015, p.1466). Different time zones can cause more difficulties for virtual teams than the physical distribution of team members (Espinosa et al., 2015, p.152). Physical location of team members in different time zones can lead to the fact that meetings are held outside normal hours of work. This can explain why, members of virtual teams often express a concern about "poor work-life balance" (Daim et al., 2012, p. 202). In fact, time distances contribute to delays in coordinating virtual teams and zero overlap in work time has been proved to have the most negative impact on it (Espinosa et al., 2015, p.181). Project leader's direct influence on team members' actions is very reduced due to the factor of geographical dispersion. Distributed virtual team members often do not feel obliged to adhere to their leaders' orders in the same way they would do while working in co-located teams (Hoegl & Muethel, 2016, p.8). In addition, silence or unexpected delays in replying tends to cause anxiety (Sarker & Sahay, 2002, p.8).

3.7.3 Culture

Finally, the review of articles and meta-analyses indicated that cultural differences can pose challenges to team communication (Jarvenpaa & Leidner, 1999, p.811; Kayworth & Leidner, 2000, p.192; Barczak & McDonough, 2003, p.17; Maznevski & Chudoba,

2000, p.474-476; Scott &Wildman, 2015, p.21), conflict management (Gibson et al., 2014, p. 230-232; Hinds & Bailey, 2003, p.617; Scott &Wildman, 2015, p. 23-25; Schaubroeck & Yu, 2017, p.639), team identification (Ebrahim et al., 2009, p. 2660; Au & Marks, 2012, p.283), trust creation (Ebrahim et al., 2009, p. 2660), coordination (Powell et al., 2004, p.17), knowledge sharing (Klitmøller & Lauring, 2013, p. 402-404; Baba et al., 2004, p. 573); team innovation (Gibson & Gibbs, 2006, p.472) the development of cohesion (Gibson et al., 2014, p. 230-231), and ultimately for effective team functioning (Lee-Kelley & Sankey, 2008, p.61; Pauleen & Yoong, 2001, p.218; Barczak & McDonough, 2003, p.18).

A closer look at the aspects of cultural differences reveals specific problems in the work of multicultural virtual teams due to (a) the diversity in values, norms, attitudes, and styles of working, (b) lack of good command of the common language, (c) ineffective intercultural communication, and (d) creation of subgroups. A variety of values, attitudes and norms orientations and conventions often lead to misunderstandings and conflicts among team members (Schulze & Krumm, 2017, p.71).

For example, in their review Gilson et al. (2015, p.1318) describe bigger preference for richer computer-mediated communication (i.e. videoconferencing) in some cultures (i.e., Brazil). Richer computer-mediated communication media is also considered important for effective sharing of equivocal knowledge in discussions where different positions exist (Klitmøller & Lauring, 2013, p. 403). Another example of differences in values, norms and attitudes is Asian team members hesitating to openly discuss potential problems, as they feel that it would reflect badly on them (Espinosa, 2006, p.355).

In addition, members of the virtual team need to overcome language differences within the team as they can become an obstacle to global cooperation, especially when the task is ambiguous and lacks visual cues (Schaubroeck & Yu, 2017, p.643). In the study of Espinosa (2006), language barriers resulted in time overrun, additional costs and efforts, and poor quality of the system in projects (p.355). Global project teams mostly comprise of team members that speak one common business language. However, even in such situation problems can arise. Even employees with good common language skills may interpret written and verbal communication through their cultural filters. Non-native speakers often experience difficulties in understanding subtle cues in the communication and read between the lines (Espinosa et al., 2006, p.355). This leads to a reduction in participation in a project of non-native speakers, longer waiting time for a reply and misunderstanding that all negatively affected team performance (Espinosa et al., 2006, p.355)

With regard to behaviour in the field of intercultural communication, the studies dealt with problems arising from different styles of communication across the world and from non-adaptive verbal communication. For example, Lee-Kelley and Sankey (2008, p.54) notes that email is not the preferred choice of communication for managers in such countries as Japan and Korea. Informal email and a largely egalitarian appeal to Western people contradicts the Confucian principle of respect for seniors and people with higher position in the workplace.

Lastly, as mentioned in the review by Gilson et al. (2015, p.1323) creation of subgroups based on cultural and language similarities, time zones, can emerge, which can lead to

implications on the work (O'Leary & Mortensen, 2010) and affect team effectiveness (e.g., Jarman, 2005).

Even though, there are obvious issues with the dimension of virtuality of cultural diversity, there is a stream of research supporting an idea of cultural diversity enriching the results of the project taking into account different points of view. For example, a difference in understanding tasks does not necessarily result in a conflict, but instead may lead to better and more innovative solutions (Stawnicza, 2015, p.24). Previous studies on cultural diversity in virtual teams identified that this diversity can be seen both as an impediment or an advantage (e.g. Krumm et al., 2013, p.1). Findings of Daim et al. (2012) suggest that "national differences tend to align themselves with the intrinsic cultural influences of the nationalities of the persons within the group" (p.203), therefore the views on the scale of how challenging cultural differences are not consistent (Han & Beyerlein, 2016, p.355). While globally distributed projects often have bigger complexity than co-located projects, they provide companies with greater benefits and opportunities for growth.

The current review further adds to the definition that teamwork in a virtual context faces challenges that are specific to the dimension of virtuality and, therefore, different selection and team members' development strategies would be needed. One potential way to address the challenges of geographic dispersion, cultural differences and technology use is to consider the KSAs that team members need in order to respond to these circumstances (Krumm et al., 2013, p.34).

3.8. The concept of virtual competence and hypotheses development

Individual characteristics play an important role in the context of virtual project team work in determining the overall performance of a team or organisation (Schulze & Krumm, 2017, p.1). The novelty of virtual project work reveals gaps in the existing structures of people's cognition (Marković et al., 2015, p.1038), which makes people a potential bottleneck in gaining the benefits that dispersed work settings can provide. Therefore, for the optimal performance organisations need to align employees with tasks and technologies (Wang & Haggerty, 2011, p.300).

Since an alignment like this cannot be achieved with poor understanding of the employees, individual characteristics that pertain to overcoming the challenges of virtual environment, deserve special attention. In response, we follow a social cognitive approach to focus on individual team members' competence to shed the light on important individual knowledge, skills and abilities (KSAs) that are necessary to effectively perform tasks in virtual work environment.

Competence in professional settings is related to the necessary ability, skill, knowledge and motivation that enable a person to act effectively in a job or situation (Spencer & Spencer, 1993, p.320). As different context may require different abilities, skills, knowledge and motivation, we take the construct of IVC developed by Wang and Haggerty (2011, p.302), that specifies "individual's KSAs to collaborate and communicate with others in virtual environments for the purpose of completing collaborative work", as a basis and slightly modify it. In our study we approach virtuality as a matter of degree, therefore we expect that people with higher levels of IVC will show better work performance and also will be more satisfied with it. According to Wang and Haggerty (2011), IVC consists of 3 dimensions: virtual self-

efficacy, virtual media skill and virtual social skill. The authors also speculate that a fourth dimension related to cross-cultural skills might be added when the global virtual teams are taken into account (p.321). Since our literature review revealed that intercultural collaboration is one of the biggest challenges in the work of global virtual project teams, and given that the subject of our research is global project teams, we add cross-cultural skills as the fourth dimension of IVC (Figure 2).

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                    ┌─────────────────────┐
                    │ Individual virtual  │
                    │     competence      │
                    └─────────────────────┘
      ┌──────────────┬──────────┴──────────┬──────────────┐
┌───────────┐ ┌───────────┐ ┌───────────┐ ┌──────────────┐
│Virtual self-│ │Virtual media│ │Virtual social│ │   Virtual    │
│  efficacy   │ │    skill    │ │    skill     │ │intercultural skill│
└───────────┘ └───────────┘ └───────────┘ └──────────────┘
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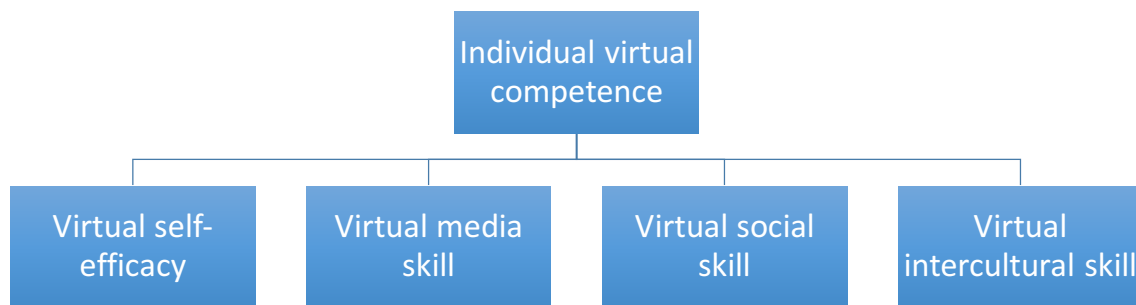
Figure 2: IVC constituent dimensions

The first dimension, virtual self-efficacy (VSE), refers to the individual's own confidence in his ability to effectively work with others in virtual environments. People with higher virtual self-efficacy tend to be more persistent in their search for an effective communication using technology. It also describes how confident the individual is in the role he performs in the work without face-to-face contacts (Wang & Haggerty, 2011, p.304). In the original research this dimension also included the confidence in the ability to use computers. However, this sub dimension did not show any significance, and we also speculate that in the year 2017 contemporary knowledge workers working in relatively senior positions all possess a baseline level of skills related to computer proficiency, therefore measuring this competence with outdated items would not provide any useful insights.

The second dimension is a virtual social skill (VSS) that is defined as the ability to build relationships with other people under the virtual work conditions. Given the limited opportunities for social interaction available in ICT industry, virtual social skill is an important element for enhancing cohesion and understanding between people, as this facilitates cooperation and healthy interpersonal relationships. A virtual team member needs to know how to interpret emoticons and other written symbols common in virtual correspondence to correctly interpret other members' feelings and ideas (Wang & Haggerty, 2011, p.305).

The third dimension of IVC is virtual media skill. This skill is defined as a person's ability to use ICT and fully explore its potential to facilitate interaction. Consequently, this skill goes beyond the mere use of ICT and is more connected to the understanding of its potential to facilitate teamwork in virtual environment. This is a key element that complements the limited wealth of information transmitted at a distance (Wang & Haggerty, 2011, p.304).

The last dimension that is suggested to be included in IVC is intercultural skill which described as ''the ability to think and act in interculturally appropriate ways'' (Hammer et. al, 2003, p. 422). It includes the awareness of the acceptable behaviours based on the norms relevant to different cultures during the communication and collaboration across cultures (Krumm et al., 2013, p.35). An effective global virtual team member is able to adapt his spoken and written communication behaviour to avoid misunderstandings (for example, by using precise language, by clarifying words' meaning and avoiding use of slang).

In order to test the proposed construct of IVC in project settings, we would like to describe and measure its impact on work outcomes, measured by job performance and job satisfaction of project team members, as they have an impact on overall project success (Hoegl & Gemuenden, 2001, p.438-439). We expect work outcomes to rely on an individual's successful virtual work practices and given our focus on medium to highly virtual project setting (i.e. global virtual teams), we have optimistic expectation regarding the influence of IVC. Wang and Haggerty (2011), conducted their research in a wider way of work arrangements, that vary in their degrees of virtuality (p.305). This is not an option for us since in order to test influence of intercultural KSAs, multi-cultural teams should be assessed.

We argue that all categories of KSA included in IVC influence work performance of an individual. Virtual self-efficacy affects the motivation and persistence of the project team member when difficulties occur, while possessed virtual media skills leverages technology use for more efficient communication which is essential in virtual project context. Highly developed virtual social skills of team members result in affective performance of a project team (Jarvenpaa & Leidner (1999, p.813). Cultural diversity in a virtual settings tend to affect team processes on different levels (Han & Beyerlein, 2006, p.365-371), thus virtual intercultural skills are expected to contribute to job performance of a project team member. Therefore, our first hypothesis states:

Hypothesis 1: Individual virtual competence is positively related to individual job performance.

Prior research also suggests that IVC may also influence individuals' job satisfaction, as it is based on members' experience at work and the fulfilment of their social needs (Müller & Turner, 2007, p.307). Supporting mechanisms in this case would be social interactions with people and self-evaluation of personal capabilities, which is incorporated in individual virtual competence via virtual self-efficacy subcategory. According to the model (Wang & Haggerty, 2011, 307), "those who have high IVC are highly capable of interacting harmoniously with others", therefore this competence supports a positive environment within a team, which should result in higher job satisfaction.

Therefore, the second hypothesis is:

Hypothesis 2: Individual virtual competence is positively associated with individual job satisfaction.

Figure 3 provides an overview of the conceptual model we are interested in testing in this research project.
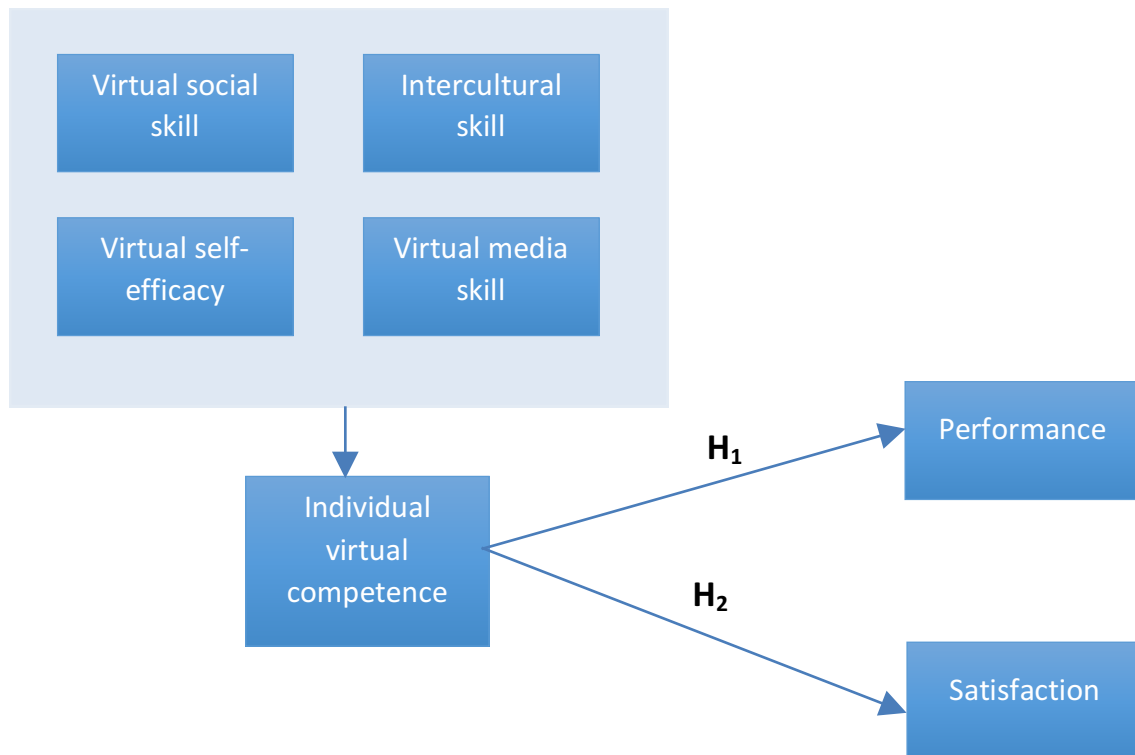

Figure 3: Conceptual model

4. Practical method

This chapter describes the practical methodology of the research. We will explain the logic behind choosing the method used for conducting the research and designing the questionnaire, discuss the approach to choosing sample size and data collection.

4.1. Research Design

O'Gorman & MacIntosh (2015, p.82) describe research design as a number of steps which are needed to coherently relate the question of the study to data collection and analysis. It can be categorised as exploratory, descriptive, and explanatory (Saunders et al., 2009, p. 139; O'Gorman & MacIntosh, 2015, p.82).

Exploratory research is employed to obtain insights into a research problem or a managerial issue. They are designed to help build theory and come up with hypothesis about new research questions when existing knowledge is inadequate (O'Gorman & MacIntosh, 2015, p.82). When the relationship between variables of an interest to the researchers, in most cases explanatory research is used for verifying cause-effect relationships (O'Gorman & MacIntosh, 2015, p.82; Saunders et al., 2009, p. 140). The objective of a descriptive design is to present a rich and comprehensive description of situations, individuals or events. It can be used in conjunction with exploratory or explanatory research as it provides detailed picture of the phenomena of interest (Saunders et al., 2009, p.140). Descriptive research can be applied to measure relationships among two or more phenomena (Williams, 2007, p.66). Due to the research question of this study, descriptive research is adopted.

Our research focuses on the existing conceptual model of individual virtual competences. Based on the comprehensive review of the academic literature on skills and knowledge specific to the field of Information Systems and also the literature on virtual work, we add an additional dimension of virtual intercultural skills to the initial model of individual virtual competence, and we intend to measure and describe relationships between independent variables (virtual self-efficacy, virtual social skill, virtual media skill, virtual intercultural skill as part of individual virtual competence) and dependent variables (individual satisfaction and individual performance). Exploratory and explanatory research design could provide us with the insights on the topic of team members working in virtual project settings and the cause-effect relationships between individual virtual competence and individual work outcomes, though these research questions are beyond the scope of the current study.

Bryman and Bell (2015, p. 53) provide an alternative classification of types of research design, such as case study, experimental, longitudinal, cross-sectional, and comparative research. Considering the quantitative nature of our study, a cross-sectional research design would be the most appropriate for it. It allows collecting qualitative or quantitative data about two or more variables at a single point in time to assess patterns of association (Bryman & Bell, 2015, p. 61). The cross-sectional research design allows researchers to find out patterns of association. This is appropriate for our work as we will examine the relationships between variables (individual virtual competence and individual work outcomes). By doing this we will be able to outline patterns of association between those variables if they exist. It also enables us to meet the research objectives of testing the relation between the independent and dependent variables.

Although, experimental design could also be applicable for this purpose, it requires control of the independent variables, which is not feasible in our study since in our study these independent variables are studied from individual's perspective (Bryman & Bell, 2015, p. 53-55). Longitudinal design is also not an option for our study since its analysis should be based on a number of variables that are observed at different periods of time (Bryman & Bell, 2015, p.66-67), which due the time constraints is not feasible for us. Moreover, we consider that longitudinal research design is more appropriate if the objective of the study is to test the time effect on the development of the competence or the effect of changes over time.

As Bryman and Bell (2015, p. 63) consider a cross-sectional design as a generic term for research with a questionnaire as data collection tools, we would use this design for data gathering as well. In our thesis we adopted a self-administered web-based questionnaire that would allow us to test our hypotheses. We conducted data collection in two stages. The pre-test was used to refine measurement instrument. Appendix 1 provides a full list of the questionnaire items.

4.2. Questionnaire Design

All the questions of the questionnaire are based on measures from previous studies. The measures of virtuality were adopted from research of Chudoba et al.'s (2005), as we took the items related to workplace mobility as our control variable. The items for measuring VSE were adapted from Staples et al.'s (1999) items of Remote work self-efficacy. In the initial model of individual virtual competence created by Wang and Haggerty (2001), the dimension of VSE consists of two sub-dimensions – computer self-efficacy (CSE) and remote work self-efficacy (RWSE). The results of the study showed that the dimension of CSE was not significant, therefore we decided to drop it in our study and attribute the characteristics of remote work self-efficacy to virtual self-efficacy. Table 4 outlines academic studies from which the questions for the questionnaire were adopted.

The measures of VSS and VMS were adapted and modified from Wang and Haggerty (2011). From 5 items of VSS we took 4 with the highest loadings. The wording and the number of VMS items has not been changed but on the ground of feasibility in order to increase response rate and not bring fatigue to the respondents we combined all virtual media types into one, instead of repeating the same questions for all possible media types used in virtual project context. The measures of virtual intercultural skills were adopted from Krumm et al. (2013): in order to reflect our research context from 6 items defining the factor knowledge about other cultures we kept 4 that had the highest loadings in the study with a bit modified wording. Measures of dependent variables were taken from prior research on virtual work and individual work outcomes (Staples, 1999, 2001). We measured perceived performance and job satisfaction.

The questionnaire consists of the questions written in English and they have not been translated to other languages since our sample consists of project-oriented global virtual team, members of which have to know English as the language that allows collaboration.

The questions are ranging from 1 to 7 with 1 meaning Strongly disagree and 7 Strongly agree due to the survey instruments used in the Wang and Haggerty (2011) research,

and we found it appropriate to use 1 to 7 on other questions as well. The only exception are the last questions that measure individual performance and satisfaction factors, in which the respondents have to choose between 1 to 6 in order to remove the "middle" answers.

Table 4: Questionnaire Items

Question number(s)	Variables	Reference
1,2,3	Demographics	General questions
4,5,6,	General to show level of virtuality	Chudoba et al., 2005
7,8,9	Virtual self-efficacy (remote work self-efficacy)	Staples et al., 1999
10,11,12,13	Virtual social skill (VSS)	Wang & Haggerty, 2011
14,15,16,17	Virtual media skill (VMS)	Wang & Haggerty, 2011
18,19,20,21	Virtual intercultural Skill (VIS)	Krumm et al., 2013
22,23,24	Individual performance	Staples et al., 1999
25,26,27	Individual satisfaction	Staples, 2001

4.3. Pre-test

To ensure that questions and instructions are clear to all respondents who may not be native English speakers, the pre-test was conducted (Saunders et al., 2009, p. 394). Saunders et al. (2009, p.394) also points out that pre-testing the survey can assess the questions' validity and the likely reliability of the data collected.

The questionnaire was presented for approval to three experts in virtual teamwork from the sample and to the thesis supervisor. The overall feedback was to decrease the number of items to increase response rate, which we did by limiting them to 27 instead of original 38. The feedback received also led to a few changes in the questionnaire itself. Thus a few statements measuring individual performance sounded very alike to each other and two respondents pointed it out that they did not understand the difference between being effective and productive, therefore one statement was substituted by another one was taken from the original source.

4.4. Sampling Technique

Sampling is applied to a research project in case it is not feasible or practical to gather and analyse the data from the entire population (Saunders et al., 2009, p. 212). It is particularly relevant in case of time and budget constraints.

There are two types of sampling techniques: probability and non-probability sampling. The first one allows achieving samples that represent the whole population through random selection, while the second one involves a sample with particular characteristics relevant to the study but does not allow to draw conclusions about the entire population (O'Gorman & MacIntosh, 2015, p.160).

Due to time constraints we were choosing from non-probability sampling techniques. In the end, we chose purposive and snowball samplings as the most appropriate for our data collection. Purposive sampling enabled us to use our judgment to select participants for our survey that were working in virtual teams on IT projects and thus were most likely to answer our research questions and to meet the objectives of the research (Sander et al., 2009, p.237). We also referred to snowball sampling for those companies where we knew only one or two people from a virtual project team and we asked them to distribute the survey to other members. The problem with snowball sampling lies in bias as respondents could identify potential respondents who would be similar to them (Sanders et al, 2009, p.240).

In a data collection procedure, questionnaires can be administered in two ways: *researcher-administered* or *self-administered (*O'Gorman & MacIntosh, 2015, p.166). When respondent's answers are recorded by the interviewer the questionnaire is called interviewer-administered, while self-administered questionnaires are usually completed by the respondents themselves (Saunders et al., 2009, p.362). We chose self-administered questionnaires as in them the respondent is not a subject to researcher's influence or bias *(*O'Gorman & MacIntosh, 2015, p.166). The questionnaire was web-based and was created in Google Docs, an online application that allows producing and easily spreading surveys on the Internet.

Overall, we have sent about 150 messages containing a web link to the web-based questionnaire in social networks and via emails to the targeted audience asking to help with the research, in addition 6 people who had access to other potential respondents were asked to spread the internet link among those who meet our criteria. Additionally, due to our familiarity with different IT project management social communities across social networks like LinkedIn and Facebook, the link with the questionnaire has been shared with the members of those communities with a request to participate in the survey.

For the purpose of conducting basic statistical analysis and checking the hypotheses, O'Leary (2004, p.105) suggests that a minimum size of 30 respondents could be enough. In order to obtain more representative data and decrease biases of the analysis it is substantial to attain a high response rate (Bryman & Bell, 2015, p. 199), therefore we expected that by following snowball and purposive sampling we will be able to collect more than 100 responses. However, at the end of the time period assigned to data gathering we received 65 usable results that were later analysed using statistical analytical software SPSS.

4.5. Ethical considerations

According to Burns and Burns, (2009, p. 47), contemporary research in social science embraces a number of key components from ethical perspective to protect the rights of participants, researchers and society in general. The research should be compliant with ethical principles and should be conducted in a responsible way. Saunders et. al (2009, p. 184) state that ethical considerations emerge at different stages of research, particularly while planning the research, accessing organisations and individuals for data collection, analysing data and writing about findings. O'Gorman and Macintosh, (2014, p. 197) outline that conducting research ethically allows researchers to predict and prevent any negative impact of research on participants along with improving the quality of research results.

Burns and Burns (2009, p. 48) highlight such participants' rights as: "the right to voluntary participation, the right of safety and freedom from harm, the right to be informed, the right to privacy and confidentiality". First of all, the well-being of research participants should be ensured, which includes both physical safety and avoidance of psychological pressure, stress or threats to mental well-being (O'Gorman & MacIntosh 2014, p. 200). The researchers should not force anyone to participate in a research as participation in the research should be voluntary (Burns & Burns, 2009, p. 49; Saunders et. al, 2009, p. 193). To guarantee it, firstly, we distributed a web-link to our questionnaire both directly to the potential respondents asking to fill in the survey if they were able and willing to, besides we placed it in relevant social media groups and distributed it using snowball sampling without personal direct communication with prospective participants, while in the introductory part of the questionnaire we defined the purpose of the survey and underlined that participation in it was completely voluntary.

Increased awareness of the research topic provides more confidence to the participants, reduces stress and the decision regarding the further cooperation becomes more deliberate (Burns & Burns, 2009, p. 48; O'Gorman & MacIntosh 2014, p. 201). For these purposes, the introductory part of the questionnaire includes a presentation of the authors and master program in general and the description of the topic and goal of the thesis project along with clarification of the meaning of "virtual teams" concept and emphasising the value of the results of the study. Ensuring anonymity and confidentiality at all phases of the research process assists in preventing harm (O'Gorman & MacIntosh 2014, p. 200) To protect the privacy of research participants, we state in the introduction to the questionnaire and guarantee anonymity and confidentiality for the participants of our survey. The data is collected without any reference to a particular respondent and processed as an aggregated data, and only we as the authors of the current study have an access to the data collected through the survey for further analysis. We provided our contact email addresses in case of any questions or suggestions from the respondents' side or if the respondents are interested in receiving the information about the results of the study. To inform the participants about the results of the study is an effective way to emphasise the value of their participation (Burns & Burns, 2009, p. 48; O'Gorman & MacIntosh 2014, p. 200).

Researchers should be objective in presenting the results of the study, do not hide any negative results, collect and analyse data in a sound and reliable way to respect the rights of society (Burns & Burns, 2009, p. 47; Saunders et. al, 2009, p. 194). Saunders

et. al, (2009, p. 194) state that objectivity means "making sure that you collect your data accurately and fully – that you avoid exercising subjective selectivity in what you record". In order to ensure the objectivity of the results, the quantitative methods were applied in the present study. The data was collected through online questionnaire and analysed with the assistance of statistical analytical software SPSS. All the collected data is analysed and all the findings are presented in accordance with actual results.

5. Data analysis and findings

This chapter shows empirical findings and analysis of collected data. First, it demonstrates findings derived from demographic questions. Then it turns to measures of Cronbach's Alpha and descriptive statistics. Afterwards, results of regression analysis are presented. These results will lay the foundation for discussion, which will follow in the next chapter.

5.1. Demographics

To describe a sample, demographic questions have been included to the questionnaire. The demographic section was comprised of questions about respondent's gender, age, and experience with virtual team work. The link to a questionnaire was sent to 150 respondents. As it has been mentioned in the earlier chapter, the electronic questionnaire link was also posted on different PM-related groups on Facebook and LinkedIn, and in addition 6 people from 150 assisted in distributing the link among the members of their virtual teams. Therefore, it is not possible to identify how many respondents in total were reached through this combination of data collection methods. It is also not possible to estimate how many participants decided to fill in the survey but dropped out along the way, since we only received submitted answers. However, the present study contains 65 usable responses. Most of the respondents (56.9 %) were males and the rest (43.1 %) females (Figure 4).
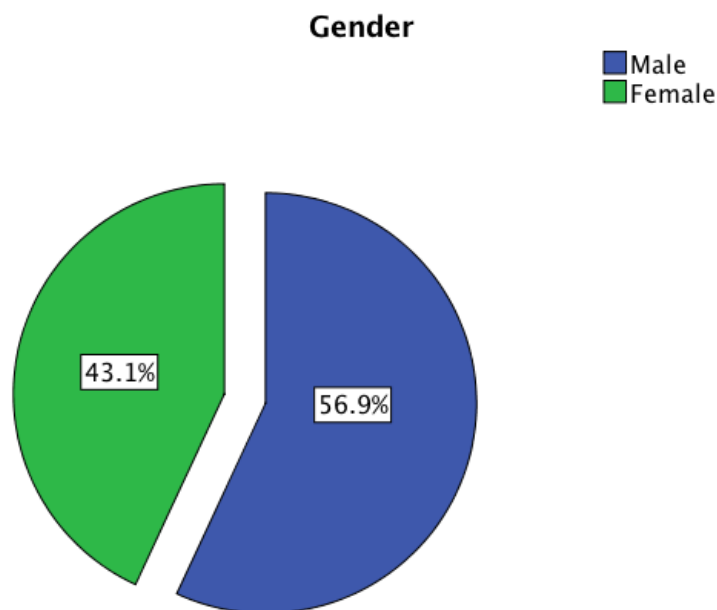
Figure 4: Percentage of male and female respondents.

The age groups included in the study and the questionnaire ranged from "18-25" to "40 and above". As it can be seen from Figure 5, the majority, 70.8 percent, of the respondents were between 26 and 40 years old. In addition, a total of 26.2 percent is

represented by young team members (18-25 years). Even though only two responses were received from project team members who are older than 40 years, this limitation can be used as a strength of our research. Such age distribution is a good sample to test our model since in the original study by Wang and Haggerty (2011) the average age of respondents was 41, thus our study can provide better insights on how the proposed concept of virtual competence is relevant to younger workforce.
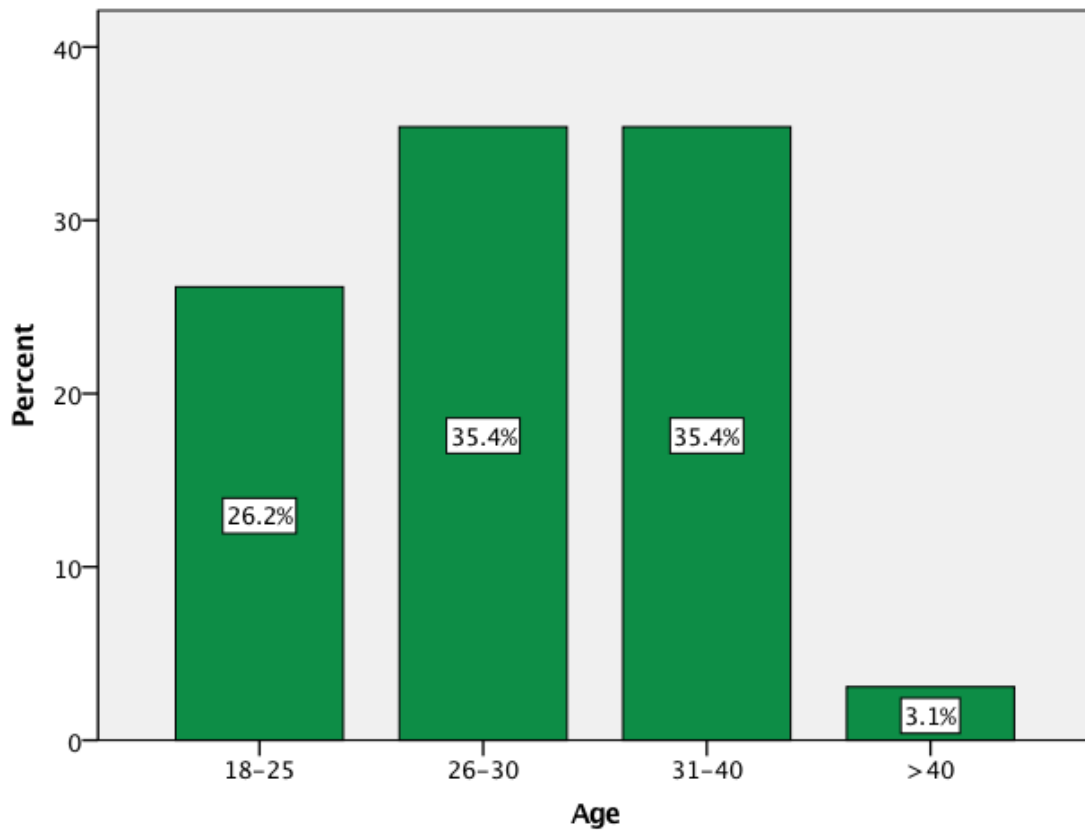
Figure 5: Age Groups of the Respondents

Furthermore, respondents were asked general questions regarding their virtual team work experience and recent work settings. When asked about overall virtual project experience, the majority of respondents reported that they have 1 to 5 years of experience working in virtual teams (61.5%), followed by 21.5% who work 6 to 10 years in such settings (see Figure 6). The smallest group of respondents has more than 10 years of experience (3.1%), which is commensurate to the oldest age group of respondents.
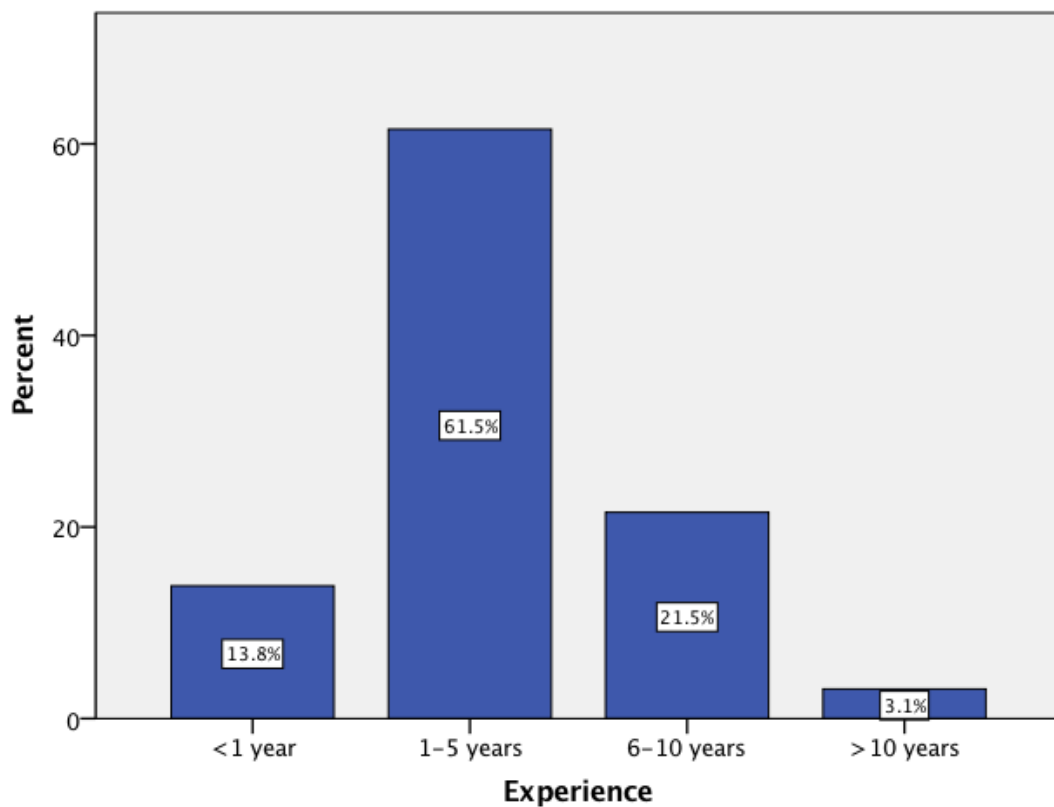
Figure 6: Virtual project work experience of respondents

5.2. Assessment of internal consistency

In order to calculate internal consistency of the measure, we are using Cronbach's alpha as one of the most frequently used methods (Sanders, 2011, p. 374). It represents the average of all split-half reliability coefficients (Bryman & Bell, 2015, p. 169). The alpha value may vary from 0 (i.e.no internal reliability) to 1 (perfect internal reliability) and for our study we establish a minimum score of 0.70 for every variable based on common practice. If any of the measure shows the result below this threshold, it would be reasonable to eliminate if for the future analysis.

As it can be seen in Table 5, the test for internal consistency was conducted for all seven variables in the research. Every construct showed a Cronbach's alpha coefficient higher than 0.7, thus we consider measure's constituent scales to be internally reliable and applicable for further analysis. The lowest coefficient value is 0.756 for control variable of workplace mobility, while the highest coefficient of 0.887 being individual performance.

Table 5: Cronbach's Alpha Coefficient

Variables	N of Items	Cronbach's Alpha
Workplace mobility	3	0.756
Virtual self-efficacy	3	0.766
Virtual media skill	4	0.767
Virtual social skill	4	0.834
Virtual intercultural skill	4	0.834
Individual performance	3	0.887
Individual satisfaction	3	0.821

After measuring the reliability of the individual constructs, we calculated the values for the aggregated variables since they all contain 3 or 4 items. Getting an average value of the variable is useful for future analysis.

5.3. Descriptive Statistics

After measuring the internal consistency reliability of our variable with Cronbach's Alpha, we look at descriptive statistics of the available data to come up with additional insights regarding our variables. The basic characteristics of a sample are measured through central tendency and dispersion (O'Gorman & MacIntosh 2014, p. 178). Mean is considered to be the most common and more suitable characteristic of central tendency measuring, since it scores all the values in a sample (Berenson et. al, 2010, p. 96; Burns & Burns, 2009, p. 141). While calculating mean, all the values from a sample are considered equally, therefore if there are extreme values in a data set, the mean does not represent central tendency accurately (Berenson et. al, 2010, p. 97). Our data did not contain any outliers; therefore, the mean was chosen as a characteristic of central tendency was chosen. Besides measuring mean, it is important to measure how the data is spread around the central tendency, which in turn allows evaluating the usefulness of the central characteristic (Saunders et. al, 2009, p. 447). Standard deviation is used for measuring the dispersion of the values around a mean in a sample (Saunders et. al, 2009, p. 447). The majority of values in a data set lie within one standard deviation below and above the mean, thus this measure allows defining the interval, where almost all the values are scattered (Berenson et. al, 2010, p. 103).

The summary maximum and minimum values of each construct, as well as its central tendency and standard deviation are outlined in Table 6, while Appendix 2 provides a detailed breakdown of the constructs.

The variable showing the highest mean is virtual self-efficacy availability with 5.80, and the lowest being virtual social skills and virtual intercultural skills with 4.70. Standard deviation of all constructs is pretty high, which means that the respondents varied significantly in their self-assessments. Since the respondents were asked to respond to questions on a 6- and 7-point Likert scale, any value higher than 3 can be considered as high. All mean values of constructs in our study are very high, which lead to a conclusion that the majority of the respondents highly evaluate their skills and work outcome.

The high mean values are the consequence of non-random sampling which we had to choose for this research due to the time and budget constraints. It can be assumed that top-performers were more active in taking part in the survey, while underperformers felt uncomfortable stating the level of their skills and therefore abstained from the participation.

Table 6: Results of descriptive statistics

Variables	N	Mean	Std. Deviation
Workplace mobility	65	5.1282	1.46332
Virtual self-efficacy	65	5.8205	.91681
Virtual media skills	65	5.7077	.84499
Virtual intercultural skill	65	4.7000	1.09169
Virtual social skill	65	4.6962	1.11584
Performance	65	5.4051	1.08732
Satisfaction	65	5.1333	1.25803

5.4. Correlation Analysis

Correlation analysis is normally used to describe the strength and direction of linear relationship between two ranked or numerical variables (Saunders et. al, 2009, p. 459). The correlation coefficient that is taken into account can take any value between -1 (precise relation, when the increase of one value decreases another) and +1 (precise relation, when the increase of one value increases another) with values in between representing weaker correlation. As correlation coefficient is standardised, therefore a correlation coefficient between 0.1 and 0.29 represent a weak relationship, 0.3 and 0.49 shows moderate relationship, while a coefficient bigger than 0.5 shows strong relationship (Field, 2005, p. 111). The most often coefficient is the Pearson correlation coefficient, however it cannot provide reliable results when at least one of the variables is ranked (Saunders et. al, 2009, p. 460). Therefore, to find covariance between different ranked variables in the proposed model, the Spearman coefficient analysis was chosen.

Table 7 presents the correlation between variables of workplace mobility, virtual self-efficacy, virtual media skill, virtual social skill, virtual intercultural skill, individual performance and satisfaction. From the correlation coefficient analysis, it was observed that control variable of workplace mobility has neither covariance nor statistical significance with any other variable except of a weak covariance with virtual social skill. Similarly, virtual self-efficacy does not have covariance or statistical significance with virtual media skill and virtual intercultural skill, but has medium covariance with virtual social skill (0.367) and outcome variables (performance (0.314) and satisfaction (0.483)). The most important conclusion that can be done from data interpretation of correlation analysis is that all our constructs that comprise IVC exhibit at least some sort of positive significant correlation with performance and satisfaction constructs. This finding supports our assumption that these variables affect each other and that a change in one variable is accompanied by a change in another variable, however it does not give us clear understanding of their cause-effect relationship.

Table 7: Inter-correlations for all constructs.

Variable	1	2	3	4	5	6	7
1.Workplace mobility	1.000	.228	.175	.179	.062	.226	.244[*]
2.Virtual self-efficacy	-	-	.163	.151	.314[*]	.483[**]	.367[**]
3.Virtual media skill	-	-	-	.510[**]	.543[**]	.427[**]	.513[**]
4.Virtual intercultural skill	-	-	-	-	.385[**]	.289[*]	.491[**]
5.Performance	-	-	-	-	-	.365[**]	.575[**]
6.Satisfaction	-	-	-	-	-	-	.442[**]
7.Virtual social skill	-	-	-	-	-	-	-
*p < .05 **p < .01							

5.5. Regression Analysis

According to O'Gorman and MacIntosh (2014, p. 183), multiple regression analysis is particularly useful while studying complex phenomenon in social science research, as it allows measuring "how much of the variance in the dependent variable can be explained by the independent variables" (O'Gorman & MacIntosh, 2014, p. 183). Correlation coefficients in multiple regression model reflect the contribution of each variable to the whole (O'Gorman & MacIntosh, 2014, p. 183). Overall multiple correlation coefficient R reflects the statistical significance of a whole multiple regression mode (Burns & Burns, 2009, p. 389). An indicator of statistical significance of the relationships among variables in the multiple regression model is p (Bryman & Bell, 2015, p. 359). The threshold for this indicator equals 0.05, meaning that for p<0.05 the relationships among variables in the multiple regression equations are considered significant, while for p>0.05, the relationships are considered to occur by chance (Saunders et al., 2009, p. 450).

Another important indicator in multiple regression analysis is coefficient of determination R², which indicates the predictable power of a regression model (Saunders et. al, 2009, p. 462), in other words, the degree to which the independent variables impact the variance of a dependent variable (Burns & Burns, 2009, p. 389). The possible values of coefficient of determination lie in the interval between 0 and 1 and the higher the value the better predictive power of the regression model is (Saunders et al., 2009, p. 461).

Variables in multiple regression models could be measured by various units or different scales. In order to measure and compare regression coefficients sometimes it is necessary to standardise the units to a compatible scale (Burns & Burns, 2009, p. 388). The coefficient which is introduced in this case is standardised beta coefficient (Bryman & Cramer, 2005, p. 302). Standardised beta coefficient (ß) utilises the same standard measurement and allows determining which of the independent variables have more impact on the dependent variable (Bryman & Cramer, 2005, p. 302). This coefficient defines "how many standard deviation units the dependent variable will change for a one standard deviation change in the independent variable" (Bryman & Cramer, 2005, p. 302).

Since our model comprises of variables measured by different scales, for instance, gender of participants is measured through nominal scale, such variables as age and

number of years of virtual project experience are measured through interval level scale, independent variables VSE, VSS, VMS and VIS which constitute individual virtual competence are measured through 7-points scale, while the dependent variables individual performance and individual satisfaction are measured through 6-points scale, the standardised beta coefficients are further computed and compared for our multiple regression model.

In order to assess the strength of relationship between our dependent variable (DV) and independent variables (IVs), multiple linear regression analysis is required (Saunders et al, 2009, p. 460-461).

5.5.1 Model 1: All Variables -> Performance

At the first stage, we check whether sub-dimensions of individual virtual competence, namely virtual self-efficacy, virtual social skill, virtual intercultural skill, and virtual media skill have influence on individual job performance of a project team member. The results suggest that the regression analysis is significant (p=0.000). We can also conclude that based on R^2=0.55, that 55% of individual performance is explained by all independent variables taken together. As shown in Table 8, only virtual media skill and virtual social skill from the model's constructs and gender as a control variable are statistically significant, the other variable, however, will contribute to the explanation individual performance as well.

As it was explained above in this chapter, standardised beta coefficient (ß) allows directly comparing each IV's influence size. Table 8 shows that among significant independent variables, virtual media skill (ß = .388) has the greatest impact on performance followed by virtual social skill (ß = .319) and gender (ß = .269). The value of coefficients and their sign can also be interpreted in a way that, for instance, for every 1 standard deviation (SD) increase in virtual social skill, performance will increase by 0.319 SD with the other variables being constant.

Table 8: Results of the regression model All variables - > Performance

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.191	.866		-.220	.827
Workplace mobility	-.071	.073	-.096	-.968	.337
Virtual self-efficacy	.133	.122	.112	1.091	.280
Virtual media skill	.500	.150	.388	3.322	.002
Virtual intercultural skill	.015	.109	.015	.134	.894
Virtual social skill	.311	.119	.319	2.615	.011
Gender	.586	.207	.269	2.831	.006
Age	.069	.136	.054	.505	.615
Experience	.190	.178	.119	1.067	.290

Note: Dependent Variable: Performance; R^2 = .550; p < .001.

5.5.2 Model 2: All variables - > Satisfaction

In the same fashion as it has been done above, we will interpret the influence of virtual social skill, virtual intercultural skill, virtual self-efficacy and virtual media skill, as well as control variables of age, gender, experience and workplace mobility on individual job satisfaction. From the Table 9 it can be concluded that the regression analysis can be considered significant (p<0.001) and that 45% of individual job satisfaction can be explained by variables in the proposed model. However, in this model, only the contribution of virtual self-efficacy followed by age's contributions are significant in predicting it. Virtual self-efficacy (ß = .352) has the greatest positive contribution to the individual satisfaction, while the age (ß = -.277) has a negative contribution to the level of job satisfaction.

Table 9: Results of the regression model All variables - > Satisfaction

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.369	1.109		-.333	.740
Workplace mobility	-.011	.094	-.013	-.114	.909
Virtual Self-Efficacy	.484	.156	.352	3.099	.003
Virtual Media Skills	.339	.193	.228	1.759	.084
Virtual Intercultural Skills	.042	.140	.036	.298	.767
Virtual Social Skills	.124	.152	.110	.815	.419
Gender	.237	.265	.094	.894	.375
Age	-.409	.174	-.277	-2.352	.022
Experience	.379	.227	.205	1.665	.102

Note: Dependent Variable: Performance R² = .449; p < .001.

5.5.3 Model 3: IVC -> Performance

As the results from the data of the majority individual sub-constructs of IVC did not show significant individual contribution to the dependent variables, we decided to calculate the construct of IVC, given the data from its sub-constructs and compare the results. Since virtual intercultural skill is the least significant construct in both of the models, the decision has been made to drop it and calculate IVC as an average of virtual media skill, virtual self-efficacy and virtual social skill constructs (12 items) to test its aggregated capacity as this conceptualised construct only exists as a combination of the dimensions of which it is composed (Wang & Haggerty, 2011, p. 303).

As shown in Table 10, and as expected, the model and the IVC construct are significant at the 0.001 level. Fifty-three percent of the variance in perceived performance is explained. R² is only 3% less than the R² in the first model which depends greatly on the number of variables in the regression, therefore replacing individual constructs with one IVC that incorporates them all can be considered valid. In addition, the construct of IVC has a significant contribution on the performance and goodness of fit (ß = .0.668). These results support Hypothesis 1.

Table 10: Results of the revised regression model IVC -> Performance

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.135	.747		-.181	.857
Individual virtual competence	.940	.137	.668	6.878	.000
Workplace mobility	-.072	.073	-.097	-.992	.325
Gender	.616	.201	.283	3.068	.003
Age Gender	.058	.134	.045	.432	.667
Experience	.221	.174	.139	1.269	.210

Note: Dependent Variable: Performance; R^2 = .532; p < .001

5.5.4 Model 4: IVC -> Satisfaction

In our last model individual virtual competence is also positively associated with job satisfaction given a coefficient of 0.543 and 42 percent of the variance in satisfaction explained, which is only 7% less than the second model. Therefore, our findings also support Hypothesis 2. With all other results, being the same every increase of 1 SD of IVC, satisfaction will increase on 0.543 SD.

Table 11: Results of the revised regression model IVC -> Satisfaction

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.466	.964		.484	.630
Individual Virtual Competence	.883	.176	.543	5.009	.000
Workplace mobility	-.008	.094	-.009	-.081	.935
Gender	.299	.259	.119	1.155	.253
Experience	.330	.225	.179	1.467	.148
Age	-.404	.173	-.274	-2.331	.023

Note. Dependent Variable: Satisfaction; R^2 = .418; p < .001.

6. Discussion and conclusions

This chapter presents the examination of our hypotheses derived from our theoretical framework and the findings from the empirical study, followed by theoretical and practical implementations of the findings of the current study, discussion regarding reliability and validity of the research along with its limitations and suggestions to further research.

6.1. Discussion

The research gap identified in the literature relates to the lack of research on the virtual competence of the project team working in IT field and its relation to positive work outcomes (Gilson et al., 2015; Wang & Haggerty, 2011). Therefore, the purpose of the study is to enhance the knowledge in the area of virtual project teams by exploring and explaining the individual skills, knowledge and abilities of team members that are related to working virtually while providing additional information about the topic. The research question of the present study is:

What individual knowledge, skills, and abilities (KSAs) that comprise virtual competence (IVC) should the virtual project team members possess, which could contribute to overcoming challenges of virtual environment?

Our research demonstrates that individuals working in virtual project teams, who have higher IVC exhibit higher perceived job performance and job satisfaction. The trend in the modern world suggests that advancement of technologies and globalisation leads to greater adoption of information and communication technology as they facilitate project execution across boundaries, such as time, distance and cultural differences. Constant increase of projects conducted on a distance is supported by the abundance of different medium channels, which are widely used for communication, and also by the percentage increase of millennial generation, that is considered to possess different technological capabilities and work expectations in the total workforce (Wang & Haggerty, 2011, p. 317-318).

Since in our study the majority of our respondents belong to the millennial generation, we compare our findings with the findings of Wang and Haggerty's (2011) study, the average age of respondents in which was 41. Perceived performance (0.668) and satisfaction (0.543) in our study are higher than performance (0.56) and satisfaction (0.31) in the original study of IVC. It is worth noting, that the original study researched virtual teams as a whole, while we focused our study on IT companies working in project setting in virtual work environment, which should also be taken into account

Current research demonstrates a reasonably high descriptive power in determining the individual effects of virtual skills and competences that form a construct of IVC and also the effect of IVC on work outcomes. The high mean value of workplace mobility (5.128) of the sample supported the view of virtual work as a ubiquitous concept, while its high standard deviation (1.46) the prevailing view on virtuality as a continuum (Kirkman & Mathieu, 2005, p. 702; Leenders et al., 2003, p. 71).

The overall results of hypotheses verification are presented in Table 12.

Table 12: Results of hypotheses verification.

Hypothesis	Results
H1. Individual virtual competence influences perceived performance of a project team member.	Supported
H2. Individual virtual competence influences perceived job satisfaction of a project team member.	Supported

Among the dimensions of IVC, VMS, VSS and VSE all appear to have statistical significance when the relationship with dependent variables was tested, while VIS not. These findings provide the support for the key capacities in the original research of IVC. At the same time, our conceptualisation of virtual intercultural skill as a separate element of individual competence has not been supported. Even though an effect of VIS is not found to be significant in the tested model, this construct exhibits relatively high correlation coefficient (0.455) in regard to VSS, which can be interpreted as a need to expand the construct of virtual social skill, taking into account cross-cultural skills as in globally distributed teams, knowledge and skills pertaining to communication with team members from various cultures is very important (e.g. Lee-Kelley & Sankey, 2008, p. 54). VMS, VSS, VSE have a positive influence on performance and job satisfaction, where VSE has the strongest influence on the satisfaction compared to other variables, while VMS on the performance. For a revised research model, we are eliminating constructs related to VIS and the new model is presented by Figure 7.
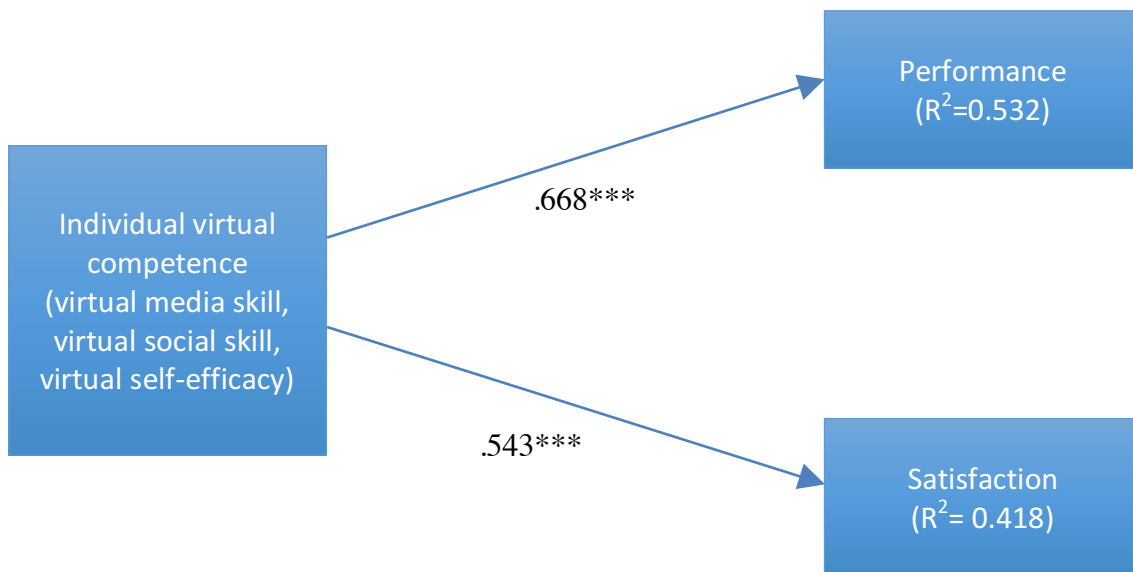
Figure 7: Revised model of virtual competence and work outcomes

Our findings reveal some interesting significant relationship between two of our control variables and work outcomes. As Gender variable has been used and coded as a dummy variable ("0" = men; "1" = women), the findings suggest that women's job performance is higher than men's. Age, has been found to have a negative relationship with the job satisfaction. We could speculate that this can be explained in the light of millennial having different expectations towards work content and environment than older generations of project team members, who are less enjoying working in the virtual settings and would prefer more traditional co-located work instead.

To sum up, the aim of this thesis is to examine the KSAs relevant to overcoming challenges of virtuality and their influence on work outcomes of virtual project team members. We have conceptualised the construct of individual virtual competence (IVC) that consists of 4 subcategories (virtual self-efficacy (VSE), virtual media skill (VMS), virtual social skill (VSS), and virtual intercultural skill (VIS)), that incorporate the key KSAs. The research was conducted by utilising the proposed research model, with the purpose of gaining insights into the influence of subcategories of IVC on job satisfaction and performance. The overall model generated from multiple linear regression analyses is statistically significant. It can be concluded that all constructs from the initial concept of IVC have a significant effect on work outcomes, while proposed in this study subcategory of VIS does not have a significant effect.

6.2. Theoretical contribution

With the emergence of the phenomenon of virtual teams and global virtual projects, researchers have explored various aspects of the concepts, for instance, leadership capabilities of a project manager, trust, communication and interpersonal skills, knowledge sharing, organisational and technological support, though few previous studies focus on the important element of virtual project work - team members of virtual projects. The current study focuses on a team member of a virtual project team and describes the relationships between individual virtual competences and individual work outcomes in global virtual project environment.

The findings of the current study contribute to the existing knowledge in project management field by describing how the individual virtual competence impacts individual work performance and individual work satisfaction of the team members involved in IT projects in virtual environment. Previous studies examined the model of KSAs of team members in virtual environments. We contribute to the prior research by adding the fourth dimension of virtual intercultural skill to the initial IVC model and testing the modified conceptual model in a global virtual project environment.

Our findings discover that individual intercultural skill as a part of individual virtual competence in a context of global virtual IT projects do not have significant influence on individual work outcomes of project team members, while other three subcategories of individual virtual competences, namely individual self-efficacy, individual social skill, individual media skill which comprise IVC have a substantial impact on individual work performance and individual work satisfaction. Although our revised conceptual model did not prove to be more significant in influencing the individual work outcomes than the initial model, the theoretical contribution of the current research is in drawing attention to a team member of a virtual project as a significant element of the virtual project work and in applying the current IVC model to virtual project environment.

6.3. Practical implications

The specificity of virtual project work implies the more increasing significance on the role of an individual team member. Although the role of project manager remains important in virtual settings, the dramatically changed working conditions require team members to possess specific KSAs to operate effectively in virtual environment. Therefore, for project and business managers it is important to understand which KSAs of team members have an impact on work outcomes. Individual performance and individual satisfaction of virtual project team members comprise the overall team

performance and team satisfaction, subsequently contributing to the success of a project. Project team members who demonstrate good results while working on a project could receive good recommendations and could be promoted or invited to participate in further projects, thus enhance their career. At the same time, members of virtual teams who are satisfied with the project work are more likely to promote the project results and wish to participate in other projects with the same team or within the same company.

The present study discovers that individual work satisfaction and individual work performance is significantly and positively influenced by such individual virtual competences as individual self-efficacy, individual social skill, individual media skill. The final conceptual model in the current study presents the general influence of individual virtual competences on individual work outcomes, while in data analysis and discussion chapters the influence of each sub categorical construct is also measured and evaluated. Both of the explored models have their practical meaning.

On the one hand, in order to enhance the individual virtual competencies of virtual project team members, it is essential to precisely understand each construct which is incorporated into the synthesised concept of IVC. The current research discovers that such constructs as virtual self-efficacy, which proved to have the most significant impact on individual work satisfaction, relates to the belief of a virtual team member that he or she could accomplish work using virtual tools. The second construct is virtual media skill, which reflects one's ability to effectively use information and communication technology for collaboration in virtual environment. The third construct of virtual social skill embraces the ability of virtual team members to build relationships with others in virtual environment. The second construct of VMS and the third construct of VSS demonstrated the higher impact on individual virtual performance than other variables.

Understanding the constructs and the level of their significance allows introducing appropriate training to the employees. Project managers could employ the measures of the team members IVC and improve it by providing, for instance, training on how to use ICT or how to structure and convey a message in a clear and accurate way to develop virtual media skill and virtual social skill respectively. Regarding virtual self-efficacy, Staples et al. (1999, p. 761) suggest a way to develop it by observing daily virtual work and successful explicit practices by the direct leadership. At the same time, the findings of the study could be applied when hiring potential employees for virtual IT projects. For instance, in order to evaluate virtual self-efficacy, a hiring manager can utilise situational questions during the interview process and select candidates with high VSE.

On the other hand, the results of the study could be used not exclusively internally by a project manager and HR team to select or develop team members of virtual project teams, but they could be utilised by project management consultancy firms. In this case, the detailed description of each construct of IVC could be of the less applicability. While providing project management services, a consultancy firm would operate with more general concepts in order to avoid a confusion of a client, and at the same time, to demonstrate awareness of the brand new research findings and implement their knowledge to enhance clients' projects performance. In this case, the results of analysis of the aggregated model of IVC would be of greater value.

6.4. Societal implications

Sustainability embraces special attitude toward society, economic development and environment. The environmental sustainable development means to care about climate protection, sensible use of natural resources and biodiversity. In terms of society, sustainability aims at handling with poverty, inequality, assuring access to education to all people. Moreover, the issues of fair trade and distribution, the sale of locally produced food reflect in the postulates of sustainable economic development.

With the regard of sustainable development, the current research contributes in several ways. First of all, as it was mentioned in the literature review chapter, one of the benefits of virtual project work is the possibility to decrease the impact on the environment by reducing the carbon footprint and pollution due to the decreased number of business trips while working across borders for a project. Secondly, executing projects in virtual environment contributes to social sustainability as it enables to hire professionals from all over the world regardless of location, thus, providing employment opportunities for people from less economically developed regions. Also, virtual project work opens hiring opportunities for people who have some mobility restrictions.

The current research contributes to the development of the research area of virtual project work by providing insights on the impact of IVC on individual work performance and satisfaction. Increased work outcomes affect the effectiveness of virtual project work and enhance its benefits to sustainability. Moreover, utilisation of the findings of the current research assists in coping with one of the challenges of virtual project work which relates to a societal wellbeing, namely, an increased sense of isolation. Increased job satisfaction could neutralise the negative effects of remote work, thus by studying the impact of virtual competences on individual work satisfaction, the current research contributes to a personal wellbeing.

6.5. Research credibility

The following chapters discuss two indicators of the research credibility, namely, validity and reliability, the approaches which were used to ensure the high quality of the research along with the statistical results evidencing the fulfilment of the criteria of validity and reliability.

6.5.1 Reliability

Reliability refers to whether the data gathering and analytical techniques utilised in the study will lead to the same findings (Saunders et al., 2009, p. 156) For instance, if another research replicates the same methods and techniques and gets the consistent findings, the original research is considered reliable.

The main threats of the reliability are participants' error, participants' bias, the researchers' error and the researchers' bias (Robson, 2002, cited in Saunders et al., 2009, p. 156-157). We conducted our research using the online questionnaire and participation in the research was anonymous and voluntary, which allowed us to eliminate the participants' error and bias. It could be argued that due to the voluntary nature of the participation, our respondents represent the so-called top-performers, or proactive employees with high motivation, therefore their estimation of their individual

virtual competences along with their job satisfaction and job performance could be higher than average, thus our sample won't properly represent general population of team members of global virtual IT projects. For the purpose of the current research, due to lack of access to general population and considering that the survey was distributed among targeted audience without intentional selection of the top performing respondents and the total number of respondents was 65, which is more than the threshold of 30 respondents (O'Leary, 2004, p. 105), our sample of participants is considered reliable.

Due to our philosophical and methodological choices, namely the objectivist ontological stance, the positivist epistemological stance, and the quantitative research design, any possible issues with researchers' interpretations are minimised. Self-administered questionnaire was chosen as the most suitable tool for data collection as a respondent in this case is not impacted by the researchers' influence or bias *(O'Gorman & MacIntosh, 2015, p. 166)*. In order to avoid errors at empirical stage of the research, both of the authors were involved in data gathering, analysis and discussion of the main findings.

One of the indicators of the reliability of a sample is Cronbach's Alpha (Sanders, 2011, p. 374). As it is described in the data analysis chapter, the Cronbach's Alpha could vary from 0, which relates to absence of internal consistency, to 1, which means that all the constructs are perfectly reliable. Therefore, the higher value of the Cronbach's Alpha indicates the higher level of internal reliability and the values greater than 0.7 characterise the model as reliable. In our model, all the constructs have Cronbach's Alpha coefficient higher than 0.7 which evidences the internal consistency of the analysed constructs and supports the reliability of our model.

6.5.2 Validity

Validity aims at evaluating if the findings answer the research question of the study and the chosen indicators actually measure the research concept (O'Gorman & MacIntosh, 2014, p. 157). In comparison to reliability, which focuses on how the concept is measured, validity concentrates on the concept itself (Bryman & Bell, 2015, p. 50-52). In quantitative studies a concept of validity is considered from internal and external perspectives (O'Gorman & MacIntosh, 2014, p. 171).

Internal validity examines if the findings regarding the relationships among independent and dependent variables are accurate (Bryman & Bell, 2015, p. 50). The current study aims at measuring impact of the individual virtual competences on the individual work outcomes of team members of global virtual IT projects. The initial model of virtual competences by Wang and Haggerty (2011), which consists of three dimensions, was revised as the results of the thorough literature review the fourth construct of virtual intercultural skill was added, thus the questions in our survey mainly aim at measuring the four dimensions of individual virtual competences along with individual work performance and individual work satisfaction.

According to Saunders et. al (2009, p. 372), the internal validity of a questionnaire refers to ability to measure the studied concepts. First of all, to increase the internal validity we adopt the survey questions from the previous studies on individual virtual competences, and the questions have been proved to be valid. Moreover, to ensure internal validity we conduct the pilot survey at the data gathering stage. A pilot survey

allows to reveal any ambiguities in questions formulations and assure the appropriateness of the questions (O'Gorman & MacIntosh, 2014, p. 171). Besides it assists in testing the sequence of questions, estimated response rate and time for filling in a survey and allows practicing data analysis techniques (O'Gorman & MacIntosh, 2014, p. 171). Saunders et. al (2009, p. 374) state that clear wording and familiar terms in questions enhance the validity of a questionnaire. The pilot survey in our research revealed that respondents could not distinguish between the meanings of two questions of the questionnaire, thus one of the two questions was excluded. The estimated reported time for filling in the survey was 5 minutes, which we include into the introductory part of the questionnaire.

External validity of the research is associated with the generalisation of its results (Bryman & Bell, 2015, p. 51; O'Gorman & MacIntosh, 2014, p. 158). The results are generalizable if they could be applied to other research context, for example, other industries or organisations (O'Gorman & MacIntosh, 2014, p. 158). One of the main conditions of generalisation of the results is to form a representative sample of the whole population (Bryman & Bell, 2015, p. 51). The current study aims at measuring the impact of individual virtual competences on individual work performance in global virtual IT project settings, therefore the general population consists of all people who work in project teams in virtual settings. For the current study, it is hard to estimate and access the whole population, thus it is complicated to accurately estimate the conditions of the sample representativeness. During data gathering stage, we utilised various methods of the questionnaire distribution, though the majority of answers were received during the first three days, when the questionnaire was sent directly to the targeted IT companies which implement projects virtually. Only approximately 6% of the responses were received through random sampling method by placing the questionnaire online in the relevant social media groups, which could also be regarded as a negative impact on our sample representativeness. We acknowledge the results of the current study applicable within the frame of virtual teams working on global IT virtual projects, therefore we regard lack of generalisation of the results as a limitation of our research.

6.6. Limitations and further research

There are several limitations in the current study. The research was conducted among team members of global virtual IT project teams. We attracted potential respondents by sending the questionnaire to the potential respondents from the IT companies that implement projects virtually across borders along with placing it in social networks, though due to constraints of time and budget, we received 65 answers in total. One possible issue with the respondents could be that predominantly so-called "top performers", in other words active people who achieve high results decided to fill in the survey, which could cause scenes in evaluation of job performance and job satisfaction. Taking into account the aforesaid along with the difficulty to access and estimate the whole population of people who work in virtual project teams, it is difficult to estimate the representativeness of our sample, which in turn could cause issues while trying to generalise the results of our study, for example, to other industries. Thus, the limited amount of data gathered is the first limitation of our research. For further research it is advised to test the conceptual model of virtual competences within the different context through random sampling technique with a higher number of respondents, and using other statistical techniques for analysis (for example, Structural Equation Modelling) in order to increase the representativeness of a sample.

Another limitation is that 53% of the variance in perceived individual work performance and 43% in individual work satisfaction are explained by our conceptual model of IVC, thus the future research could further explore the possible constructs of IVC in different virtual settings. For instance, even though in the current research the construct of virtual intercultural skill was discovered to have no significant impact on individual work outcomes for global virtual IT projects, this sub-category could be tested as a part of IVC in a context of virtual projects in the industry, where intercultural communication comes to the forefront. Another possible model for investigation in future research is the one where VSS includes VIS as these two variables showed significant correlation during data analysis stage.

The sample demographics was explored in by measuring gender, age and work experience in global virtual projects. The findings reveal the negative impact of age on the job satisfaction. The millennial generation which is entering the job market is considered to have more advanced skills in operating through ICT in a virtual environment, thus could adapt to and enjoy working in virtual settings more than their older colleagues. One of the possible directions of future research is to investigate the impact of generational differences on virtual competences and individual work outcomes, which will allow to diversify the necessary training in accordance with the needs of different groups of employees and increase the effectiveness of virtual project work.

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Appendix 1. Questionnaire

Questionnaire: Virtual competence in PM context

Our names are Irina Armasheva and Daria Gaioshko and we are studying the Business Administration Program at Umeå School of Business and Economics (Sweden). This study is part of our degree project and therefore we are very grateful if you would like to participate by filling in this survey. We guarantee anonymity of your responses and that no answers would be traced to any individual.

The responses will be used in order to find ways to help team members develop capabilities needed to work in global virtual project teams with a final goal to improve work outcomes. With virtual teams we mean workgroups that use IT to communicate and that are not bound to a physical location to conduct their work-tasks.

The estimated time to complete this form is 5 minutes. If you have any questions regarding this survey, please contact us by e-mail: armasheva@gmail.com, d.gaioshko@gmail.com

1. Gender *

- ◯ Female
- ◯ Male
- ◯ Prefer not to say

2. Age *

- ◯ 18-25
- ◯ 26-30
- ◯ 31-40
- ◯ >40

3. How many years of virtual project experience do you have? *

- ◯ <1
- ◯ 1-5
- ◯ 6-10
- ◯ >10

4. How often do you collaborate with people in different time zones? *

	1	2	3	4	5	6	7	
Never	◯	◯	◯	◯	◯	◯	◯	Daily

5. **How often do you collaborate with people you have never met face-to-face?** *

	1	2	3	4	5	6	7	
Never	◯	◯	◯	◯	◯	◯	◯	Daily

6. **How often do you work with people via Internet-based conferencing applications?** *

	1	2	3	4	5	6	7	
Never	◯	◯	◯	◯	◯	◯	◯	Daily

7. **Below you will find several statements, please mark to what extent do you agree with them:** *

	Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree
I have confidence that I can complete my virtual work because I can access information needed to perform my job.	◯	◯	◯	◯	◯	◯	◯
I have confidence that I can complete my virtual work because I can set objectives that align with the organization's goals.	◯	◯	◯	◯	◯	◯	◯
I have confidence that I can complete my virtual work because I can prioritize tasks to use my time effectively.	◯	◯	◯	◯	◯	◯	◯

8. **Below you will find several statements, please mark to what extent do you agree with them: ***

	Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree
In virtual settings, I am keenly aware of how I am perceived by others.	◯	◯	◯	◯	◯	◯	◯
In virtual settings, I am good at making myself visible with influential people in my organization.	◯	◯	◯	◯	◯	◯	◯
In virtual settings, I find it is simple to put myself in other people's positions to understand their point of view.	◯	◯	◯	◯	◯	◯	◯
In virtual settings, I am particularly good at sensing the motivations and hidden agendas of others.	◯	◯	◯	◯	◯	◯	◯

9. **Below you will find several statements, please mark to what extent do you feel capable of using digital communication tools (e.g. email, video conference, chats, etc.):** *

	Extremely incapable	Incable	Slightly incapable	Neutral	Slightly capable	Capable	Extremely capable
To give and receive timely feedbacks when communicating with others whom you are not able to meet in person?	⬭	⬭	⬭	⬭	⬭	⬭	⬭
To convey multiple types of information (e.g., factual information, emotional information) when communicating with others whom you are not able to meet in person?	⬭	⬭	⬭	⬭	⬭	⬭	⬭
To transmit varied symbols (e.g., words, numbers, and pictures) when communicating with others whom you are not able to meet in person?	⬭	⬭	⬭	⬭	⬭	⬭	⬭
To tailor the message to fit other parties' requirements when communicating with people whom you are not able to meet in person?	⬭	⬭	⬭	⬭	⬭	⬭	⬭

10. **Below you will find several statements, please mark to what extent do you agree with them**
*

	Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree
In virtual settings, I know the customs of the other team members' cultures in written communication	◯	◯	◯	◯	◯	◯	◯
In virtual settings, I know the verbal/spoken customs of the other team members' cultures	◯	◯	◯	◯	◯	◯	◯
In virtual settings, I know the social customs of the other team members' cultures	◯	◯	◯	◯	◯	◯	◯
In virtual settings, I read between the lines (to be sensitive to written insinuations)	◯	◯	◯	◯	◯	◯	◯

11. **Below you will find several statements, please mark to what extent do you agree with them**
*

	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
I am a highly productive employee.	◯	◯	◯	◯	◯	◯
Among my work group, I would rate my performance in the top quarter.	◯	◯	◯	◯	◯	◯
The quality of my work output is outstanding.	◯	◯	◯	◯	◯	◯

12. **Below you will find several statements, please mark to what extent do you agree with them**
*

	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
I am satisfied with the attention paid to the suggestions I make.	◯	◯	◯	◯	◯	◯
I am satisfied with the way I am managed.	◯	◯	◯	◯	◯	◯
I am satisfied with the recognition I get for good work.	◯	◯	◯	◯	◯	◯

Appendix 2. SPSS Analysis Results.

Demographics:

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	37	56.9	56.9	56.9
	Female	28	43.1	43.1	100.0
	Total	65	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-25	17	26.2	26.2	26.2
	26-30	23	35.4	35.4	61.5
	31-40	23	35.4	35.4	96.9
	>40	2	3.1	3.1	100.0
	Total	65	100.0	100.0	

Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1	9	13.8	13.8	13.8
	1-5	40	61.5	61.5	75.4
	6-10	14	21.5	21.5	96.9
	>10	2	3.1	3.1	100.0
	Total	65	100.0	100.0	

Descriptive Statistics:

Item	N	Minimum	Maximum	Mean	Std. Deviation
MOB1	65	1	7	5.43	1.845
MOB2	65	1	7	4.54	1.855
MOB3	65	2	7	5.42	1.648
VSE1	65	3	7	6.05	.891

Item	N	Minimum	Maximum	Mean	Std. Deviation
VSE2	65	3	7	5.63	1.180
VSE3	65	2	7	5.78	1.231
VSS1	65	2	7	4.60	1.309
VSS2	65	1	7	4.78	1.397
VSS3	65	2	7	4.89	1.371
VSS4	65	2	7	4.51	1.382
VMS1	65	2	7	5.66	1.176
VMS2	65	3	7	5.37	1.206
VMS3	65	3	7	6.05	.975
VMS4	65	3	7	5.75	1.031
VIS1	65	2	7	4.78	1.317
VIS2	65	2	7	4.74	1.228
VIS3	65	2	7	4.82	1.333
VIS4	65	1	7	4.46	1.459
PER1	65	2	7	5.54	1.147
PER2	65	2	7	5.49	1.301
PER3	65	2	7	5.18	1.158
SAT1	65	2	7	5.26	1.326
SAT2	65	2	7	5.11	1.582
SAT3	65	1	7	5.03	1.479

Correlations:

			MOB	VSE	VMS	VIS	PER	SAT	VSS
Spear-man's rho	MOB	Correlation Coefficient	1.000	.228	.175	.179	.062	.226	.244*
		Sig. (2-tailed)	.	.068	.164	.154	.621	.071	.050
		N	65	65	65	65	65	65	65
	VSE	Correlation Coefficient	.228	1.000	.163	.151	.314*	.483**	.367**
		Sig. (2-tailed)	.068	.	.195	.229	.011	.000	.003
		N	65	65	65	65	65	65	65
	VMS	Correlation Coefficient	.175	.163	1.000	.510**	.543**	.427**	.513**
		Sig. (2-tailed)	.164	.195	.	.000	.000	.000	.000
		N	65	65	65	65	65	65	65
	VIS	Correlation Coefficient	.179	.151	.510**	1.000	.385**	.289*	.491**
		Sig. (2-tailed)	.154	.229	.000	.	.002	.019	.000
		N	65	65	65	65	65	65	65
	PER	Correlation Coefficient	.062	.314*	.543**	.385**	1.000	.365**	.575**
		Sig. (2-tailed)	.621	.011	.000	.002	.	.003	.000
		N	65	65	65	65	65	65	65
	SAT	Correlation Coefficient	.226	.483**	.427**	.289*	.365**	1.000	.442**
		Sig. (2-tailed)	.071	.000	.000	.019	.003	.	.000
		N	65	65	65	65	65	65	65
	VSS	Correlation Coefficient	.244*	.367**	.513**	.491**	.575**	.442**	1.000
		Sig. (2-tailed)	.050	.003	.000	.000	.000	.000	.
		N	65	65	65	65	65	65	65

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

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

Multiple Linear Regression:

Model 1

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.742[a]	.550	.486	.77986

a. Predictors: (Constant), Experience, Virtual Self-Efficacy, Gender, Virtual Intercultural Skills, Workplace mobility, Age, Virtual Media Skills, Virtual Social Skills

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	41.607	8	5.201	8.551	.000[b]
	Residual	34.058	56	.608		
	Total	75.665	64			

a. Dependent Variable: Performance
b. Predictors: (Constant), Virtual Self-Efficacy, Experience, Gender, Virtual Intercultural Skills, Workplace mobility, Age, Virtual Media Skills, Virtual Social Skills

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.191	.866		-.220	.827
	Workplace mobility	-.071	.073	-.096	-.968	.337
	Virtual Self-Efficacy	.133	.122	.112	1.091	.280
	Virtual Media Skills	.500	.150	.388	3.322	.002
	Virtual Intercultural Skills	.015	.109	.015	.134	.894
	Virtual Social Skills	.311	.119	.319	2.615	.011
	Gender	.586	.207	.269	2.831	.006
	Age	.069	.136	.054	.505	.615
	Experience	.190	.178	.119	1.067	.290

a. Dependent Variable: Performance

Model 2:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.670[a]	.449	.370	.99862

a. Predictors: (Constant), Experience, Virtual Self-Efficacy, Gender, Virtual Intercultural Skills, Workplace mobility, Age, Virtual Media Skills, Virtual Social Skills

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	45.444	8	5.680	5.696	.000[b]
	Residual	55.845	56	.997		
	Total	101.289	64			

a. Dependent Variable: Satisfaction
b. Predictors: (Constant), Virtual Self-Efficacy, Experience, Gender, Virtual Intercultural Skills, Workplace mobility, Age, Virtual Media Skills, Virtual Social Skills

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.369	1.109		-.333	.740
	Workplace mobility	-.011	.094	-.013	-.114	.909
	Virtual Self-Efficacy	.484	.156	.352	3.099	.003
	Virtual Media Skills	.339	.193	.228	1.759	.084
	Virtual Intercultural Skills	.042	.140	.036	.298	.767
	Virtual Social Skills	.124	.152	.110	.815	.419
	Gender	.237	.265	.094	.894	.375
	Age	-.409	.174	-.277	-2.352	.022
	Experience	.379	.227	.205	1.665	.102

a. Dependent Variable: Satisfaction

Model 3:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.729[a]	.532	.492	.77462

a. Predictors: (Constant), Experience, Gender, Individual Virtual Competence, Workplace mobility, Age

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	40.263	5	8.053	13.420	.000[b]
	Residual	35.402	59	.600		
	Total	75.665	64			

a. Dependent Variable: Performance
b. Predictors: (Constant), Experience, Gender, Individual Virtual Competence, Workplace mobility, Age

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.135	.747		-.181	.857
	IVC3	.940	.137	.668	6.878	.000
	Workplace mobility	-.072	.073	-.097	-.992	.325
	Gender	.616	.201	.283	3.068	.003
	Age	.058	.134	.045	.432	.667
	Experience	.221	.174	.139	1.269	.210

a. Dependent Variable: Performance

Model 4:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.647[a]	.418	.369	.99936

a. Predictors: (Constant), Age, Gender, Individual Virtual
Competence, Workplace mobility, Experience

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	42.365	5	8.473	8.484	.000[b]
	Residual	58.924	59	.999		
	Total	101.289	64			

a. Dependent Variable: Satisfaction
b. Predictors: (Constant), Age, Gender, Individual Virtual Competence,
Workplace mobility, Experience

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.466	.964		.484	.630
	Individual Virtual Competence	.883	.176	.543	5.009	.000
	Workplace mobility	-.008	.094	-.009	-.081	.935
	Gender	.299	.259	.119	1.155	.253
	Experience	.330	.225	.179	1.467	.148
	Age	-.404	.173	-.274	-2.331	.023

a. Dependent Variable: Satisfaction