

Intercultural Communication and Collaboration in Software Development

ARIANA DOST
HANNE KRISTINE AUSTENAA

SUPERVISOR
Professor Ilan Alon

University of Agder, Spring 2020
Faculty of Business and Law
Department of Management

Master

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Lastly, we hope this thesis will offer some new knowledge regarding intercultural communication and collaboration in software development for you as a reader.

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Ariana Dost

Ariana Dost

Hanne K. Austenaa

Hanne Kristine Austenaa

Abstract

Many Global Software firms outsource parts of their operations to other countries due to cheaper labour costs and to find employees with high knowledge within a specific area. Collaboration and communication between different nationalities are difficult not only due to the distance geographically, but also distances in cultural aspects. The purpose of this study is to investigate different factors that impact intercultural communication and collaboration in software development firms.

Previous research in this field shows various factors impacting intercultural communication and collaboration in software development companies. To investigate these factors exploratory mixed-method design has been used. Initially, qualitative methodology was used to collect data from semi-structured interviews. Eight interviews were conducted with various work roles within a single Norwegian firm. The interviewees explain how various factors impact their communication and collaboration with colleagues in India and Ukraine. These results have been analysed. Secondly, a quantitative survey was conducted based on Isern's (2014) eight identity factors of intercultural communication. Other factors based on the findings from the interviews have also been discussed.

Results prove that there are several factors of intercultural communication that impact collaboration. From the interviews, geographical distance and time-zone differences, hierarchical mindset, cultural differences, technical knowledge and working roles, and language barriers, are factors impacting software development. From the survey three of the eight identity factors were proven to have a significant impact on intercultural communication. Cultural Identity Factor (CIF), Individual Identity Factor (IIF), and Roles Identity Factor (RIF) have a direct impact on intercultural communication and collaboration.

This study provides new insight into how intercultural communication and collaboration impacts a Norwegian software firm, which has been outsourcing. The company has been outsourcing the whole testing team and some developers to Ukraine and India for a long period of time.

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1 Introduction

Along with advancements in technology development, the demand for more complex software has increased (Tuli, Sharma, Haster, and Banzal, 2014). As competition grows in the software industry, several software development companies adopt Global Software Development (GSD) strategies to draw benefits from other countries and increase competitive advantage (Rodger, Pankaj, and Nahouraii, 2011; Khan and Keung, 2016). Global Software Development is defined as an outsourcing technique in which development teams are distributed across geographical boundaries (Ammad, Janjua, Madni, Cheema and Shahid, 2019). Availability of highly skilled workforce in low cost locations such as Eastern Europe, Latin America and the Far East are benefits from which managers can take advantage of by operating in these environments (Noll, Beecham, and Richardson, 2010).

As the number of firms engaging in GSD increases, several studies have been conducted to research problems and challenges occurring in these environments. One crucial element of global software projects is the intercultural factors arising when developers, testers, managers and other executives with different cultural backgrounds are required to collaborate (MacGregor, Hsieh, and Kruchten, 2005). Still, there are not only cultural factors that make GSD challenging.

Conchuir, Ågerfalk, Olsson and Fitzgerald (2009) addresses the problems associated with the software development process. The authors emphasize the role of cultural, temporal, and geographical distance and claim these cause challenges with communication, coordination, and control in GSD. Some scholars argue that these distances add to the complexity of distributed project teams by affecting communication, coordination and collaboration negatively (Zahedi, Shahin and Babar, 2016). Other scholars add less time overlap, and language differences and state that these have a negative impact on the team members which then lead to significant challenges in communication, coordination, and control (Ammad et al., 2019).

However, cost reduction and other business-related issues still draws the attention of managers toward outsourcing strategies (Conchuir, et al., 2009; UIHaq, Raza, Zia, and Khan, 2011; Niazi Conchuir et al., 2009; Niazi, Mahmood, Alshayeb, Riaz, Faisal, Cerpa, Khan and Richardson, 2016; Zahedi, et al., 2016; Ammad, et al., 2019). Benefits such as increased

product quality (Niazi et al., 2016), increased productivity (Rodger et al., 2011), time zone exploitation (24/7 development model) and increased pool of skilled human resources (Conchuir et al., 2009; Niazi et al., 2016; Ammad et al., 2019) are discussed and remain important factors of GSD.

Cultural differences, geographical distance, language and time-zone differences are widely explained. While some scholars view them as benefits (Conchuir et al., 2009; Niazi et al., 2016), others address them as challenges hampering the development process (Conchuir et al., 2009; Zahedi et al., 2016).

Further literature research led to a study on eight identity factors affecting intercultural communication in software development (Isern, 2014). The factors are cultural identity, racial identity, ethnic identity, gender role identity, individual personality identity, social class identity, age identity, and roles identity. Some factors have been widely researched previously, while others remain without attention.

This research contributes to existing literature by bringing all factors, proposed by Isern, to the surface and research each factor regarding intercultural communication and collaboration in globally distributed software development teams. Cultural difference, geographical distance, language and time-zone differences will also be addressed in this paper, forming the basis for the first phase in this study. By allowing Isern's paper to form the basis of the second phase of the study, it is possible to extend the literature further by testing cultural and personal factors and rank them accordingly.

In this study the phenomena of intercultural communication and collaboration is investigated based on the experiences of employees in a Norwegian Software Development company. The company is currently outsourcing the whole testing team and some of the software development to Ukraine and India, while some activities are kept in Norway. There are four development teams in the company, where each team is assigned a tester from India and/or Ukraine. Employees and managers engaged in the software development processes in this company are therefore required to deal with three different cultures daily.

Based on the intercultural relationship between employees in this company, the following research questions will be addressed and discussed:

RQ1: *Does intercultural communication have an impact on collaboration in Software Development teams?*

RQ2: *Which of Isern's eight factors have direct impact on intercultural communication and collaboration?*

An exploratory research design is implemented to answer the research questions. The first research question will be investigated by using a qualitative method conducting semi-structured interviews with eight employees. The second research question will be investigated using quantitative methods implementing a digital survey. The interviews will help in confirming or rejecting current theories found in existing literature, while the survey aims to test whether the eight identity factors have an impact on intercultural communication and rank them accordingly.

The findings of this research can benefit existing literature by addressing factors which previously have received limited attention. Further, firms and managers operating in similar environments can get better insight into specific challenges acknowledged by employees based on real life experiences. This can make it easier to address certain challenges and thereby improve development processes. There are however some limitations that must be considered. This study is based on a single firm with a limited number of employees and cultures which limits generalizability. On the other hand, the firm has several years of experience in the software industry and collaboration with India and Ukraine. By confining the research to one firm only, the concern of sharing sensitive information was reduced. Data collected from both interviews and the survey has therefore a great deal of depth within the field of research.

In the next section the literature review is presented, and hypotheses are developed, followed by a description of the used methodology, data collection, and data analysis. The results are divided into two phases and presented before a discussion is provided. Further, limitations and future research are considered as part of the discussion before the conclusion.

2 Literature Review

The literature review is based on research on intercultural communication, collaboration and software development. This study uses mixed methodology and the literature review is therefore divided into three sections. Based on the research done there are relatively few articles that use both qualitative and quantitative methodology which makes this study unique for this field of research. The first section of this literature review aims to elaborate on the first research question with focus on collaborating work in software development. The second section is based on intercultural communication in software development, while in the third section the hypotheses are presented, along with their in-depth reason for selection.

2.1 Collaboration in Software Development

Collaboration in software development is related to the strategy a company has implemented. Agile methodology is a strategy created on the basis that a software program requires continuous changes and updates. This methodology has had a large impact on the software development industry (Dybå & Dingsøy, 2008). There are several different “agile” methods used by software development companies. This study focuses on scrum as it is used by the company investigated. According to Schwaber and Beedle (2002), scrum is an empirical process control system used by management in situations where it is difficult to plan forward. Development is continuously driven forward with feedback loops called “sprints”. A sprint often lasts for a total of fourteen days and includes an initial and final review in the beginning and end of a sprint. The sprints include several features from the system backlog and are selected to be included or not by the project owner. To ensure the team contributing in the sprint works efficiently, a scrum master is in charge of leading daily stand-up meetings where team members can coordinate and plan their work for the day.

Furthermore, an overview of some of the highest rated and cited research papers on collaboration in software development are presented, with respect to the agile development methodology. Multiple research articles exist on agile software development. Dybå and Dingsøy (2008) used 1996 previous research studies on agile software development to create an overview of the various fields of study. 36 of the studies were categorized as empirical studies, resulting in the creation of four themes within the research on agile software

development. The first were introduction and adoption of agile development. The second was human and social factors (which will be the further focus of this study). While the third presented the perception of agile methods, and the fourth on competitive studies. Within the human and social factors, studies investigated organization culture, categorization of agile development teams and how collaborative work takes place.

There are many barriers affecting successful collaboration in software development. An article by Noll et al. (2010) enlightens this statement by looking at “collaboration as four practices related to agreements, allocating and planning goals, objectives and tasks among distributed teams”. The barriers found in the article affecting collaboration are geographical, temporal, cultural and linguistic distance. This is also observed in the study performed by Espinosa, Slaughter, Kraut and Herbsleb (2007), where interviews were used to investigate the need for coordination, effects of team knowledge and the influence of different geographical distances. The results of the study reveal that software development companies have technical, temporal and process coordination needs, depending on the role of each member.

In other studies, researchers have proposed multiple solutions to the barriers in successful collaboration in software development. Noll et al. (2010) suggested solutions “including visits, synchronous communication technology and knowledge sharing infrastructure to capture implicit knowledge and make it explicit”. Likewise, different tools supporting software development collaboration, coordination, and communication have been suggested. Favela and Peña-Mora (2001) designed a course called “Distributed Software Engineering Laboratory” to educate new software developers on how to interact with specialities from different fields. They found that developers need to communicate their decision and coordinate their activities. The course creates an understanding and they become familiar with the requirements, analysis and the collaboration technology in software development. Espinosa et al. (2007) explains that the geographical distance has a negative effect on coordination but is reduced by shared knowledge of team and presence awareness. For co-located members, shared task knowledge becomes more important in coordination in software development.

When distributing workforce over multiple locations, the communication in software development collaboration becomes even more important. Multiple researchers have investigated this matter, investigating how the collaboration and communication is impacted.

Chiu (2002) investigates design communication in design collaboration at an organizational view. How a team is organized affects communication and thereafter the performance. In addition to Dybå and Dingsøy (2008), who explains that within the field of collaborative work, researchers looked at the role of conversation, progress tracking and standardization of work. Kotlarsky and Oshri (2005) found that effective collaboration increases with “social ties and knowledge sharing”. Different mechanisms that contribute to improve social relations, is to use open communication channels and non-hierarchical communication approaches. The importance of clear messages that are interpreted properly is also mentioned. Another similar article by Nakakoji (2006), investigated knowledge sharing between developers in software development. The study investigates the interruptions and the motivational effects by this. Knowledge sharing has a great impact on developers' collaboration skills, resulting in developers creating their own communities. The study also investigates the developers peer-to-peer collaboration of knowledge.

There are also other factors that impact the agile global outsourced software development. An article by Gheni, Jusoh, Jabar and Ali (2016) investigated factors affecting global virtual performance such as language problems, cultural differences, team size, time-zone differences, lack of trust, technical problems, ICT problems and lack of sufficient training. These factors will be further elaborated in section 2.2.

Table 1. Summary of Literature on Collaboration in Software Development

Author/Year	Barriers in collaboration in software development	Proposed solutions to the barriers on collaboration in software development
Noll, Beecham and Richardson (2010)	Geographical Temporal Cultural Linguistic Distance	Visits Synchronous communication technology Knowledge sharing infrastructure (to capture implicit knowledge and make it explicit)

Espinosa, Slaughter, Kraut and Herbsleb (2007)	The following vary with each member's role: Coordination process Technical process Temporal process	Shared task knowledge
Kotlarsky and Oshri (2005)	Insufficient trust Poor social relationships	Open communication channels Non-hierarchical communication approach Quality of messages to avoid misunderstandings
Nakakoji (2006)	Weak social ties and knowledge sharing Interruptions and the low motivation	Develop interdisciplinary research
Chiu, (2002)	Poor team organization affect communication and performance	Well-structured organization Computer supported collaborative work Supporting three levels of communication, including individual, group and project
Gheni, Jusoh, Jabar and Ali (2016)	Cultural differences Language problems Time-zone differences Team size Technical problems Lack of trust ICT problems (Information Communication Technologies)	Lack of sufficient training is the highest level of effect on global virtual teams' performance

As seen in this section there are many important factors for good collaboration and coordination, including communication especially in geographical distance. The following section will further elaborate on intercultural communication in software development.

2.2 Intercultural Communication in Software Development

Research on intercultural communication began with Hall (1960), when he introduced five checkpoints of communication with different cultures: language of time, space, things, friendship, and agreements. Since 1960 these checkpoints have been developed into more separate fields of study. A definition of intercultural communication by Arasaratnam and Doerfel (2005) is described as “people of two different ethnic groups or cultures trying to communicate, perhaps despite their differences”. The definition is created based on a semantic network analysis of interviews with 15 different nationalities and is an example of how many researchers are investigating the many aspects of this field.

Cross cultural communication and intercultural communication are linked in multiple ways, but intercultural communication involves investigating more verbal and nonverbal communication between two people from different cultures. Therefore, by investigating how “interacting” bet individuals of different cultures, intercultural communication is investigated. Huang and Trauth (2007) investigated, through interviews with twelve Chinese professionals, three cross-cultural challenges in software development: the complexity of language issues in global virtual work, the culture and communication styles and work behaviours, and the cultural understandings at different levels. Although their study is based on Chinese workers, their research concludes that the most important factors to improve intercultural communication is by improving language skills, the importance of promoting an organizational culture to value the generation of innovative ideas, and facilitating such an organizational culture as well as the understanding and adaptation around it.

In a study by Redmond (2000), Hofstede's four dimensions of culture variability (uncertainty avoidance, masculinity, power and individualism) are used to investigate cultural distances and stress at universities in the United States. Competence in intercultural communication is divided into six components: language, adaption, social decentring, communication effectiveness, social integration and knowledge of the host culture. In addition, MacGregor et al. (2005) also uses Hofstede’s dimension when looking at intercultural communication factors on global software development but adds long time orientation as a model of cultural diversity. The authors look at Hofstede’s and Hall’s work to underline intercultural factors such as the Japanese concept of “not losing face” as an example of collectivist dimension. Besides in the collectivistic approach, the Japanese “exhibited a greater concern for form and

group harmony” compared to what the Americans would view as “shear efficiency” (MacGregor et al., 2005). The reason behind this perception is the differences in high and low context cultures.

The level of awareness and degree of what people pay attention to in the meaning of received information provides a model that enables the research to range communication from non-verbal (gestures, body movements, facial expressions and speaking tone) to verbal (written words or spoken words) (Hall, 1976). These are also referred to as high-context and low-context cultures and it is still one of the most used theoretical frameworks interpreting intercultural communication (Cardon, 2008). North American and Western European countries are classified as low-context countries, which means that communication usually is taken at face value without much attention to the unspoken context. Unlike Asian countries for example, where much of the communication relies heavily on the underlying/unspoken context that is at least as important as the spoken words (Peng and Meyer, 2016). The use of high and low context culture is widely used in intercultural communication (Kim, Pan, and Park, 1998).

Walsham (2002) adds to the understanding of cross-cultural development production by analysing cultural heterogeneity, cross-cultural conflicts, work patterns and culture. The research points out the importance of “culture sensitivity”. By this the author emphasizes the importance of understanding and empathising the attitudes, norms, and values of others. According to the author, when these elements are considered it offers the possibility of mutual respect and the opportunity to move forward to a more negotiated culture of cooperation in international partnerships.

Depending on the quality of the communication, productivity can also be impacted. Andres (2002) investigated whether groups have higher team productivity, higher level of interaction quality and higher team interaction satisfaction when they are using co-located teams compared to distributed teams. The results of the study exhibit that video conferencing software had less productivity than face-to-face communication in a fixed period, suggesting that managers using video conferencing software should find good solutions for the exchange of information in software development projects.

Ochieng and Price (2010) looks at cultural factors on communication that affect multicultural project environments. By investigating both external and internal cross-cultural

communication, suggestions on cross effective cultural communication were made. Managers are suggested to convey an awareness of the cultural variations and develop an effective cross-cultural trust, empathy, collectivism and communication in leadership.

In leadership it is important to see every team member as individuals and is also important in GSD. According to Arasaratnam (2015) multiple of the researched articles on intercultural communication covers individual aspects such as “personal/relational identity, cultural identity, ethnic identity, national identity, and immigrant identity”. He further argues that studying intercultural communication between people, identities, nationality and ethnicity are not sufficient. Categories of cultural distinction between blended identities should be explored further especially from a communication perspective. Considering Arasaratnam’s study, the literature can be further extended by addressing the factors proposed by Isern (2014). In the study, Isern identifies the following eight factors of intercultural communication: cultural identity factor (CIF), race identity factor (RaIF), ethnic identity factor (EIF), gender roles identity factor (GRIF), individual identity factor (IIF), social class identity factor (SCIF), age identity factor (AIF), and roles identity factor (RoIF).

Table 2. Summary of Literature on Intercultural Communication in Software Development

Author/Year	Barriers on intercultural communication in software development	Proposed solutions to the barriers on intercultural communication in software development
Hall (1960)	Language of time Language of space Language of things Language of friendship Language of agreements	Create friendship Knowledge of the economics, law, and politics of the area Understand (if not speak) the silent languages of other cultures
Huang and Trauth (2007)	Complexity of language issues Culture (cultural understandings at different levels) Communication styles Work behaviours	Improving language skill Organizational culture of valuing diversity and generation of innovative ideas. Mutual cultural learning and informal cultural learning.

Andres (2002)	Social presence and media richness have a significant impact on: team productivity interaction quality group process satisfaction	Use face-to-face setting over video conferencing settings regarding team productivity.
MacGregor, Hsieh and Kruchten (2005)	Power distance Index (PDI) Individualism/Collectivism Index (IDV) Masculinity/Femininity Index (MAS) Uncertainty Avoidance Index (UAI) Long-term/Short-term Time Orientation (LTO) High and Low Context Culture	Strategic choice of projects Accept projects only when the benefits outweigh the risks
Walsham (2002)	Cultural heterogeneity Cross-culture conflicts Work patterns Culture	Importance of understanding and emphasizing the attitudes, norms and values of others.
Arasaratnam and Doerfel (2005)	Cognitive components Behavioural components Affective components	Listening skills Global outlooks instead of ethnocentric one Other-centered style of communication

As described in this section, researchers have found that intercultural communication is impacted by personality characteristics and identity factors. The next section will draw lines between the previous two sections and explain how Isern's identity factors impact intercultural communication and collaboration in software development.

2.3 Identity Factors of Intercultural Communication

In this section hypotheses are created based on eight identity factors of intercultural communication. As seen in the previous section the individual aspect of intercultural communication is an important factor in collaboration in software development. By considering these factors of Isern (2014), a wider view on intercultural communication can be investigated against collaborative work in software development. The factors are introduced and investigated based on existing research, followed by the proposed hypotheses.

2.3.1 Cultural Identity Factor (CIF)

The first of the eight factors describe cultural issues involving values, attitudes, and habits learned while growing up (Isern, 2014). According to Isern, this factor impacts cross-cultural communication due to differences in norms and practices in the area people are brought up in. These differences may clash when individuals with different cultural backgrounds work together. Walsham (2002) investigated the variations in cultures that are affected by the different norms of behaviour and researched the people's appropriate behaviour that causes conflict in collaboration with other cultures. Scholars claim that cultural identity factors have a negative influence on communication and collaboration in software development (Jameson, 2007; Walsham, 2002). In consideration of the clarification of the factor the following hypothesis was made.

H1: *Cultural identity will have a direct effect on intercultural communication and collaboration.*

2.3.2. Racial Identity Factor (RaIF)

This factor refers to how people's conscious membership of a race impacts interaction between colleagues with different cultural backgrounds (Isern, 2014). "Race" has been widely used to categorize people into groups based on biological entities coinciding with the Darwinist belief of a natural biological hierarchy among several racial groups (McCann-Mortimer, Augoustinos and Couteur, 2004). Physical appearance has also been used to define different races or racial belonging (Thomas and Dyal, 1999; Betancourt and López,

1993). This led to research on racism, so subsequent scholars argued the scientific validity of “race” as a construct. Multiple researchers claim “race” is a social construct, and not biological (McCann-Mortimer et al., 2004). Along with the continuing debate about the scientific meaning of the term, it is also often used interchangeably with “ethnicity”, “culture” and “nationality” (Betancourt and López, 1993). Therefore, the following hypothesis is developed.

H2: *Racial identity will have a direct effect on intercultural communication and collaboration.*

2.3.3 Ethnic Identity Factor (EIF)

According to Isern (2014) this factor highlights how ethnicity impacts the interactions among co-workers from different cultural backgrounds. He further examines how European Americans are less likely to consider their ethnicity when communicating, compared to Latin Americans and Asian Americans. The meaning of “ethnicity” and the overlap with concepts such as “race” and “national identity” are widely discussed in the literature (Connelly, Gayle and Lambert, 2016). This leads to the development of the following hypothesis.

H3: *Ethnic identity will have a direct effect on intercultural communication and collaboration.*

2.3.4 Gender Role Identity Factor (GRIF)

The industry of software development is characterized by masculine dominance and inequalities in genders obtaining managerial positions and research shows that managerial positions usually are occupied by men (Arun S. and Arun T., 2002). According to Isern, this factor expresses that culture is affected by the view individuals of a culture has on the role of men and women in a society. The different views on gender roles in a society is assumed to have an impact on communication (Isern, 2014). Considering this assumption, the following hypothesis is developed.

H4: *Gender role identity will have a direct effect on intercultural communication and collaboration.*

2.3.5 Individual Identity Factor (IIF)

Individual personality, also referred to as the individual identity factor, is described by Isern (2014) as personality traits that affect communication due to differences in culture.

According to Cruz, Silva and Capretz (2015), the trait and type approach presumes that individual behaviour is affected by different inner qualities among people that forms personality. Differences in personalities are characterized by differences in how people perceive themselves, relate and think about the environment and is revealed through social and personal interaction (Cruz et al., 2015). Based on this description the following hypothesis is created.

H5: Individual identity will have a direct effect on intercultural communication and collaboration.

2.3.6 Social Class Identity Factory (SCIF)

This factor refers to the different hierarchical levels in the society, usually grouping individuals into upper, middle and lower classes (Isern, 2014). Communicating across hierarchical levels in different societies is known as vertical and horizontal communication. Postmes, Tanis and De Wit (2001) investigates how social identity looks at horizontal and vertical communication, where horizontal communication involves interacting with people within the same level of class. Vertical communication is described by the authors as communication across levels in the society, for instance at work. Social class is also affected by the cultural diversity of inclusion and exclusion. Thomas and Dyall (1999) looks at inclusion and exclusion as an important factor in the behavioural aspects of social class in different cultures. Inclusion emphasises a sense of belonging, membership or solidarity among people. Exclusion is the opposite where members of the society are more individualistic. Inclusion and exclusion are important for collaboration, according to Tamburri (2012). A consequence of engaging in globalization leads to social challenges, including social class differences. He further states that social class differences hinder collaboration in software development teams and increase the chances of failure.

Considering this description of social class identity, the following hypothesis is developed.

H6: Social class identity will have a direct effect on intercultural communication and collaboration.

2.3.7 Age Identity Factor (AIF)

This factor refers to the generation gap and how interaction is perceived between the age groups (Isern, 2014). According to the study of Ota, Harwood, Williams and Takai (2000) age identity and an individual's daily communication is closely related. The findings of the study proclaim that in the Japanese culture, age is ranked of higher importance than in the American culture. This implies that communication between age groups has a higher meaning for some cultures than others. This suggests that cultural aspects are important when considering age identity. In addition to research of one actual age for identity, there is also the aspect of the age a person feels or recognizes themselves with (Garstka, Schmitt, Branscombe and Hummert, 2004). As well as people can recognize themselves with a specific age, there has also been some research on age stereotypes which is related to age identity factor. According to Schloegel, Stegmann, Maedche and Van Dick (2016), age stereotypes are shared belief on human characteristics behaviour related to a specific age group. The authors investigated the negative stereotypes related to older employees and underlined that these stereotypes can hinder cooperation in team collaboration. Considering this, the following hypothesis is created.

H7: Age identity will have a direct effect on intercultural communication and collaboration.

2.3.8 Roles Identity Factor (RoIF)

This factor refers to how people have different roles in societies and how this affects the communication to other individuals from different cultures (Isern, 2014). Research describes the importance of investing in different roles, including family and work-related roles. The efforts invested in these roles are fundamental for role performance. However, investments in these roles are often in conflict because investing in one role can make it challenging to fulfil the demand of the other role. Thus, the issues related to work and family role investments are central to performance in these roles (Rothbard and Edwards, 2003).

According to Cohen, Birkin, Garfield and Webb (2004), communication and collaboration in software development is impacting the differences in working roles, such as a tester and a developer. The authors describe how the two roles are fulfilling each other and the typical conflicts that appear. An example of this is that a tester's job becomes more time consuming

and difficult because testers' role lacks status and support (Cohen, et al., 2004). This leads to the formulation of the following hypothesis.

***H8:** Roles identity will have a direct effect on intercultural communication and collaboration.*

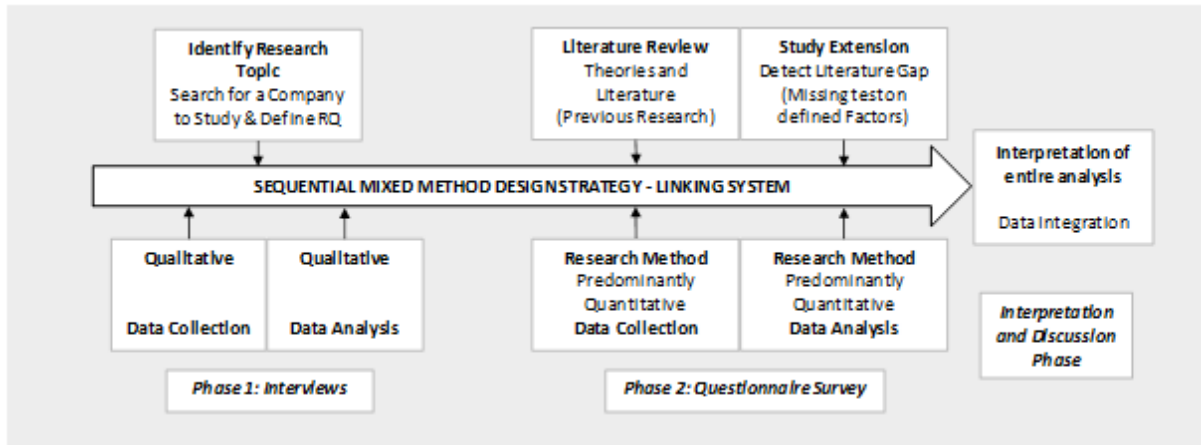
3 Methodology

This study is based on the experiences of an international company based in Norway providing software to the Norwegian public sector and the research of Isern (2014), presented earlier in this study. Due to a confidentiality agreement, the name of the company and names of the participants of interviews are redacted and withheld. The company in question will from here on and onwards be referenced to as “the firm”.

Qualitative research methods are usually used to explore why or how a phenomenon occurs, while quantitative methods usually discuss questions regarding causality, generalizability or magnitude of effects (Berman, 2017). Therefore, qualitative methods have been used to explore why and how issues occur in distributed teams (RQ1). A survey is also conducted to discover to what extent Isern’s eight factors affect intercultural communication, and whether it can be generalized in the terms of globally distributed software development teams (RQ2).

This study uses a sequential exploratory mixed method design. An exploratory research design combines qualitative and quantitative methods to neutralize weaknesses and exploit the strengths of each method (Bhatti and Ahsan, 2015). Instead of fully basing quantitative research on the qualitative findings, the study combines only those parts that are relevant for RQ2 to explore additional factors. This provides a better understanding of implications and challenges occurring in global software development. Additionally, the impact of several factors is addressed in terms of intercultural communication and collaboration. The methodology is outlined in figure 1.

Figure 1. Sequential Exploratory Method – Mixed Method Strategy



Note. Adapted from Tone, Skitmore and Wong, 2009, Journal of Construction Management and economics, 27(4), pp. 344.

Figure 1 illustrates that the first step in sequential mixed method design strategy is to identify a research topic. After identifying the research topic, collaboration with a company to work with was found and the first research question was developed. Interviews were conducted as part of phase 1 to investigate challenges employees in the firm may experience, and how they overcome these challenges. Thereafter, a survey was conducted to explore whether there are other factors influencing their communication and collaboration processes. Additionally, some of the factors mentioned during the interviews were considered in the survey (phase 2). The identity factors proposed by Isern was used to create the questionnaire survey in order to identify whether these factors also have an impact and to which extent they matter in the case of this firm.

The first phase addresses the first research question using semi-structured interviews conducted with eight employees of the firm (seven from Norway, and one from India). The population consists of employees in the firm and the sample was chosen by the company representative to ensure that the questions are answered by relevant candidates. The sample consists of individuals with different positions such as managers, testers and developers, who are involved in both the development processes and daily interaction with international colleagues. To ensure better insight and depth in the data collected the interviews were semi-structured, and questions varied according to the interviewee's position and experiences.

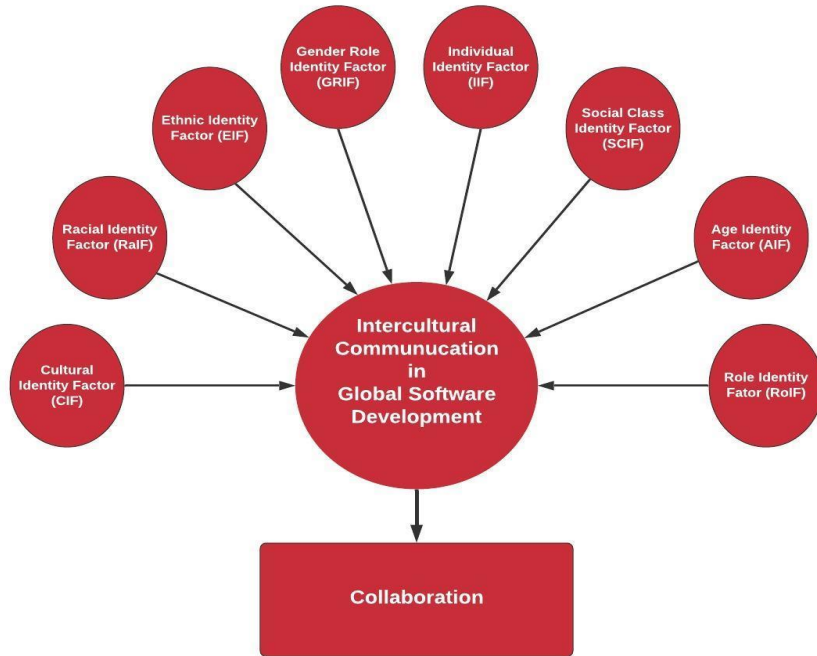
The second phase consists of the questionnaire survey used to address the second research question and the identified hypotheses. An online survey was conducted to test the factors of

Isern's study and to rank them accordingly. The main questions of the survey are based on a seven-point Likert scale where one is rated "Very Low Impact" and seven "Very High Impact", followed by control questions to support the validity of the survey (see Appendix II).

In order to measure Isern's factors, previous research measurements of the same constructs were investigated (McKenzie and Crowcroft, 1994; Connelly et al., 2016). Factors like individual personality and social class identity were difficult to measure and have been measured based on definitions and explanations given in subsection 2.3. Culture was measured using verbal (written/spoken words and language) and nonverbal (gestures, body language, intonation, facial expressions observed) communication based on the theory of Hall (1976) regarding high and low context cultures. Collaboration was measured by looking at the organization structure, collaboration technology, and frequency of communication (Noll et al., 2010).

Communication and collaboration are often used together in the literature. According to Noll et al. (2010), communication can be a barrier for collaboration, but communication is also often used to measure collaboration. Therefore, the study assume that communication and collaboration go together, hence when communication is directly impacted, it will have an indirect impact on collaboration. This leads to the development of figure 2.

Figure 2. Framework of Dependent and Independent Variables



Note. Adopted from Ammad et al., 2019, IEEE Access 7(1), pp. 171654.

Figure 2 illustrates the proposed effects of each factor, demonstrating that CIF, RaIF, EIF, GRIF, IIF, SCIF, AIF and RoIF have a direct impact on intercultural communication. Collaboration is impacted by intercultural communication illustrated by the indirect impact of each factor.

3.1 Data Collection

In the first phase, semi-structured face-to-face interviews were carried out with eight candidates (seven from Norway and one from India). The questions were kept somewhat open to allow the respondents to answer as honest and intuitively as possible, and also to get as much information as possible relying on their individual expertise and experience. The interviews were held in Norwegian to ensure complete and comprehensive answers from Norwegians (Sekaran and Bougie, 2016) and in English with the candidate from India.

The interviewees were asked to describe their job in their own words and to tell about how they perceive the communication with their international colleagues. In addition, interviewees were also asked how time zone differences and linguistic challenges affect their job. Other questions were related to collaboration looking into frequency of communication and type of medium used to communicate.

To get better insight, candidates with different roles including testers, developers and managers were interviewed. The interviews typically lasted for one hour, with one interviewee and two interviewers present. One of the interviewers mainly took notes while the other asked questions. All interviews were recorded and later transcribed by the interviewers.

For the second phase, data was collected using a questionnaire survey consisting of 19 questions in total. The digital survey was sent to 56 employees located in India, Ukraine and Norway and received 35 answers (62.5%). The survey was designed to answer the second research question and the questions were composed in accordance with the eight factors proposed by Isern, with the objectives to test their impact on the intercultural communication and collaboration experienced by employees in this particular company. Each question directly connected to the factors included a definition (as given by Isern) to the corresponding factor prior to the question. Each such question was followed by additional questions related to the factors, measuring the factors to ensure reliability of results.

The literature review was helpful in creating the questions for the interviews and survey, as well as providing additional information based on the results of other researchers. Findings from the literature review can help support the reliability and validity of the findings or discover weaknesses in this study.

3.2 Data Analysis

After the interviews, a thematic analysis was conducted. By categorizing identified patterns of the data collected, factors impacting intercultural communication on collaboration were identified. The identified factors are geographical distance, time zone, respect for authority, high versus low context culture, technical knowledge, working roles and language barriers. These are further explained in the results and discussion sections.

The assumptions of Isern were converted into hypotheses in section 2. To test whether the assumptions are applicable to the population or not, a t-test is used. One sample t-test is usually used to test hypotheses by comparing the mean of a sample with a standard. Data collected from the survey was analysed using SPSS and conducting a one sample t-test to test the hypothesis related to each of the eight factors. The statistical test was chosen based on characteristics of the sample (number of samples, independency, and sample size) and type of data collected (no outliers, Likert Scale - approximate to a continuous scale). Averages were also calculated to rank each factor according to their perceived level of impact.

4 Results

The findings from the interviews and the survey are presented in this section. The most repetitive answers from the interviews are discussed first, followed by the survey results and hypothesis test. The data collected shows different cultural and managerial factors impacting intercultural communication and collaboration in the software company. This is further discussed in the discussion section of this research paper.

4.1 Phase 1: Results from Interviews

To answer the first research question, eight people were interviewed. As seen in table 3, seven of the interviewees are from Norway and one is from India. Most of the respondents are developers with more than 15 years of experience within software development, while the firm has approximately eight years of experience with outsourcing parts of their operations to India.

Table 3. Summary of Respondents Demographics - Interviews

Code	Nationality	Position	Experience
1	NOR	Manager	15 years
2	NOR	Developer	12 years
3	NOR	Developer	20 years
4	NOR	Developer	16 years
5	NOR	Developer	2 years
6	NOR	Manager	13 years
7	IND	Tester	36 years
8	NOR	Manager	34 years

Several topics emerged from the thematic analysis of the interviews. The topics addressed the participants' perception of their work in software development due to collaborating in intercultural communication teams and how communication factors have affected this. Communication depends on the relationship between the colleagues with different cultures. Individuals change and adjust their behaviour both consciously and subconsciously depending on various factors.

From the interviews the following themes emerged as factors impacting the communication: communication arena, geographical distance and time-zone differences, hierarchical mindset, cultural differences, technical knowledge and working roles, and language barriers. The findings are divided into subsections which have been drawn from the analysis. Quotations are provided to give an example of an observed phenomenon.

4.1.1 Communication Arenas

In the department of the company investigated in this study there are 40 employees working as testers, developers and managers, and are divided into four teams. Every team has at least one tester at every time, but the testers change teams every third month. The teams also schedule regular meetings according to the agile methodology, which last for 15 minutes and contain a status update every day. A status update and a 30-minute lasting meeting is also held every 14th day where the current and next sprint is evaluated.

By using the agile methodology, instant changes can be done during a sprint. Communication is mainly done through the Microsoft software “Teams”. A dashboard with development and testing tasks is also connected to emails, so if there are any updates or comments tagged with a task identifier, the tester or developer gets a notification. This system allows employees from different countries to communicate and collaborate with each other and it has proven to be effective for several years. The company started their software outsourcing in India approximately eight years ago. Employees therefore now have significant experience of collaborating with employees of other cultures. Respondent 3 explains how communication is currently happening in the company:

“We use Teams. It is a software provided by Microsoft. We use Teams all the time - it has taken over for Skype. Teams have both voice communication and text chat. The application also has similarities to Facebook, with channels and with posts and you can call people too. And it works fine. We don't use web-cameras that much, but we use them in meetings. When I am at work, I normally only use my headset, but sometimes we might also share our screen with each other to show each other things.”

As observed in the quote, there is not much use of cameras. Respondent 2 does not use a camera on the daily meeting, but respondent 3 and 5 explains that it is used once a week or every 14th day. The other respondents did not mention using cameras during meetings. Here is an additional quote to the use of camera from respondent 1:

“Some choose to have the camera on, but others do not. Usually there are three cameras on. For me it can be a bit confusing with 10, 15 cameras on where people are moving. After all, it is what they say that is most important, but then you do not see body language and stuff like that. Still, you get confused by all these people moving in the background. It is easy to get distracted by something. They have something called a turnmaster... It's a terminology that is part of the process we have. It leads to everyone being told to say something, it goes around who has the word.”

Employees in this company are in daily contact with people with different cultures. However, one of the respondents commented that he/she is not always aware of the nationality of the recipient. The respondent could not answer the question regarding the differences between interacting with Indian and Ukrainian colleagues.

All the respondents were however satisfied with the communication tools and using an agile methodology in software development.

4.1.2 Geographical Distance and Time-zones

Creating a good virtual work environment where everyone is listened to and responded to in the right way is challenging, even for a manager that is physically present in a team. The engagement from leaders is difficult when the communication is through audio, video or chat/email functions. The result of not being in the same office creates challenges for managers to engage and encourage members of the team. Respondent 1 commented the following regarding this.

“...core of communication, the closer you sit the more engaged you become. When they are sitting on the other side of the globe and have repetitive work tasks it impacts the work engagement. It is not the same as sitting in the same office. Then you would have more to talk about too.”

The respondent mentions that the manual testers often have repetitive work tasks, and this can lead to lack of engagement at work. Most of the Norwegian respondents mentioned that working would be easier if their co-workers in Ukraine and India were in the same office as themselves. The relationship inside an office would normally create informal communication and would create a better relationship between the co-workers. Furthermore, some of the respondents added that it would be inefficient and time consuming with too much informal communication during work hours.

Another prominent difference emerged from the analysis in regard to communication pattern due to time zone differences. To be able to understand how the communication is affected by time zone differences, respondent 1 explains the following.

“There are not that many meetings, and some things are best to discuss over Skype, but because of the time-zone this becomes difficult. When I arrive at work between 8 and 9, they have lunch in India, so we only have a small window of two hours before I go to lunch. They have meetings over there as well. Therefore, it is best to discuss over email or chat.”

Collaborating on different geographical distances is a factor of problems in intercultural communication. In India there is a 3,5- or 4,5-hour difference depending on daylight savings time from Norway, and Ukraine has a 1-hour time difference from Norway. Before the Norwegian team starts their working day, the testers in India have already been working for approximately three to four hours. As a result, the Norwegian and Ukrainian developers have multiple testing questions ready for them when they start their day, as explained by respondents 6:

“The tester is ready to ask new things once I log on to my computer in the morning.”

There has been some tension towards the working hours as well. One respondent from Norway has been living in India and said that Indians often value their family time during the morning. By starting their working day later in the day, they get closer to the Norwegian and Ukrainian time zones.

4.1.3 Hierarchical Mindset

Some people tend to adjust their communication when interacting among people with different social classes or hierarchical levels. Factors impacting this might be social network, salary, and education. Research on cultural differences highlights the differences of hierarchical levels in society and has an impact on communication. Communication between a person in a higher hierarchy level needs a higher level of respect in some countries, and this is more known to some than others. This can be confirmed by the following quote by respondent 4:

“It is clear that the business culture would have been quite different if they had been Norwegians, due to how one perceives the hierarchy. But on the other hand, if they were to come here and work in our building, then I guess it would have been different. Because then they might have incorporated a better understanding that we are a more horizontal oriented organization, and maybe then they would have been more engaged. So, I do not necessarily think that it is Indians, but rather the environment they work in that is the challenge.”

Organization structure is also mentioned. Since it is a Norwegian firm, people from Ukraine and India need to adjust to the way Norwegians work. They need to adapt the right communication style, to be able to develop a beneficial collaboration. Respondent 8 has been working with the test team in India and mentions the following of his experience.

“If you set 20 Indians in a room together, they would create 10 levels between them.”

“Indians are like most people... It is a variation between them as it is for Norwegians. But there is a big cultural difference, and the biggest is the respect for authority and it actually hinders good teamwork.”

This is a challenge for the managers in the company. Even though there are employees working from India and Ukraine, managers work towards achieving a common understanding of how to work together. Respondent 6 confirms this in the following explanation:

“Trying to remove the line between being a developer and being a tester... it's not to keep in the dark that a tester is lower in status than a developer, like purely hierarchical speaking. So, try to remove these differences and make the team

understand that we are actually one team and we should work together and solve the tasks together.”

One of the questions was regarding the tone and adjustments in communication when interacting with people from different cultures. The answers suggested that communication especially with testers from India were normally in a formal tone and the content was only work related. The respondents explain that most of the time the tone between them is okay or good.

4.1.4 Cultural Difference

One of the first respondents explained that a “yes” for a person in India may not have the same meaning of how a Norwegian person would interpret the word. This can be linked to high and low context culture theory. Therefore, the following respondents got a question to confirm or deny this statement. Respondent 2 confirmed and added the following.

“...I often feel that some Indians say yes even though they haven't understood anything...”

This statement has been confirmed by three of the respondents, but not in recent times. Two of the respondents disagreed with the statement.

Additionally, some respondents mentioned that Ukraine is in many ways more similar to Norway than India, in terms of executing a specific job. Respondent 1 explains:

“In India, the culture is that they work less independently, they require closer follow-up. They need a more detailed description of work tasks. In Ukraine it is the opposite, where they are more independent and do not need detailed management. ... One does not get questions regarding general tests in India, but in Ukraine questions are asked regardless.”

Indian testers need more controlled monitoring because they are reluctant to ask additional questions when a task is given, and it can be time consuming. Respondent 8 explains how he has experienced working together with those in India.

“One must specify thoroughly. What I have experienced is that the fear of asking what to do is greater than making mistakes.”

To put it on the edge, respondents 8 continues with an example of how specific managers must be:

“If you ask an Indian to build a car without wheels and steering wheels, they would do it without asking any question on how you plan to drive the car. This is quite the opposite of how Norwegians would do it, they start by looking for missing parts in the specifications to do what is actually asked for. (...) Indians have very high respect for authority. Norway has probably too low respect for authority.”

Another example of this is described by respondent 6.

“If you ask an Indian to build a house, you might receive the most beautiful house you have ever seen. But you get a house, without a door and windows. Because you did not ask for it. So, one must specify thoroughly. (...) While Ukrainians would have asked how many windows you want, and where you want them to be.”

Respondents 1, 2 and 4 mentions that some of the communication is based on a person's personality as well as their culture. Respondents 4 elaborates on this with the following:

“It is clear that they have another business culture, and I think that it impacts their personality. But I think that your personality matters anywhere you are with whomever. ... It varies again from person to person. Personality to personality on how they write, extensively, added a video or if it is only the test.”

4.1.5 Technical Knowledge and Working Roles

The relationship between developers and testers can be problematic to some, as the developers create software, and the testers attempt to break it. On one hand the developers want to protect their work, and on the other hand the testers discover, and present mistakes made in the code. This kind of relationship requires good intercultural communication, collaboration and trust towards each other. One year ago, the testers were included in developers daily stand-up meetings, but due to change towards a cloud-based system the

demand for manual testing was reduced. The testers are included earlier in the development process, due to changes towards increased knowledge sharing between the two working roles. Testers have a great deal of domain knowledge while a developer has high development skills. When including a tester earlier in the development process they can provide valuable input with their domain knowledge. Here is a statement from respondent 2 on how communication between the roles happens:

“If testers find something, they send an email. They write it on the task board, and then it is sent automatically to me. If there are any questions, then we use Teams to chat. We also use Teams to voice chat if it is not sufficient to just chat. It does not happen very often. Now, I don't have that much contact with the testers because I work with larger tasks. So, it is not that often I send anything to testing. Larger tasks require less communication.”

In addition to how the communication takes place, questions were asked regarding how often the respondents were in contact with their colleagues abroad. Respondent 2 explains the following on how often communication is happening.

“If I have sent anything in for testing, then 50% of the time they contact me for something. It might be about something that is not set-up correctly, or that they find an error or bug, but if they do not discover anything special then I hear nothing from them. They will just pass it on.”

Respondent 1 and 5 are in daily contact with their colleagues in India. Respondent 5 is more in contact with the Indian developers but estimates that he/she is in contact with the testers from India approximately three times per week. Respondent 1 also commented on how quick the communication is when interacting with the testers in India:

“They respond to mail fairly quickly, but that is not their first priority. They prioritize testing things. If I need instant contact, I will use chat. I have actively been working to reduce online meetings, because it is ineffective due to poor preparation and the effectiveness of meetings halts after a while. We used to work in an open landscape with several meeting rooms available, but now we need to book a meeting room and we do not have many of them.”

The testers do not have the same knowledge as the developers do. Even though the relationship seems to be acceptable most of the time, there are underlying feelings towards between them. When asking about the tone between the testers in India respondent 2 answered the following:

“It is difficult to explain. It is formal communication with the testers in India. Those in Ukraine are developers and I feel like we can be more playful with each other. With India we only talk about what we need and nothing else. It somewhat feels like we are complaining on each other.”

4.1.6 Language Barriers

The importance of fluent English skills in software development has been investigated in previous research. Most of the respondents claim they do understand each other when interacting on a daily basis. In events where unclear messages occur, the usual underlying cause is normally work related and not based on language difficulties. Respondent 2 explains the view of how communication is towards the Indian and Ukrainian colleagues:

“I see that it is easier to communicate with those in Ukraine than those in India. Although there are different roles. I think it has to do a bit with language too. It is sometimes a little difficult to understand what they mean. They both say words a little weird, so it is a little difficult to understand them, but I have gotten used to it. They also have a different culture. It just seems like they just say yes, even though they do not understand things. Then sometimes I get a little frustrated, because I find that they often misunderstand and that there are misunderstandings. Not because they are testers, but because they are from India. Also, it can be how much domain knowledge the testers actually have.”

One of the reasons why Indian English is different to Norwegian English is how it is taught in school. In India, an old version of business English originating from the colonial times is still taught at school. Therefore, it was interesting to investigate the respondents` thoughts on the language differences. Respondent 5 explains the communication with Indian testers:

“So far it goes well. Sometimes you have to ask twice. But otherwise the communication goes well. Never informal conversations always just work related. They have a very formal tone. Indians are very polite, but so it is probably because they are very formal. They say for example, “good evening”. It is not something you use that often here in Norway. It often feels like they look up to you, but it becomes something else when they write politely.”

Respondent 8 presented two other examples in the following quote:

“Yes, they use some different words for things. It is from the colonial times. If you ask to elaborate something, they will say: CAN YOU FURNISH THE DETAILS? Instead of elaborating they say furnish the details. It is an elegant style. And if you are moving out from an apartment to another. They do not say move but say SHIFT. I do not remember more examples, but they utilize a different vocabulary.”

As well as there are many linguistic differences between Norwegian-English and Indian-English, there are also some positive responses towards Indian verbal communication.

Respondent 8 added from the previous quote with the following quote:

“Indians are better in English than most Norwegians, it is just their accent that makes it difficult to understand sometimes.”

In addition to the Indian language differences, respondent 1 gives an example of language differences with the Ukrainian colleagues.

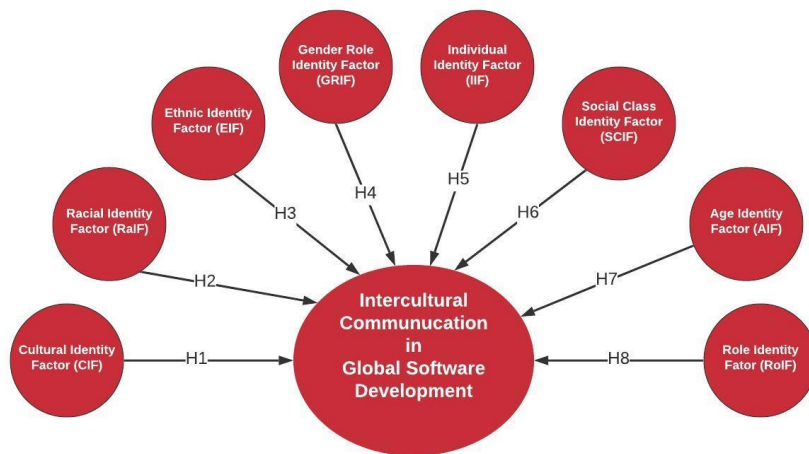
“... then it comes to the writing. They tend to use words with different meanings. Like NO and NOW, there are two different words with different meanings, but sound similar. Such words are sometimes used the wrong way.”

This type of mistake can cause misunderstandings and make communication more demanding sometimes.

4.2 Phase 2: Results from Survey

To answer the second research question and test the hypotheses, a quantitative approach was used. Although some scholars (Gheni et al., 2016) have identified some of these factors as significant in these terms previously, not all of them have been tested before. Therefore, a digital survey measuring each factor and testing the hypotheses was created. The figure below illustrates the research in this regard and each arrow pointing to “intercultural communication” represents a corresponding hypothesis.

Figure 3. Proposed Conceptual Framework with Hypotheses



Note. Adopted from Ammad et al., 2019, IEEE Access 7(1), pp. 171654.

This figure illustrates each of the mentioned factors impacting intercultural communication. As mentioned in the methodology section, a direct impact on communication implies an indirect impact on collaboration. This assumption is considered in the analysis of survey results.

When conducting empirical investigation in descriptive statistics, details of the sample are very important. A closer look at the participants' basic information can be helpful to infer the results (Ammad, et al., 2019). Therefore, the demographic information in this study was gathered and structured in a table (Table 3) as done by Ammad, et al. (2019). Participants' gender, country and the position they obtain is included in table 2, below.

Table 4. Summary of Respondent Demographics - Survey

Demographics	Respondents	Frequency	(%)
Gender	Male	29	83%
	Female	6	17%
Total		35	100%
Country	Norway	19	54%
	India	6	17%
	Ukraine	10	29%
Total		35	100%
Position	Tester	7	20%
	Developer	19	54%
	Dev. Lead.	3	9%
	Other	6	17%
Total		35	100%

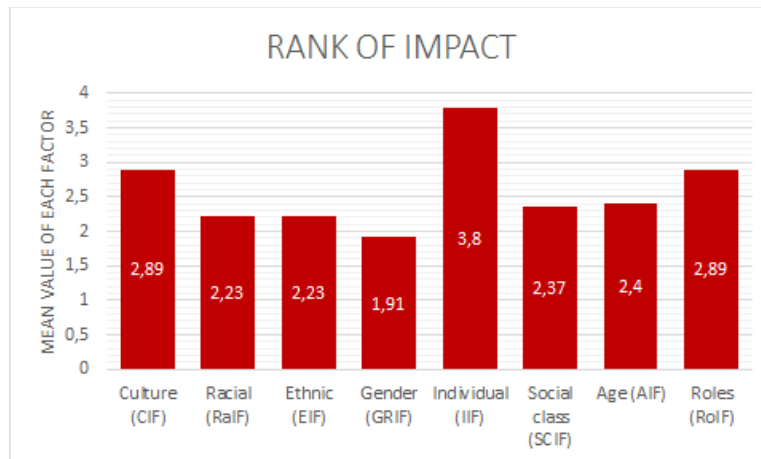
Note. Adopted from Ammad et al., 2019, IEEE Access 7(1), pp. 171661.

Gender distribution is uneven, which is not unusual for the software industry. As reported in table 2, most employees are male (83%) and only six respondents were female (17%). The same trend can be seen in Ammad et al. (2019) and Khan, Basri and Fazal-e-Amin (2014). Since this study focuses on the industry of software development, most participants are developers (54%) and testers (20%). A good communication and collaboration flow among these team members is very important in the context of software development.

As shown in the table, most respondents come from Norway (54%) and few of them are from India (17%). This is due to the distribution of employees in the firm. The majority of employees and operations are located in Norway while there are less employees in Ukraine and the least number of employees in India. The test team is mainly located in India and the developers are mainly located in Norway. This may cause some bias to the findings since the Indian culture is underrepresented. Still, this study is investigating the total effects of communication and collaboration in this firm and are not concentrated on one specific culture.

Further, the factors are ranked according to their level of impact and presented in figure 4. The ranking is based on data gathered from the survey using a seven-point Likert Scale where; 1-Very Low Impact, 2-Low Impact, 3-Some Impact, 4-Neutral, 5-Moderate Impact, 6-High Impact, and 7-Very High Impact.

Figure 4. Ranking of Isern's Eight Factors of Intercultural Communication



Note: Adapted from Kumar, S. A., & Thangavelu, A. K. (2013). In 2013 International Conference on Computer Communication and Informatics, pp. 1-10.

The vertical axis represents mean values calculated from survey data, while the horizontal axis shows each factor addressed in the survey. After analysing the frequency of answers given by the 35 respondents (out of 56) calculations were made on the averages to find which factor is perceived as the most significant by the employees in this firm. As shown in figure 4, individual identity scores the highest, meaning this factor is perceived to have the most impact when it comes to intercultural communication and collaboration. Then followed by cultural identity and roles identity, which appears to be the second most important factors impacting communication and collaboration in the firm. Gender Roles Identity scores the lowest with an average of 1.91 which implies almost no impact or very low impact.

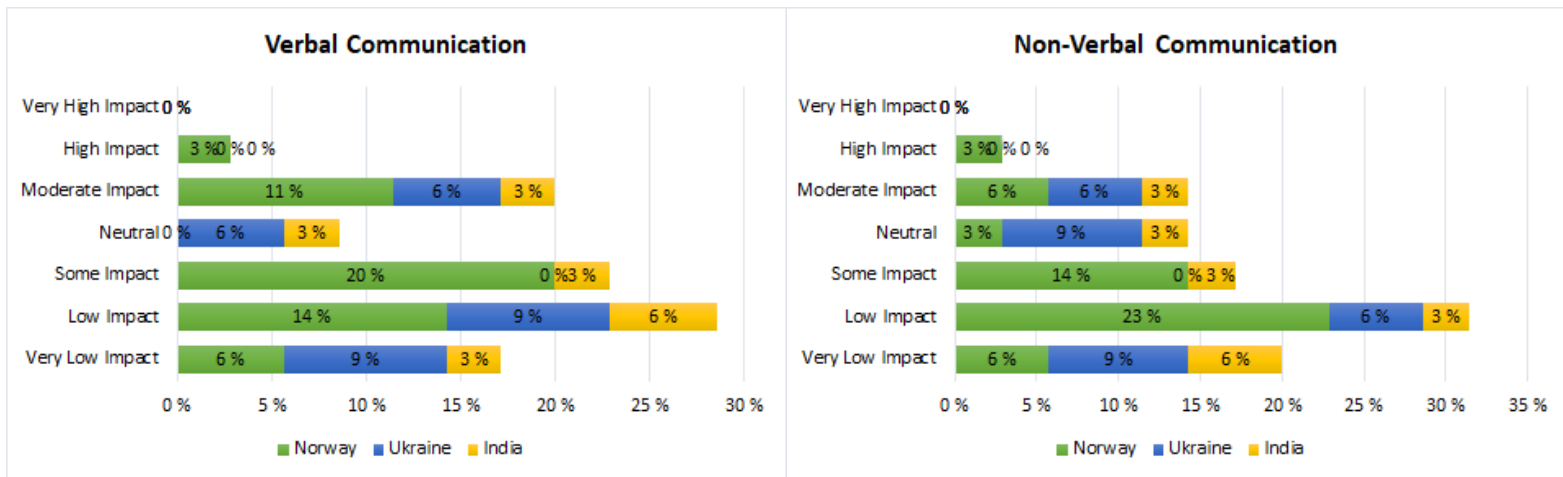
To add validity to the survey in addition to Isern's factors additional questions measuring each factor was asked. All percentages are calculated based on the total number of respondents (e.g. divided by 35).

4.2.1 Cultural Identity Factor (CIF)

To measure cultural identity, question was asked about verbal and nonverbal communication habits each respondent have observed during interaction with their international colleagues. This measurement was established based on Hall's theory of high-low context cultures (Hall, 1976). The results are presented in figure 5 and 6 below.

Figure 5. The Impact of Verbal Communication

Figure 6. The Impact of Non-Verbal Communication



In total, verbal communication is perceived more significant (20% said it has moderate impact) than nonverbal (15% said it has moderate impact). As seen in figure 5 and figure 6 there is a higher tendency for low impact than overall high impact. This indicates that both verbal and non-verbal has a low impact on the cultural communication and collaboration at the firm. Even though cultural identity factor has a high average ranking score, there might be other factors in the firm that have a higher impact on the verbal and non-verbal communication. In total, both verbal and nonverbal communication has either some impact (40%), moderate impact (35%), or high impact (6%) according to the respondents.

According to the question directly addressing this factor (CIF), it scores second highest on the scale (Figure 3), hence assumption can be made that this factor does impact intercultural communication and collaboration.

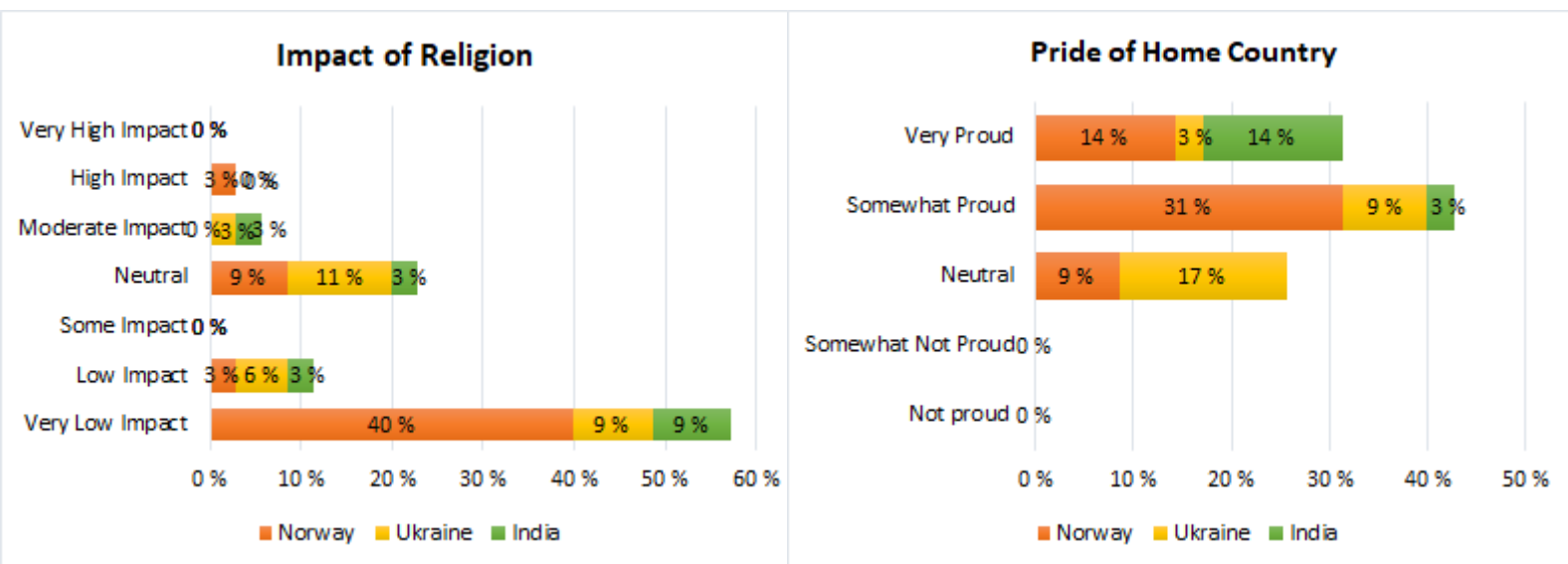
4.2.2 Racial Identity Factor (RaIF) and Ethnic Identity Factor (EIF)

Culture is closely associated with conceptions like “race” and “ethnicity”. Betancourt and Lopez (1993) states that this misconception is an obstacle in the matter of cultural studies.

Based on the definitions given by Isern (Literature Review section) and Connelly et al. (2016) studies on ethnicity, additional questions were asked, and results are presented in figure 7 and 8.

Figure 7. Impact of Religion

Figure 8. Proud of the Country Origin



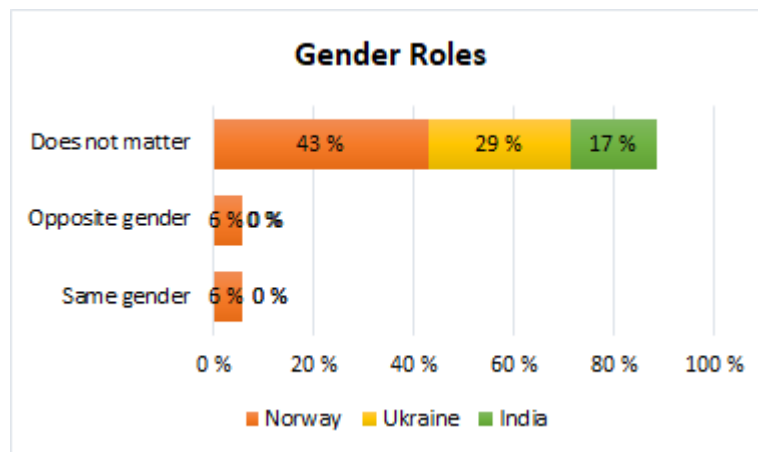
Most respondents (58%) chose “Very Low Impact” when asked to rate the level their religion impacted the sense of who they are. When asked “how proud” they are of the country they were born in, 31% chose “extremely proud” and 40% chose “somewhat proud”. Nobody showed low pride in their country of origin. It is important to note that this may not indicate that ethnicity and race have a huge impact on their daily habits. Nationality is often associated with culture and addresses groups of people sharing similar values. Scholars also note that the concepts of race, ethnicity, and culture are often used interchangeably and inconsistent (McKenzie & Crowcroft, 1994; Connelly et al., 2016). This adds uncertainty related to measuring the factors, which will be addressed in the limitations section (5.1).

Based on the questions addressing these factors directly, the results (Race mean = Ethnicity mean = 2.23) reveal that the impact on intercultural communication and collaboration is quite low (see figure 4).

4.2.3 Gender Role Identity Factor (GRIF)

When asked whether gender roles had an impact on communication and collaboration at work, most respondents replied that it had very low impact which in this case is the lowest value on the Likert Scale. Additionally, participants were asked whether they preferred working with the same or opposite gender. Results are presented in figure 9, below.

Figure 9. Gender Preference in Collaborative Work



Approximately 89% (43% + 29% + 17%) said gender did not matter, and around 6% preferred working with same gender and 6% preferred working with opposite gender (figure 9). This adds validity to the results shown in figure 4, illustrating that gender role is not a significant factor, scoring the lowest with a mean of 1.91 (see figure 4).

4.2.4 Individual Identity Factor (IIF)

Individual identity has been mentioned several times in the interviews being the most important factor to consider when studying the field of collaboration and interaction among a group of people (team members). Several interviewees emphasized the importance of individual personality being more significant and important than differences in culture, language and time zones. This can also be seen in figure 3, with IIF scoring the highest of all factors with a mean of 3.8.

Nonetheless, an additional question was asked to test this factor more thoroughly, results are presented in figure 10, below.

Figure 10. Individual Personality in Collaborative Work

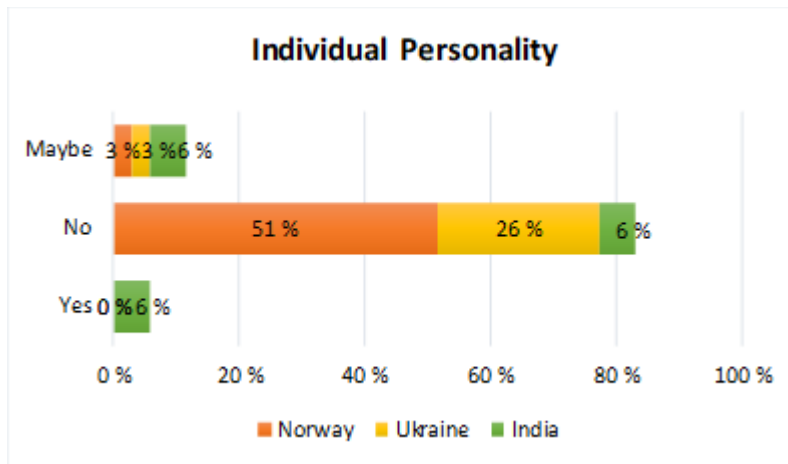


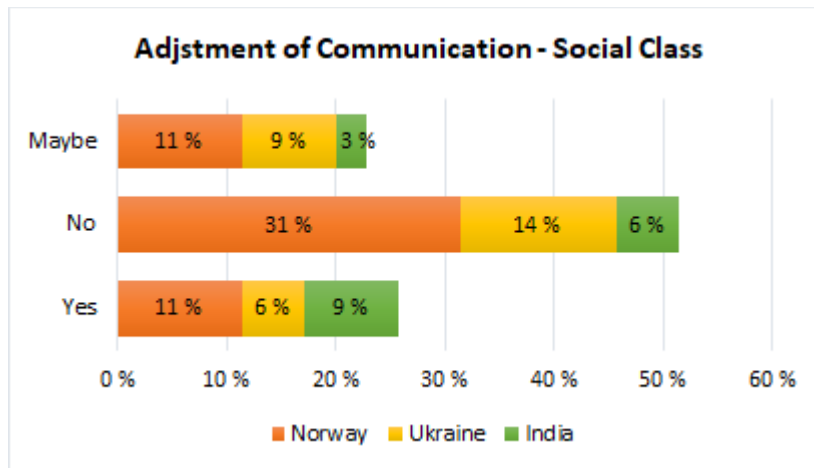
Figure 10 shows that the majority does not consider themselves as better persons compared to their colleagues. Nevertheless, this may be a weak measurement for individual personality. This factor encompasses individual personality which is a quite comprehensive phenomenon that is demanding to measure. Several tests and studies are suggested aiming to measure and determine different personalities and characteristic traits.

4.2.5 Social Class Identity Factory (SCIF)

Looking at the data from the survey, one can observe that on average this factor has a limited impact on communication and collaboration with a mean of 2.37 (Figure 4).

To better measure this factor, an additional question was added (ref. Appendix II) asking participants whether they adjust verbal and nonverbal communication when interacting with colleagues in different positions (tester, developer, manager). The results are shown in figure 11, below.

Figure 11. Adjustment in Communication – Social Class Awareness



The total result indicates that only 26% adjust their communication style depending on who they are interacting with. The majority, 51%, do not adjust their communication style when interacting with colleagues in different positions. However, looking at the distribution based on each country (colour codes), it can be seen that Norwegians and Ukrainians are less likely to consider social class and status when communicating, while most Indian employees do adjust their communication style. This tendency has also been mentioned by the interviewees (hierarchical mindset).

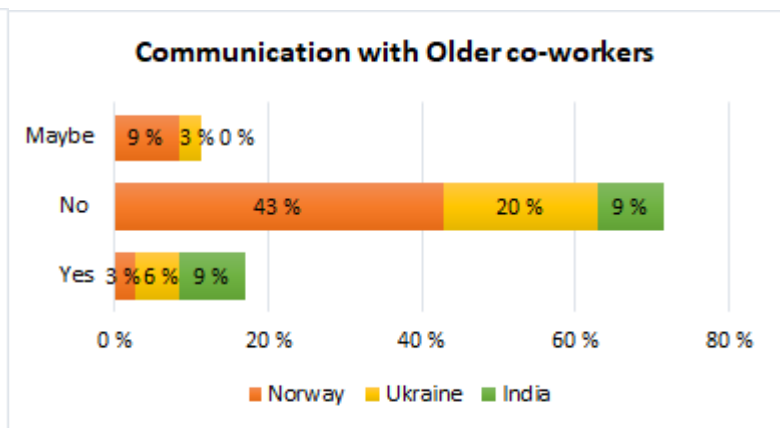
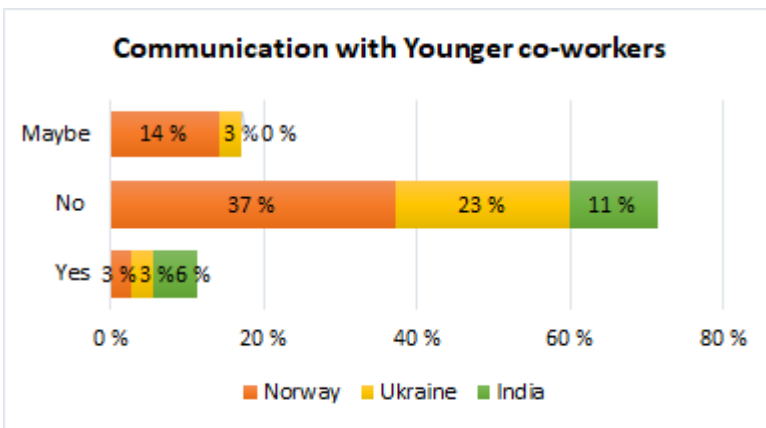
4.2.6 Age Identity Factor (AIF)

Age is one of the factors that has not been researched to a large extent previously. Some interviewees have commented on this factor as well.

This factor scores 2.4 (see figure 4) indicating the impact is relatively low when it comes to communication and collaboration. Most respondents claim that they do not adjust verbal and nonverbal communication when interacting with older or younger colleagues (72% and 71% accordingly in figure 12 and 13).

Figure 12. Communication with Younger Colleagues

Figure 13. Communication with Older Colleagues



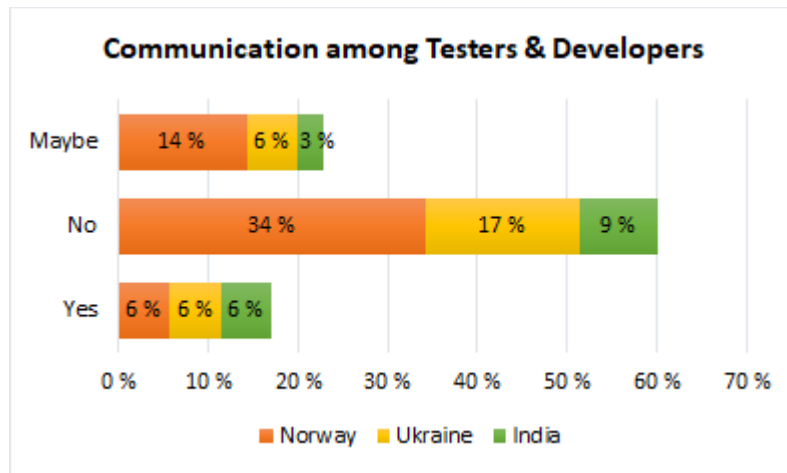
These figures suggest that age does not have a significant impact on communication and collaboration in this firm.

4.2.7 Roles Identity Factor (RoIF)

Based on the survey data, roles identity appears to impact communication and collaboration to the same extent as culture - both culture and roles identity scores an average of 2.89. This indicates that the impact of roles identity is significant in this matter.

From the survey one respondent commented that he/she adjusts the level of technicality when communicating with testers, due to their technical background. This was also noted during the interviews when talking about the educational background and previous experience with the interviewees. As the teams consist of people with different experiences due to their age and background, they obtain different roles, and sometimes it will have an impact on the communication and collaboration process. In figure 14, data from the question regarding communication between the different positions at work are presented.

Figure 14. Communication among Testers & Developers



The majority (60%) claim that they do not adjust communication depending on who they are interacting with. Meanwhile, only 18% are consciously adjusting their communication style. As previously mentioned, this may be caused by different technical and cultural issues as well as respect for the position of others.

4.3 Testing the Hypotheses

Since questions related to race, ethnicity and religion may be sensitive and controversial to some, adjustments were made to correct for the bias this may bring by lowering the test value equal to two. According to the scaling used in the survey, an average of two will imply that the average perception of the impact of a factor is “low impact”. This indicates that there is an impact. The significance of the impact is tested using a statistical method - one sample t-test as described in the data analysis section.

To test the hypotheses and evaluate them, a one sample t-test was conducted in SPSS, calculating mean difference, standard deviation, t-values, p-values and standard error. These calculations are presented in table 5.

Table 5. Evaluation and Analysis of T-test

Hypothesis Testing	Mean Difference	SD	t-Value	p-Value	Std. Error	Results
H1: CID → ICC & Collab.	0.886	1.568	3.346	0.002	0.265	Supported
H2: RaIF → ICC & Collab.	0.229	1.395	0.969	0.339	0.236	Not Supported
H3: EIF → ICC & Collab.	0.229	1.374	0.984	0.332	0.232	Not Supported
H4: GRIF → ICC & Collab.	-0.086	1.245	-0.407	0.686	0.211	Not Supported
H5: IIF → ICC & Collab.	1.800	1.677	6.351	0.000	0.283	Supported
H6: SCIF → ICC & Collab.	0.371	1.374	1.599	0.119	0.232	Not Supported
H7: AIF → ICC & Collab.	0.400	1.311	1.806	0.080	0.222	Not Supported
H8: RoIF → ICC & Collab.	0.886	1.605	3.266	0.002	0.271	Supported

Note. Adopted from Ammad et al., 2019, IEEE Access 7(1), pp. 171663.

The last column in table 4 provides the results of the hypothesis test. This test was conducted with a confidence interval of 95%, meaning that the significance level is $p = 0.05$. When the p-value is lower than 0.05 (<0.05) conclusions can be made that the alternative hypothesis can be supported (Null hypothesis is then rejected) (Sekaran and Bougie, 2016). Results from the table manifest that H1, H5, and H8 are supported ($0.002 < 0.05$, $0.000 < 0.05$, $0.002 < 0.05$), while H2, H3, H4, H6, and H7 are not supported ($0.339 > 0.05$, $0.332 > 0.05$, $0.686 > 0.05$, $0.119 > 0.05$, $0.080 > 0.05$). This means that Cultural, Individual, and Roles Identity factors have a significant impact on intercultural communication and collaboration. Racial, Ethnic, Gender Roles, Social Class, and Age Identities are not supported in this test, hence assumptions can be made that these factors do not have a significant impact on intercultural communication and collaboration. Thereby the study proves the theory of Isern wrong based on the results of the interviews and surveys in this research.

5 Discussion

In this section of the study a discussion of the results is provided. This part of the paper is divided into four parts, the first two parts discuss the two research questions while the third tries to combine them. The last part of this section reveals the limitations to the study and enlightens future research.

5.1 Discussion of the Results of Phase 1 - Interviews

In this section a discussion of the results from the interviews are provided. To answer the second research-question there are many factors that has been investigated. As seen in the results from the interviews several important topics impacting intercultural communication and collaboration emerged. As an international company, the firm has implemented the agile global outsourcing software development strategy (AGOSD). Although there are many benefits with outsourcing parts of operations, several conflicts and problems may emerge within intercultural communication in AGOSD (Schmidt and Meures, 2016). The aspects of intercultural communication that had an impact on the collaboration in the firm is geographical distance, time-zone, hierarchical mindset, culture differences, technical knowledge, working roles and language barriers. Some of these are seen in previous research.

The impact of geographical distance between the testers in India and the developers in Norway was mentioned as an impacting factor of international communication and collaboration. This is also seen in Noll, et al., (2010) where he argues that geographical distance creates non-personal relationships. One of the respondents mentioned this, but also mentions that multiple personal relationships can create a great deal of informal talk at work and ultimately hinder progress. In software development the need for full focus is important, therefore too many disruptions such as questions can prevent progress.

Managing cross geographical distance is also affecting intercultural communication and collaboration in software development. The respondents mentioned the difficulty to motivate and encourage the testers when they are not physically present. In addition, the repetitive work task a manual tester has is a barrier for their motivation. With repetitive work tasks the mental distance between the manager and the tester is increased. A tester shows frustration of

the repetitive work tasks while the manager might be frustrated. To communicate is difficult in situations like this, especially without the face-to-face non-verbal communication. On the other hand, having testers in-house would create more informal communication and might hinder the workflow. Results regarding the impacts of time-zone are not significant but creates a limited number of hours where they can contact them directly.

Time-zone is a factor that is often seen as preventing collaborative work in software development. Noll et al. (2010) calls this for temporal distance and it is the delay in response time and few hours of the day that everyone is working. Respondent 1 explains the difficulty with managing the time-zone, but after many years of collaboration the firm is used to collaborating with different time-zone. The two-hour gap between the Indian lunch time and the Ukrainian lunch time is used for the daily scrum meeting at 11.05 am. Besides, email and chat work fine when communicating across different time-zones.

From the interviews the respondents' answers can confirm that Indian employees have higher respect for authority. Their strong hierarchical mindset creates a conflict with the flat Norwegian organizational structure. Respect for authority creates a gap between how a message is perceived and the following response to the message. According to Hofstede (1994), this can be recognised as power distance, and is reflected on the extent to which people consider less powerful in an institution or organisation. Indians make their own hierarchical structures even inside their group, which is not necessary in collaboration according to respondent 8.

There are several cultural differences appearing in communication, one that was clear from the interviews was the differences in managing Ukrainian and Indian people. As seen from the interviews Indians tend to confirm questions without understanding them. They do exactly what they are asked to and sometimes hesitate to ask even if they do not clearly understand their task. This can be referred to as a collectivistic culture and the term "afraid of losing face" while avoiding direct confrontations. According to Hall (1976), this can be referred to as a high context culture where communication relies heavily on the spoken context. In India their communication style is heavily related to the underlying/unspoken context. This is in contrast with Norwegian employees who take unspoken communication more under account when receiving a message.

Another intercultural communication factor that has an impact on collaboration in software development is technical knowledge and working roles. The education and experiences as a tester and a developer are quite different in software development. According to Cohn and Ford (2003), micromanagement is used by developers using the agile processes. What the respondents are describing in the interviews are reflecting on this. In India there is a tendency for needing more micromanagement than in Ukraine and Norway. Some of the respondents mentioned that Ukraine is in many ways more alike Norway than India. The reason being that Ukrainians are more like Norway in executing the job. Approaches like Scrum and extreme programming have more frequent communication in shorter periods.

Language barriers are also seen as an impact on collaboration and intercultural communication in software development. From the interviews, respondents claim that it is easier to talk to those from Ukraine than those from India. According to Huang and Trauth (2007) language skills are mandatory in software development. They speak highly of handling the conflict language barriers create. From the interviews, the respondents explained that conflicts were handled directly with the person involved and with no other difficulties. The language issue is also impacted by the experience, most of the respondents have long experience and are therefore familiar with the language issues that arise.

As observed in this discussion of the interviews, intercultural communication factors have an impact on software development. The investigated firm has a well-structured communication system that works well in outsourcing parts of the software development, but there are underlying conflicts due to the differences in the cultures.

5.2 Discussion of the Results of Phase 2 - Survey

Data from the survey shows that not all of the identity factors of Isern have a significant impact on intercultural communication and collaboration. According to this study his theory is not scientifically supported. This research managed to prove several of the proposed factors insignificant in the matter of intercultural communication and software processes.

In table 5 (section 4.3), hypotheses are tested, and the results suggest that culture, individual personality and roles identity are significant factors impacting intercultural communication. This indicates that ethnic background, race, age, social class and gender roles are not significant in this matter. By looking at previous research and the interviews this research can support this assumption even more.

Results suggest the following ranking of important factors impacting intercultural communication:

1. Individual personality factor (IIF)
2. Cultural identity factor (CIF) and roles identity factor (RoIF)

Individual personality scores highest on the scale with a mean of 3.8, while cultural identity and roles identity scores second highest both with a mean of 2.89 (see figure 4). These means show that these factors are important, and the impact is at least defined as “low impact” or “some impact” according to the scale used in this study.

The results reveal that respondents of this study acknowledge cultural differences as important matter for the communication and collaboration processes. The majority of participants express that collaboration is impacted by differences in verbal and nonverbal communication habits (figure 5 and 6). According to survey results presented in figure 5 and 6, nonverbal communication is perceived to be less important compared to verbal communication. This can be explained by the preferred communication medium among employees. In this firm, communication usually happens through email, chat, or calls. Since people prefer non-visual interaction (seldom video conferences) and mainly formal communication the chance of discovering nonverbal and culture specific communication are reduced. As seen in figure 5 and 6 verbal communication is generally perceived having more impact than nonverbal communication.

The importance of different roles is also considered as seen in figure 4. According to the survey, individuals may consider the different roles engaged in the development process in terms of their educational background and technical knowledge. Individual personality is always a concern when it comes to communication and collaboration not only due to cultural matters or geographical distance. As many expressed in the interviews, personality issues may even occur in co-located teams sharing the same culture. It is not a secret that individual personality can vary a lot, and numerous studies on personality have been conducted in the field of psychology.

Other factors such as race, ethnicity, gender, social class and age are perceived as less important or not important factors at all. This can be seen in section 4.2, where all factors are presented and figures illustrating results are included. Additionally, the company representative mentioned that young professionals are preferable as they can bring new and innovative ideas to the company. On the other hand, he/she also emphasized the advantage of having older employees with longer experience. In a highly dynamic environment, like software development, new and bright ideas and knowledge that are “up to date” are valuable.

5.3 Discussion of the Results from Both Interviews and Survey

Significant amounts of research have been conducted identifying and testing several factors and their level of impact related to intercultural communication and collaboration. Based on the literature review in this paper, factors such as ethnicity, race, gender, social class, and age were not considered as important factors in this matter. Meanwhile, cultural factors have been widely discussed in several papers, along with time zone differences, language differences, and other challenges occurring in distributed teams due to geographical distance, and technical issues.

Culture is one of the most discussed factors when it comes to international business. MacGregor et al. (2005) noted the concept of “not losing face” in the Japanese culture. As stated by respondent 2, Indian employees tend to agree (say yes) even when they do not really understand. According to respondent 8, Indian employees are more afraid of asking questions than making mistakes. This underpins the concept of “not losing face”. Hofstede’s cultural dimensions are widely used in the literature (See section 2.2). In the interviews, power distance was frequently mentioned as seen in section 4.1. It is characterized by colleagues from India being extremely polite and formal when interacting with colleagues in Norway, often obtaining higher positions. In India they also tend to create several levels among themselves (section 4.1.3). Survey results support these findings as seen in section 4.2 (in particular 4.2.1) and 4.3. according to the t-test H1 is supported (p-value 0.002, see table 5), further underpinning these assumptions.

Individual identity is often mentioned in the literature but seldom researched as an important variable. From the interviews, several respondents (1, 2 and 4) emphasized that most challenges occur due to individual personalities and cannot be blamed on cultural distance or linguistic distance. A participant also mentioned that challenges and misunderstandings in teams can occur regardless of location and cultural background. This adds validity to the support of H5 (Individual identity) which according to the statistical test appeared to be the most significant factor in this matter (p-value 0.000, see table 5).

Roles Identity has not been discussed much in the literature previously. According to the interview results, roles are perceived differently in each country of interest. In India family time is important and valuable and usually happens in the morning. From the interviews it is

clear that this fact actually has a positive impact in this case. As noted by respondent 1, this leads to more overlap in the working hours of Norwegian and Indian employees since the workday begins closer to the working hours in Norway. There are less differences in both time zones and roles identity perception among Ukraine and Norway compared to India. This is an important factor and survey results confirm this. The hypothesis test (t-test) shows that H8 can be supported (p-value 0.002, see table 5), meaning the impact of roles identity has a significant impact on intercultural communication and collaboration.

5.4 Limitations and Future Work

The limitations of this study must be acknowledged since it has implications for the extent of its generalizability. This study is based on a small sample of participants from one company within the software industry and represents three national cultures. However, as the nature of this research is explorative, the small sample size allows the research to achieve understanding of which factors do matter in the processes of global software development and to what extent. Nevertheless, several statistically significant results were achieved in this research, and the findings provide a solid starting point for further research in this field.

Bias related limitations are also considered in this part. Interviews were conducted face-to-face and recorded, allowing biased answers given by participants due to lack of anonymity. Another limitation is the fact that the interviews were held in Norway meaning most of the data collected from the interviews mainly represents Norwegian opinions. When it comes to the survey, questions related to race and ethnicity may have contributed to bias in this research. Race and ethnicity are sensitive matters to some, and the answers of such questions may therefore be biased, especially considering the setting - the survey was sent by their employer. Some respondents even commented that “ethnicity is a bit controversial” to ask about. Additionally, race is a problematic term and not easy to define (McCann-Mortimer et al., 2004; Connelly et al., 2016; Pan, Glynn, Mogun, Choodnovskiy and Avorn, 1999) which made establishment of measures difficult. This was also noted by a respondent adding a comment to the last question saying, “*race is not a scientific term*” (Appendix II). However, the survey was anonymous to ensure honest answers, and based on the 35 responses received,

the study was able to calculate statistically significant results. Some bias is however natural when the aforementioned methods are used.

As the nature of this research is explorative it provides implications for future research. The first suggestion is to conduct a quantitative study to verify and validate the findings of this study. As the analysis has taken place in one company and with a limited sample size, further research should include several companies and account for more cultures. By including more companies and more cultures in one research, generalizable results can be achieved. Another suggestion is to further investigate the three factors (Cultural Identity Factor, Individual Identity Factor, and Roles Identity Factor) that appear to have significant impact on intercultural communication and provide explanatory results.

6 Conclusion

Intercultural communication and collaboration have been widely discussed in the field of global software development. Various theories including implications of communication and collaboration have been proposed and researched for decades. Throughout this study two research questions were researched and analysed by adapting a two phased mixed-method methodology. Each phase (phase 1 and phase 2) of this study aims to answer RQ1 and RQ2 presented in the introduction. The literature review gives good insight to existing theories and serves as an underpin to the findings.

According to the interviews geographical distance, cultural differences such as hierarchical mindset, technical knowledge, working roles and language barriers are factors impacting collaboration in distributed software development teams. These findings suggest that intercultural communication will have an impact on collaboration, which represents the answer to RQ1. To answer RQ2 a survey was conducted, and the results reveals that Cultural Identity (CIF), Roles Identity (RoIF) and Individual Identity (IIF) are factors impacting intercultural communication and collaboration. Based on these findings, the theory of Isern was proven incorrect.

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Appendix

I Interview Guide

General Questions

1. Describe your work. / What does a normal workday look like?
2. What do you think of working in teams?
3. Have you experienced any differences between the teams?

Communication Questions

1. What is the general difference between a tester and a developer?
2. How is the communication between a Norwegian developer and a tester from India?
3. How is the communication and collaboration between the testers in India/ the developers in Norway?
4. What is the benefit of working in an international team?
5. Which communication tools are being used?

Culture

1. How would you describe your colleagues in Norway/India/Ukraine?
2. How does it affect the communication that you are not communicating in your mother tongue?

II Questionnaire

Factor	Question	<i>Very Low Impact</i>	<i>Low Impact</i>	<i>Some Impact</i>	<i>Neutral</i>	<i>Moderate Impact</i>	<i>High Impact</i>	<i>Very High</i>
	<i>Impact</i>							
Cultural Identity Factor (CIF)	How much does cultural background impact communication and collaboration at your workplace?	1	2	3	4	5	6	7
	How much does culture impact communication and collaboration at your workplace in the following statements:	1	2	3	4	5	6	7
	Verbal Communication							
	How much does culture impact communication and collaboration at your workplace in the following statements:	1	2	3	4	5	6	7
	Non - Verbal Communication							
Racial Identity Factor (RIF)	How much does racial identity impact when you communicate and collaborate with your colleagues abroad?	1	2	3	4	5	6	7

Ethnic Identity Factor (EIF)	How much does ethnic background impact when you communicate and collaborate with your colleagues abroad?	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>
	How much does your religion impact your sense of who you are?	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>
	Do you use words/expressions specific to your location/country when interacting with your colleagues abroad?	<i>Yes</i>			<i>No</i>		<i>Maybe</i>	
	Do your colleagues use words/expressions specific to their location/country when interacting with you?	<i>Yes</i>			<i>No</i>		<i>Maybe</i>	
	How proud are you of the country you were born in?	<i>Extremely not proud</i>		<i>Somewhat not proud</i>	<i>Neutral</i>	<i>Somewhat proud</i>	<i>Extremely proud</i>	

Gender Role Identity Factor (GRIF)	How much does gender roles impact communication and collaboration in your daily work?	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>
	How much does same gender impact communication and collaboration in your daily work?	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>

How much does opposite gender impact communication and collaboration in your daily work? 1 2 3 4 5 6 7

Do you prefer working with people of: *Same Gender* *Opposite Gender* *Does Not Matter*

Individual Identity Factor (IIF) How much do you think individual identity impacts communication and collaboration at your workplace? 1 2 3 4 5 6 7

Do you consider yourself a better person than your co-workers? *Yes* *No* *Maybe*

Social Class Identity Factor (SCIF) How much does differences in social class impact communication and collaboration at your work? 1 2 3 4 5 6 7

Do you adjust the verbal and non-verbal communication when interacting with people with different education/position? *Yes* *No* *Maybe*

Age Identity Factor (AIF) How much does age impact communication and collaboration at your workplace? 1 2 3 4 5 6 7

Do you adjust verbal and non-verbal communication when interacting with older co-workers? *Yes* *No* *Maybe*

Do you adjust verbal and non-verbal communication when interacting with younger co-workers? *Yes* *No* *Maybe*

Race Identity Factor (RaIF) How much does Roles Identity impact communication and collaboration at your workplace? 1 2 3 4 5 6 7

Do you adjust verbal and non-verbal communication when interacting with testers/developers? *Yes* *No* *Maybe*

Open end questions

Please specify if there are any unclear questions.

Please specify if there are any unclear questions.

III First Reflection Note

Reflection note - Master's Degree in Business Administration

By: Hanne Kristine Austenaa

In relation to our master thesis I was asked to prepare a reflection note. The purpose of this note is to reflect on the three topics; internationalization, innovation and responsibility, which are all highly relevant in business administration.

Brief summary of the thesis

The theme of our master thesis was to investigate the intercultural communication and collaboration in software development. Cultural differences affect communication and collaboration and are highly relevant in today's society. Global software development is increasing and becoming more and more important, especially due to increased use of online resources.

Our research was conducted by investigating a Norwegian firm with part of their operation outsourced in Ukraine and India. After research on communication and collaboration in software development, interviews were conducted with various positions in the firm. Eight interviews were conducted with seven employees from Norway and one employee from India. After collecting and analysing the data from the interviews a survey was made for employees in all three countries, ultimately investigating eight factors of intercultural communication. These factors were based on individual factors that affect the way individuals communicate, and thereby impact the collaboration.

Results from the interviews enlightened some of the problems that arise in software development collaboration due to the differences in the three cultures. Some of the problems originated from Indian testers with a strong hierarchy mind and a high respect for authority, which created problems for the developers and the quality manager. Results from the survey shows that three of eight identity factors of intercultural communication is important for intercultural communication and collaboration. Individual identity factor had the highest ranking, followed by Roles and Culture identity factor.

Relations to Internationalization

A large number of global software development firms outsource parts of their operations to other countries due to cheaper labour costs. This can be observed in several industries globally. In global software development it is common to take advantage of opportunities in different countries. An example of this is time zone exploration, where development is outsourced to countries all around the globe, resulting in development 24/7. Another example of taking advantage of the workforce in other countries is finding employees with certain skill sets and high knowledge within specific areas.

In addition to all of the advantages of global software development there are also some disadvantages. For instance, it becomes more difficult for managers to manage people in different time zones, with different languages, and different cultural backgrounds. Here both collaboration and communication are two important factors for global software development.

The firm used in the master thesis has approximately eight years of experience with outsourcing the whole testing team and parts of their development team to Ukraine and India. In the beginning the Indian testing team spent a couple of months in Norway in the local development office and learned how operations were done. After the months in Norway, they went back to India and were managed remotely from Norway, which led to some conflicts. When the testing team moved back to India their working method had changed. The business culture in India was different from the business culture in Norway.

The fundamentals of the master thesis are based on international standards. By investigating international communication and collaboration it is required to have high academic knowledge within the research field. Therefore, all the research on this theme has been on an international level, and the master thesis has been conducted with the goal of publishing it as a journal article. To achieve this multiple hour of research on high quality studies and various topics had to be done. In the world today, internationalization is fundamental to be able to compete against the leading companies as every industry is in some way connected to other nations, either by money transfer or products produced in other countries.

Relations to Innovation

The contribution of the study is the investigation of the eight identity factors of intercultural communication on collaboration in software development, in addition to using a Norwegian global software development firm in the research. The contribution provides new insight into intercultural communication and collaboration. In previous research there has been a great deal of research on this topic, nevertheless nothing on a Norwegian firm with outsourcing to Ukraine and India, and the testing of individual identity factors of Isern (2014).

To be able to stay competitive in software development, innovative thinking is crucial. Developers need to have an innovative mindset when developing the software. If not, managers and owners may not be able to provide the customer with the requested functionality. The industry is rapidly changing, and the importance of implementing new functionality with a proper design is therefore an important factor for quality measurement. To be able to maintain a quality standard and a good reputation, software development firms need to provide a high quality in the software they deliver.

The investigated firm delivers software to the public sector and has recently moved some of their software to the cloud. This is a time-consuming job, where several problems may occur. The cloud-based system provides easier solutions for updating the software. Before, software experts were needed on-premises to implement the newest software version on the computers, but now this happens automatically. In addition, the firm reduced the manual testing team and increased financing towards automatic testing.

Relations to Responsibility

In a master thesis there are several responsibilities. Towards the University, the supervisor, the research partner and the investigated firm. One of the most important responsibilities is handling the data correctly, especially when collecting sensitive data through interviews and surveys. Additionally, the rules of NSD (Norsk Senter for Forskningsdata) had to be followed, which responsibility is taken by following the guidelines on their webpage.

There was also responsibility that had to be taken by me, as the firm investigated had customers from the public sector whose information is considered confidential. In addition,

when working internationally, strict laws and requirements apply when dealing with information on Norwegian citizens to prevent information from getting leaked.

The software development company is also responsible for delivering software that not only works, but also has a certain level of security to it. For instance, loss or leaks of information from the public sector can result in large damages for individuals. Other customers may also handle client information that is considered personal or sensitive. Agreements are therefore made in regard to responsibility of each party.

Conclusion

The discussion of the three topics highlights some of the important factors of business administration and economics in relation to our master's thesis.

The internationalization of businesses is important for growth and economic reasons, especially if this can be combined with innovation, and is done by the Norwegian firm discussed in this thesis. By having investigated a company that outsources work force to countries of lower cost, I have gained insight into the responsibility process of performing such labour agreements and the difficulties that may occur when employees of multiple cultures are collaborating and working together.

Although the last couple of months have been significantly unusual and somewhat challenging due to the outbreak of COVID-19, the results of the master's thesis were not impacted negatively.

Upon completing my degree as a master student at the University of Agder, both the courses and final thesis have provided valuable experience for me to bring into my future career and widened my horizon and understanding within the field of business administration and economics.

IV Second Reflection Note

By: Ariana Dost

Summary

In this thesis we discuss implications and challenges international firms may face in communication and collaboration based on the experiences of employees in one particular firm engaged in global software development. For the first part of this thesis interviews were conducted to investigate how geographical distance, cultural distance, language and time zone differences impact communication and thus collaboration across team members. While looking into existing literature we discovered an article written by Germinal Isern in 2014. In this article Isern suggests the theory of several factors (Culture, Race, Ethnicity, Roles, Age, Individuality, Social Class, and Gender roles) impacting intercultural communication. This theory has not been fully tested before, therefore we decided to do research and discover whether these factors really do impact intercultural communication and collaboration.

This thesis aims to address the following research questions:

RQ1: Do intercultural communication have an impact on collaboration in Software Development teams?

RQ2: Which of Isern's eight factors have direct impact on intercultural communication and collaboration?

The first research question was answered using qualitative data from our interviews. Results indicate that not all participants perceive cultural distance, language and time zone differences as significant matters. Most interviewees do not consider culture as the major issue when communicating and collaborating with their colleagues abroad. Individual personality is the main concern. Still, differences in cultures are visible and one interviewee explained that some colleagues require more specific explanation than others. And some obtain more hierarchical mindsets and highly respect those with higher positions at work. This is described in Hofstede's cultural dimensions covered by the dimension "power distance". However, the majority agrees that the situation would have been different if teams were co-located despite cultural differences.

To answer the second research question, we conducted a digital survey that was sent to 56 employees in the firm, located in Ukraine, India and Norway. According to our survey results we can prove the theory of Isern wrong. By doing a statistical test (one sample t-test) we discovered that only three of the eight factors have a significant impact on intercultural communication: culture, individual personality and roles identity.

In conclusion we acknowledge our limitations underlining the lack of generalizability of this study and suggest further research to include more firms and/or more cultures to investigate this topic. Software industry is a highly globalized industry and issues related to distances in culture, language, time zone and geography are not to be avoided these days. The suggestion is to address these issues by increasing knowledge and awareness of the inequalities among employees to avoid “culture shock” and other unexpected events.

Internationalization

Internationalization has grown at high pace the last decades and has become a vital part in many businesses. The world has become more united in terms of trading and economy. However, some challenges related to politics and culture still remain to solve. Although, cultures and politics are getting more united and mixed, as the desire to capture new markets grow the distance among national borders, cultures, politics and economies also grow. Along with the benefits of capturing new and bigger markets comes also challenges related to international forces such as cultural distance, economic and political implications that must be considered and addressed.

As mentioned in the introduction of this thesis, internationalization is widely spread in the software industry as a strategy to enhance productivity, reduce costs, ensure skilled workforce and improve competitive advantage. While managers and owners of such businesses benefit from economic advantages, employees at lower levels may face difficulties in communicating and cooperating with their international colleagues. According to our research, employees experience the internationalization as an economic benefit only, while managers expressed the benefits of skilled workforce availability in addition to lower costs.

Internationalization bring new opportunities to businesses seeking to expand, not only economically but also when it comes to the labour market. Lower costs of producing and cheap labour markets are often referred to as primary reasons for internationalizing businesses. The matter of talented and highly skilled workforce is highly relevant in the

software development business and is acknowledged by many managers all over the world. By looking at outsourcing trends in this industry, we can see a clear pattern of where companies choose to locate their businesses. India and China are popular markets in these terms. Not only due to lower production costs but also due to availability of skilled professionals in these markets.

Political implications are important to acknowledge before entering new markets. Politics govern rules and laws in a country. This also sets standards for trading and doing business in that country, through regulations of the labour market, trading agreements and alike. Google in China can be brought as a good example of how politics may impact businesses in foreign markets. When political ideology collides with business ideologies, the consequences can be enormous. These challenges can be addressed through acknowledgement of inequalities, mutual respect and negotiations.

Innovation

Innovation is about bringing new ideas and solutions to live. The software industry is highly dependent on new ideas and innovative solutions as the development of technology evolves. Our Thesis is based on the experiences of a software development company which is involved in providing software to the Norwegian public sector. Innovation is not directly discussed in our thesis. Nonetheless, through interaction with the company is in constant search for better and more productive solutions and seek to increase efficiency every day.

Research shows that face-to-face meetings are beneficial in terms of team performance. An opportunity to increase innovation in the firm of interest can be said to be more face-to-face meetings among international team members. By exploring new ideas across roles and cultures new products and services could emerge. The company is constantly working to improve and develop existing products as well as new products are produced from scratch. Additionally, by engaging in different type of products, the firm could capture new markets and meet demands of other segments than the public sector in Norway. New services and software products for private customers or expanding to the private market could benefit the firm as well as motivate further development of both existing and new products and services. Innovation is a highly relevant matter in the software industry. Responsibility Since this thesis is written in collaboration with a firm, we are responsible to keep the information confidential, in particular sensitive information that could identify the firm and probably have

an impact in its competitive situation. Therefore, we signed a confidentiality agreement to assure that sensitive information is not published. Still, we chose to do our best to conceal the firm's identity in our thesis to enable a potential future publication. We also conducted interviews which implies additional responsibility in regard to each participant. Permission to conduct the interviews was gained from NSD and an agreement was signed with each participant in particular. We stay responsible for the anonymity of each interviewee and all data gathered in form of audio records and notes from the interviews. When it comes to responsibility of the firm, it meets a number of ethical challenges related to employees in each of the three countries the firm is operating in. Examples like labour salary and management style can be challenging to adapt and incorporate to all levels in the firm. An ethical question arising may be the salary given to a developer in Norway compared to one in India. Is it right to issue local or domestic salaries? Beside the responsibility of employees, the firm also has a social responsibility and security responsibility toward its customers.