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**AGILE METHODS INFLUENCE ON COMMUNICATION
IN GLOBALLY DISTRIBUTED IT PROJECT TEAMS**

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List of Abbreviations

IT	Information technology
MNC	Multinational company
ICT	Information and communication technology

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ABSTRACT

Agile methods are increasingly used by companies. Although these methods were initially developed for collocated teams, the number of their successful implementation in globally distributed IT project teams is growing. Despite the considerable research on distributed teams and agile methods, little is known about how they influence communication in globally distributed IT project teams. The study aims at examining the relationship between agile methods and communication in such teams. The research question of the study is dedicated to the exploration of agile methods influence on communication in globally distributed IT project teams. Data collection was done with the help of such qualitative research method as a case study in form of ten semi-structured Skype interviews. The results showed that the use of agile methods has a mixed impact on communication in globally distributed IT project teams. On one hand, agile methods facilitate informal communication among team members. However, the use of agile methods may further limit this informal communication, which is ICT mediated. At the same time, agile methods do not offer adequate tools for effective formal communication.

KEYWORDS: Agile methods, Communication, Globally distributed IT project teams

1. Introduction

1.1. Background of the study

Modern companies try to employ the best talent regardless of its physical location. However, teams working across borders and time zones lead to various challenges, which decrease productivity, compared to collocated teams (Sutherland et al., 2009, p. 277). These challenges are especially acute in modern IT (information technology) industry, where MNCs (multinational companies) have clients and employees, needed to fulfil projects, distributed across the globe. Other critical issues, which IT companies are facing, are the speed and costs of the project. In today's age of global competition, projects have to be done in the shortest time frame and with minimal costs. It means that communication within the project team has to be quick and effective, in order to hasten the project speed. However, in globally distributed project teams, immediate communication is problematic due to time and geographical distances. Therefore, MNCs seek the way to overcome these obstacles.

Agile methods are a solution for overcoming time and budget constraints of the project. These methods are widely used in IT industry. Compared to traditional plan driven methods, agile methods are more flexible. They emphasise frequent informal communication between the team and the client. Initially, agile methods were used in collocated teams, where employees meet face to face. Therefore, such methods require team members to be seated in the same office. In globally distributed projects, agile methods are traditionally used only by collocated groups of employees (Abrahamsson et al., 2002). However, since more and more IT companies employ distributed project teams, face to face communication is rare and not always possible. Therefore, the use of agile methods in globally distributed project teams has to be limited due to their unsuitability for such type of

communication. Still, a number of IT companies successfully adjusts agile methods and use them in their globally distributed project teams. (Holmström et al., 2006, p. 8)

1.2. Research problem

Agile methods became a focus of scientific research only recently. This fact is explained by the novelty of these methods: the core principles of agile methods were published in 2001 in Agile Manifesto (2001). Since that time, the popularity of these methods has been constantly growing. The research on the application of agile methods in globally distributed IT project teams is still scarce and is largely presented in form of conference papers, this underlines the novelty of this field of research (Abrahamsson et al., 2003; Dybå & Dingsøy, 2009; Jalali & Wohlin, 2010, Hossain et al., 2009; Mac & Kruchten 2006; Nevo & Chengalur-Smith, 2011; Niinimäki, 2011; Sutherland et al., 2009). In future, the phenomenon of agile methods use in globally distributed teams should deserve more attention, because of their increasing popularity among IT companies.

In its turn, the existing research in the field of distributed teams is more numerous. It mainly focuses on distributed teams in general (Avolio & Kahai, 2003; Bass & Avolio, 1990; Bell & Kozlowski, 2002; Cascio & Shurygailo, 2003; Duarte & Snyder, 2001; Huo et al., 2004; Kahai et al., 2007; Kauppila et al., 2011; Kurupparachchi, 2009; Martins et al., 2004; Mukherjee et al., 2012; Potter et al., 2000). It has a prevailing shift towards theory and discusses advantages and disadvantages (Kurupparachchi 2009, p. 20; Bell & Kozlowski 2002, p. 16), as well as various classifications of distributed teams (Cascio & Shurygailo 2003, p. 363, Bell & Kozlowski 2002, p. 21).

Therefore, the purpose of this study is to investigate the influence of agile methods on communication in globally distributed IT project teams. Thus, the study will contribute to covering the existing research gap. It will contribute not only to academic but also to practical field by using the empirical data for the analysis. The research outcomes contribute to theory and practice, since they allow a better understanding of communication and its difficulties in globally distributed agile project teams.

To achieve this, a case study method will be used, since it employs an investigation of particular phenomenon in its real life context by using multiple sources of evidence (Saunders et al., 2003, p. 145). The analysis of information about the company as well as a survey in form of semi-structured interviews will be used as sources of evidence. A case study is the most suitable research strategy, because it pays special attention to context, i.e. to particular industry and company using globally distributed IT project teams.

1.3. Research question

The current study aims at examining the relations between agile methods and communication in distributed IT project teams. This study focuses on the application of agile methods in one of Ukrainian offices of an international IT company with subsidiaries in the USA, Europe and Asia.

Thus, the research question of the study is formulated as follows:

How do agile methods influence communication in globally distributed IT project teams?

In accordance with the above mentioned research question, the following research objectives are set:

1. To identify key characteristics of distributed teams.
2. To develop a theoretical framework explaining communication in globally distributed IT project teams.
3. To investigate the influence of agile methods on communication in project teams of company ABC.

1.4. Scope and delimitations of the research

The scope of the study is focused on agile methods requirements in communication in globally distributed IT project teams. It outlines such concepts as distributed IT teams, the application of agile methods, communication characteristics and theories explaining communication process in such teams. The research is based on the case of a single MNC and focuses on communication between its globally distributed project teams. The discussion is limited to the analysis of practices in one particular subsidiary, located in Dnipropetrovsk, Ukraine.

The delimitation of this study is that it does not focus specifically on the influence of intercultural differences and cultural distance on communication in distributed teams. Besides, the research does not investigate the usage of agile methods in collocated teams, even if they are working on a separate part of a distributed project.

1.5. An outline of research structure

This study consists of six chapters. The structure is presented in **Figure 1**. Chapter 1 gives an introduction to the research topic. It justifies the study background and delimitations, as well as the research problem and research question.

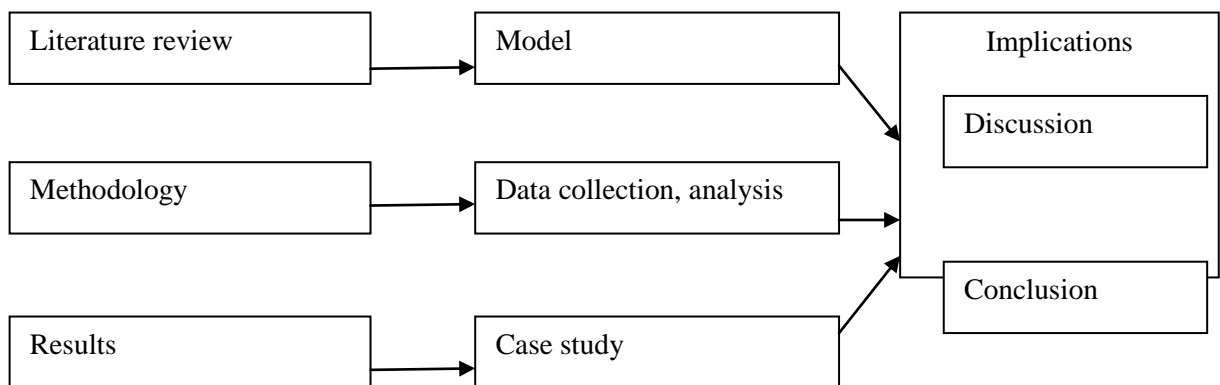


Figure 1: Structure of the paper.

Chapter 2 presents the literature review used for this study. It discusses main terms, concepts and theories existing in the field. It explains the concept of globally distributed teams, their classification, advantages and disadvantages; origins and the essence of the agile methods, their types, advantages and disadvantages; features and constraints of communication in globally distributed project teams; theories explaining communication in globally distributed IT project teams. At the end of Chapter 2, a theoretical framework, which is based on the existing literature, is illustrated.

Chapter 3 discusses methodological approach and research strategy used in this study. It also presents the research methods and data collection technique of the study, as well as measures taken to ensure reliability and validity of the research

findings. Besides, the chapter also includes background information on the case company.

Chapter 4 explains the research findings. It includes the results of data collection through semi-structured interviews with managers and employees of the Ukrainian subsidiary of the company ABC.

Chapter 5 discusses and analyses the findings presented in Chapter 4. This part provides the analysis of findings according to the research question. In the discussion part, the findings are linked with the theoretical framework developed in Chapter 2. The findings are explained through the earlier developed theories used in the literature review.

Finally, Chapter 6 provides a conclusion of this study. It underlines the main contributions of the research and its implications. It also discusses the limitations of the study and gives suggestions for future research.

2. Literature review

This chapter will discuss core terms well as key concepts existing in the literature on distributed teams, agile methods and communication.

2.1. Globally distributed IT project teams

2.1.1. Concept of globally distributed IT project teams

Distributed teams are also referred to as virtual or dispersed teams in the literature. Most of the researchers, describing such teams, give similar definitions, which differ only in small details (Martins et al. 2004, p. 806). Distributed teams are teams working on an interdependent task, relying heavily on electronic communication and overcoming several boundaries (Bell & Kozłowski, 2002, p. 15; Cascio & Shurygailo, 2002, p. 362; Horwitz et al., 2006, p. 473; Martins et al. 2004, p. 806; Mukherjee et al., 2012, p. 275). These boundaries include geographical separation, time distance, and boundaries of the organisation. Geographical and temporal distances are mentioned more often compared to organisational boundaries (cf. Kahai et al., 2007, p. 61; Townsend et al., 1998, p. 17). Despite its popular use, time difference is a less important criteria in defining a distributed team, since this criteria is not always present, as members of a distributed team can reside in different countries within the same time zone or within the same country. Organisational boundaries refer to the possibility of distributed team members to be employed within one company as well as outside of it (e.g. to work for the client's or partner company) (Martins, 2004, p. 808). Geographical and temporal distances make meetings team members of such teams extremely rare or even impossible.

These, together with the use of asynchronous communication tools (e.g., email), limit the ability of distributed team to interact in the real time. Since distributed teams do not require movement of people to one location, such teams are more flexible compared to traditional ones. Distributed project teams often bring together members with different cultures, experience, expectations etc., which leads to communication difficulties within the team (Horwitz et al., 2006, p. 475).

Additional characteristic, underlined by several scholars (Martins et al., 2004; Kirkman et al., 2004), is a fluid membership in distributed teams, resulting from the possibility to add or remove team members if task requirements change, and a shorter life period of distributed teams compared to collocated ones. For example, after completing a project, distributed team members are dismissed or reorganised for the next project (Horwitz et al., 2006, p. 474). Besides, team members can be simultaneously involved in other projects or be a part of other distributed project teams. Since such team members do not have to be physically located in one place, distributed project teams often bring together members from different cultures and with different experience, skills, expectations etc.

Since globally distributed project teams are created to involve talents not available locally, they often include specialists in various areas and with various skills (Griffith et al., 2003, p. 268; Malhotra et al., 2007, p. 63; Potter et al., 2000, p. 131). This allows a company to adjust faster to the competition and to lower project costs, and even implement projects, which it could not implement with collocated teams (Bell & Kozlowski, 2002, p. 23).

In globally distributed project teams, team members usually use virtual communication, because face to face communication is very rare in such teams. Virtual communication is more demanding compared to traditional one, because in globally distributed project teams, information is usually spread without social context, in which it occurs. Moreover, such communication is physically and cognitively more demanding (to talk takes less effort than to type). (Purvanova & Bono, 2009, p. 344)

Initially the scientists describing distributed project teams contrasted them to traditional teams (Bell & Kozlowski, 2002, p. 20). Distributed project teams were viewed as teams using electronic communication media, while collocated teams were believed not to use them. But during the recent years with the development of communication technology, electronic media are used by traditional teams as well. Despite the active use of electronic media in collocated teams, here electronic media are only an additional communication tool to support face to face communication. But in distributed teams electronic media are often the only available communication tool. (Bell & Kozlowski, 2002, p. 22) Thus, this contrast is decreasing since technologically mediated communication may now be considered as a potential property of any team. Because nowadays almost every project team uses electronic communication to a certain degree, it is unclear, how to distinguish distributed and traditional teams. Some scholars view only teams interacting exclusively through electronic media and not having any face to face meetings as distributed teams (Bell & Kozlowski, 2002, p. 22; Cascio & Shurygailo, 2003, p. 362). Others allow some face to face communication, if the majority of interactions is still electronically mediated (Martins et al., 2004, p. 808). In this research, the second approach will be used.

Globally distributed project teams are distributed teams working across geographical, time and organisational borders (Martins et al., 2004; Mukherjee et al., 2012). This definition does not clarify the extent and type of technology used for communication within globally distributed team. Technology may include a variety of tools: from e-mails to video-conferences. Therefore, Jarvenpaa and Leidner (1999, p. 792) add also temporariness and cultural diversity of team members to this definition. The definition is presented in **Figure 2**. Temporariness of globally distributed project teams refers to the fact that team members may never worked together in the past and may not work as a team in the future. Cultural diversity means that team members are of heterogeneous origin and thus they can better react to the diversity of global environment. Finally, in globally distributed project teams geographical and time distances are overcome by computer-mediated communication.

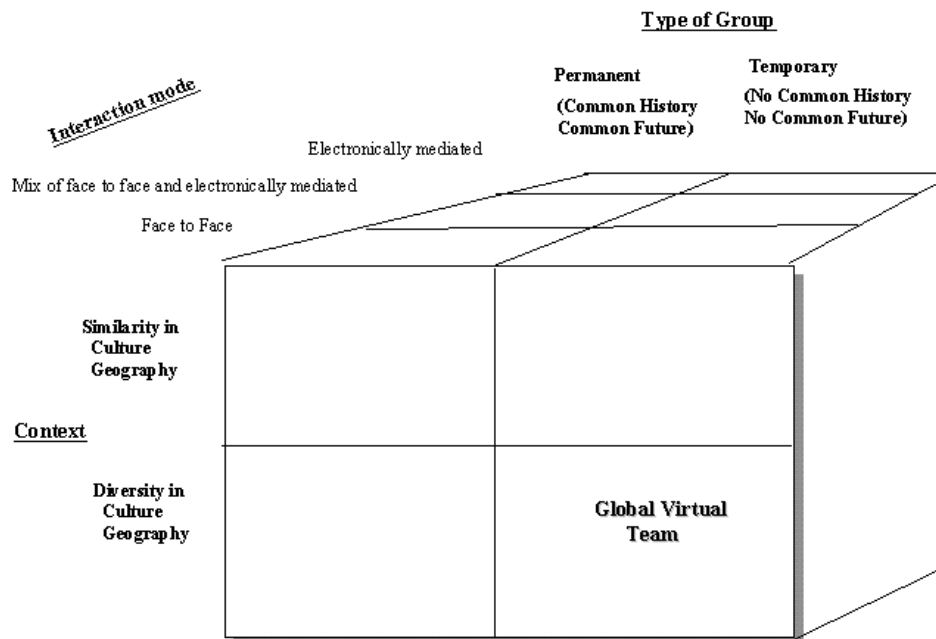


Figure 2: Definition of globally distributed team.

Source: Jarvenpaa & Leidner, 1999, p. 792.

2.1.2. Types of globally distributed project teams

There is no one universal classification of globally distributed project teams. Most often they are simply contrasted to collocated teams, as mentioned before, and further classification does not occur. However, there are several attempts to classify globally distributed project teams (Dorn et al., 2007; Duarte & Snyder, 2001; Griffith et al., 2003), which are presented in **Table 1** and will be analysed next.

Griffith et al. (2003, p. 267) distinguish hybrid and pure virtual teams. According to this typology, hybrid teams are teams, which interact using both electronic and face to face communication. The proportion is determined by the adaptation of the team itself and process structure. Distributed (or virtual) teams are teams where physical meetings of team members do not occur at all. Such teams rely exclusively on

computer mediated communication. (Griffith et al., 2003, p. 268) This typology has the following drawback: using the authors' logic if team members meet at least once, the team changes its status from distributed into hybrid.

Table 1: Classifications of distributed teams.

Distributed team types	Authors
Hybrid and pure virtual teams	Griffith et al., 2003.
Nimble, virtual, and nomadic teams	Dorn et al., 2007.
Networked, parallel, project or product development, work or production, service, and action teams	Duarte & Snyder, 2001.

The second typology is proposed by Dorn et al. (2007, p. 198), who classify distributed teams into three types: nimble, virtual and nomadic. This distinction is based on the following criteria: team goal, team relations, team existence time, etc. A nimble team is created to work on unexpected problems or issues. In such team, members may perform multiple roles. Virtual team has a relatively stable structure, where each member is assigned with roles and responsibilities. In nomadic teams, employees are usually involved in several projects simultaneously. Team members possess a high degree of mobility and can move to different places to meet other team members. (Dorn et al., 2007, pp. 198-199)

The most comprehensive typology, offered by Duarte and Snyder (2001), suggests seven categories of globally distributed project teams depending on members' temporal distribution, roles and team lifecycle and objectives. Networked teams are teams, which are geographically distributed and may include members from outside the company. In such teams, membership is flexible, i.e. members can be added or dropped out as the project develops. Life period of a networked team depends on the time needed for project goals achievement. After that, the team is dissolved. Networked teams are widely used in consulting and technology companies. Parallel teams are globally distributed project teams usually consisting of the same company members, who combine team membership with their ordinary duties within the

company. In parallel teams membership is constant until the achievement of team's goal. Because of the difficulties of dual responsibilities, such teams are usually formed for a short time period. Parallel teams are effectively used by MNCs, which need a global perspective. Project or product development teams are composed of experts in a certain field, who are brought together to fulfil a clearly outlined task, which involves new project, information system or organisational process development. Like in networked teams, membership in project or product teams is also flexible. (Duarte & Snyder, 2001, p. 6) Work or production teams are teams, where employees of one role are brought together to carry out single type on-going day to day work. Each member has a clearly defined role and works independently. In the end, all of team members' work are combined together to produce a final solution. In service teams, each member works independently but together they perform continuous work. (Duarte & Snyder, 2001, p. 7) An example is technical and customer support teams. Action teams are ad-hoc teams, which are created for a definite time period. In such teams, employees are grouped to solve an immediate problem and after it is solved, the team is dissolved. (Duarte & Snyder, 2001, 8) Such type is similar to Dorn's et al. nimble teams. Management teams are formed from globally distributed managers, who get together virtually to work on corporate level strategies and activities (Duarte & Snyder, 2001, p. 7). This classification is also not perfect, since globally distributed teams may combine qualities of several team types. For example, a team may be simultaneously parallel and management or networked functional teams. In this paper, project teams will be analysed.

2.1.3. Advantages of globally distributed IT teams

Compared to traditional collocated teams, the use of globally distributed project teams brings company benefits in several areas: human resource management, finance, social capital, competition, and equality. First of all, globally distributed project teams allow companies employing talent for a particular project regardless of its location. This is especially important in IT industry, where competition is fierce.

Moreover, distributed teams increase flexibility of employees' working hours, since they do not need to be at the same office with their colleagues all the time. (Kuruppuarachchi, 2009, pp. 21-22) Besides, the usage of globally distributed project teams allows company to hire the most talented employees in the field. Such teams are a solution to employees' unwillingness to relocate. Thus, the talent pool, available for a company, would be much smaller in the case of a collocated team. Additionally, the same worker can be a part of several teams. This flexibility allows using human resources optimally, since employees with particular or rare skills can be on several teams simultaneously. (Bergiel et al., 2008, p. 105)

Secondly, globally distributed project teams provide financial gains through improving productivity, reducing costs, and travel time (Kuruppuarachchi, 2009, p. 22). Bergiel et al. (2008, p. 105) imply that globally distributed teams reduce travel time and costs because technologically mediated communication allows to eliminate or at least significantly reduce travel, accommodation, and daily allowance expenses.

Thirdly, the usage of globally distributed project teams allows facilitating information and knowledge sharing (Kuruppuarachchi, 2009, p. 21). Moreover, globally distributed project teams encourage creativity and originality among team members because employees involved are of diverse and heterogeneous backgrounds (Bergiel et al., 2008, p. 106). Since such teams include members from different locations, they have greater potential in creating company's social capital because team members and managers have access to contacts and networks across the globe (Zaccaro & Bader, 2003, p. 380). Additionally, globally distributed teams improve cross-functional and cross-divisional interactions within the company (Kuruppuarachchi, 2009, p. 22).

The usage of globally distributed project teams allows not only having a qualified labour force, but also achieving a higher speed of product development, increasing the flexibility of resources allocation, improving customer relationship. (Kuruppuarachchi, 2009, p. 21) Other researchers also underline such advantages as

reduced time to market, increased effectiveness and speed of decision making, and improved productivity and shorter development times (Ebrahim et al. 2009, pp. 2656-2657). Because globally distributed project teams are less limited by geographical distance, they are more adaptable (Zaccaro & Bader, 2003, p. 380). Besides, fewer face to face meetings decrease disruptions of everyday office routine (Bergiel et al., 2008, p. 105).

Finally, such distributed teams create equal opportunities in workplace, because the access to virtual workplace is easier than to physical office, which helps to satisfy the needs of disadvantaged employees. Moreover, globally distributed project teams eliminate age and race discrimination, since in such heterogeneous teams performance appraisal depends mainly on employee's productivity, and not on other personal traits. (Bergiel et al., 2008, p. 106)

2.1.4. Disadvantages of globally distributed IT teams

Disadvantages of globally distributed teams result from already mentioned boundaries, which such teams have to overcome. They include ineffective communication caused by the absence of non-verbal communication and context, additional efforts needed to communicate electronically (e.g. to type), time, culture and language differences. Temporal distance brings difficulties in project control because of the team's asynchronicity across different time zones. Moreover, this also leads to communication and coordination challenges due to frustrating delays in communication. (Holmström et al., 2006, p. 11)

Besides, other drawbacks include resistance to the unstructured nature of the team, loss of vision, and additional pressures because of the emphasis on project speed. Moreover, members may lack knowledge and/ or experience about applications related to distributed teams. There may be a misfit between team structure and its

operational environment. Some employees may not fit for distributed project team psychologically. (Bergiel et al., 2008, p. 106; Kurupparachchi, 2009, p. 20)

Lack or even full absence of face to face meetings with other team members or project manager also leads to challenges. Team management often becomes more difficult, members often operate on different assumptions, and there are additional costs of supporting different locations (Nevo & Chengalur-Smith, 2011, p. 1). Besides, it is difficult to apply same standards to work and control of various locations in different cultural and linguistic environments (Kurupparachchi, 2009, p. 20).

Further downsides of globally distributed project teams include the following things. Lack of experience in technology related to distributed teams among senior management and clients, who may be less acquainted with computer applications compared to younger employees. Moreover, team members may experience a general lack of knowledge about programs related to distributed teams. Thus, for the first time of work in a globally distributed project team employees may need an additional training before the start of the project. (Bergiel et al., 2008, p. 106)

Misfit between distributed team structure and company's industry is another disadvantage, which a company may experience. For example, the usage of globally distributed project teams may not be successful in manufacturing. Psychological unsuitability of some employees for work in distributed teams may also negatively influence team performance. Since some employees may need additional interactions with other people, they require additional training and support, if they have to work in globally distributed project teams, to overcome these limitations. (Bergiel et al., 2008, p. 106)

The absence of non-verbal and lack of visual communication lead to longer decision making process. Martins et al. (2004, p. 811) suggest that this leads to decreasing ability of the team to assess members' knowledge. Thus, globally distributed project teams often experience problems in task coordination and project control (Nevo & Chengalur-Smith, 2011, p. 1). High dependence on technology may lead to the

disruptions in team progress and communication in case of problems with internet access or software crash.

Because of geographical distance, members of globally distributed project teams often experience lack of trust, which makes effective collaboration more difficult. Besides, in such teams employees may suffer from language, interpretation and meaning issues, which influence communication and result from national culture, language, individual motivations and work ethics of each worker involved in globally distributed project. (Holmström et al., 2006, p. 12) One of the most spread difficulties is language and interpretation. Although all team members might possess sufficient language knowledge, they might still experience problems caused by differences in accents and “decoding” the message. (Holmström et al., 2006, p. 15) This problem is less common in collocated teams, where team members are of a more homogeneous origin and informal communication enables a better understanding.

2.2. Agile methods

2.2.1. Origin of agile methods

Agile methods are software development methods, used to facilitate software development process. These methods were invented as a reaction to “traditional” software development methods. (Javdani et al., 2012, p. 127) They were designed to tackle the following challenges occurring during software development: long development time, high costs, and quality issues upon delivery (Holmström et al., 2006, p. 8; Pikkarainen et al., 2008, p. 304). To overcome these problems, the methods focus on individuals and interactions, working software, customer collaboration and quick response to change (Holmström et al., 2006, p. 8).

Therefore, agile methods address these challenges by decreasing development time and improving collaboration and communication process, especially if project delivery time is a critical issue for the company (Pikkarainen et al., 2008, p. 304). These methods differ from traditional software development methods mainly through attention to change adaptation and high quality product delivery through simple work processes (Dingsøyr et al., 2010, p. 2).

Agile software development methods have following features: they are incremental, cooperative, straightforward, and adaptive. Incremental refers to small software releases with quick development cycles. Cooperative means close collaboration of customers and project team. Straightforwardness indicates that agile methods are easy to learn and adjust to project requirements. Adaptiveness means the ability to make and adjust to changes quickly. (Abrahamsson et al., 2003, p. 245)

Agile methods are characterised by lack of comprehensive project documentation (Javdani et al., 2012, p. 127). These methods overcome the limitations of traditional approaches by taking into account changes in project requirements. Agile methods focus on establishing a close relationship between a customer and project team, as well as on the project delivery under time and budget constraints. Since agile methods suggest that the project is repetitive, adaptable, and minimally defined, these methods rely on frequent informal face to face communication. (Jalali & Wohlin, 2010, p. 45) Because of such emphasis on face to face communication, agile methods are best suited for collocated project teams, where frequent interactions are possible both within the team and with customers (Jalali & Wohlin, 2010, p. 46; Pikkarainen et al., 2008, p. 304).

Holmström et al. (2006, p. 10) imply that agile methods require frequent communication. Therefore, they are difficult to implement in globally distributed project teams, where there is a limited number of opportunities for face to face interaction and collaboration with a customer. At the same time, Nevo and Chengalur-Smith (2011, p. 1) suggest that even partial application of agile methods in globally distributed IT projects has a positive effect and increases morale and

commitment of team members. This suggestion is supported by Jalali and Wohlin (2010, p. 46), who stress a successful use of agile methods in globally distributed projects by several software companies.

Although the key principles of agile methods have been formulated only a decade ago in the Agile Manifesto (2001), the concepts and practices used in agile methods originated much earlier (Greer & Hamon, 2011, p. 1) in other fields. Nerur et al. (2010, p. 21) suggests that agile methods developed from such fields as architecture and strategic management. In particular, strategic management also moved from traditional to adaptive view. Traditional strategic management approach uses logical and rational, focused preplanning with actions leading to concrete goals, while adaptive view considers an organisation as an organism, which needs constantly to rearrange itself and adapt to changing environment. (Nerur et al., 2010, p. 21; Chaffee 1985) In its turn, in architecture, the need for different groups of project stakeholders and decision makers to interact is underlined (Nerur & Balijepally, 2007, p. 80).

Thus, agile methods originated from a number of different fields, from product development to architecture, whose methods were transferred and applied in software development.

2.2.2. The essence of agile methods

As already underlined before, agile methods are an attempt to meet the software industry demand for more lightweight and faster product development. The methods themselves are not revolutionary new. Instead, they are rather a set of tried and proved methods taken to an extreme level. (Holmström et al., 2006, p. 8) Agile methods are based on agile values: (1) individuals and interactions over processes and tools; (2) working software over comprehensive documentation; (3) customer collaboration over contract negotiation; (4) responding to change over following a

plan. Agile values are summarised in twelve principles published in 2001 in the “Agile Manifesto”. These principles are: (1) customer satisfaction through early and continuous delivery of valuable software; (2) promotion of sustainable development, facilitating indefinite development; (3) emphasis on simplicity; (4) taking into account even late in development requirement changes; (5) frequent delivery of working software; (6) working software as a primary measure of progress; (7) continuous attention to technical excellence; (8) daily close cooperation of business people and developers; (9) face to face communication as the best method of conveying information; (10) regular team reflection on improving its productivity and efficiency; (11) the emphasis on self-organising teams as the best way to carry out a project; (12) building projects around motivated individuals. (Agile Manifesto, 2001)

Agile methods differ from traditional methods in a number of ways. Firstly, agile methods cope with unpredictability by relying on people and their creativity rather than on formalised procedures. Secondly, agile methods use short, iterative development cycles, characterised by reflection periods, collaborative decision making, minimal documentation, and incorporation of rapid feedback. (Jalali & Wohlin, 2010, p. 45; Holmström et al., 2006, p. 9) The agile development cycle is presented in **Figure 3**.

Further comparison of traditional and agile methods is given in **Table 2**. Thus, agile methods try to avoid long and time consuming product development process, which adds little value to the end product.

Agile methods gained popularity since they reduce risks and increase product quality by providing product in regular parts. This enables re-evaluation of goals and priorities at the end of each cycle. Moreover, constant integration allows feedback on software testing and thus errors are eliminated much earlier in product development. (Jalali & Wohlin, 2010, 45)

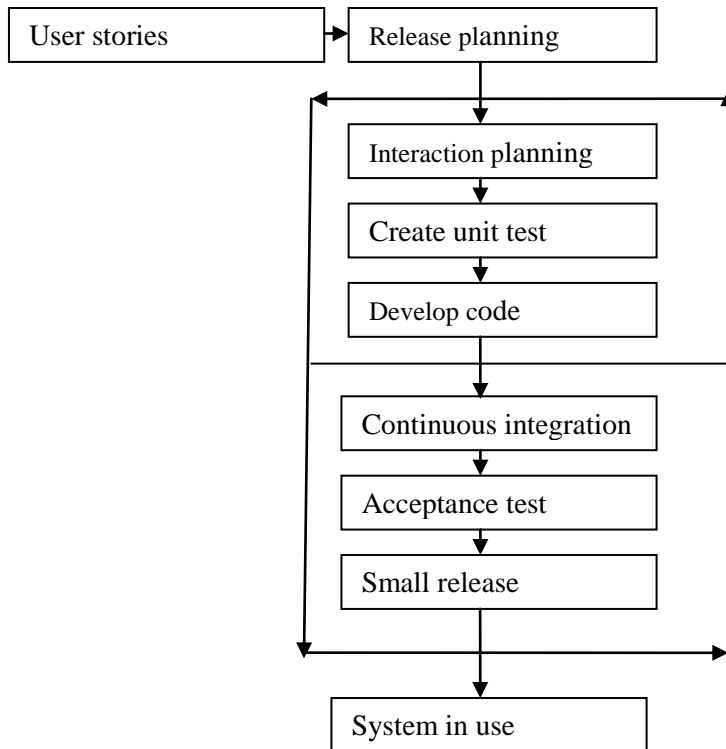


Figure 3: Agile development cycle.

Source: Huo et al., 2004, p. 521.

Table 2: Traditional and agile perspectives on software development.

	Traditional view	Agile perspective
Design process	Deliberate and formal, linear sequence of steps, separate formulation and implementation, rule-driven	Emergent, iterative and exploratory, knowing and action inseparable, beyond formal rules
Goal	Optimization	Adaptation, flexibility, responsiveness
Problem-solving process	Selection of the best means to accomplish a given end through well-planned, formalized activities	Learning through experimentation and introspection, constantly reframing the problem and its solution
View of the environment	Stable, predictable	Turbulent, difficult to predict
Type of learning	Single-loop/adaptive	Double-loop/generative

Key characteristics	Control and direction Avoids conflict Formalizes innovation Manager is controller Design precedes implementation	Collaboration and communication; integrates different worldviews Embraces conflict and dialectics Encourages exploration and creativity; opportunistic Manager is facilitator Design and implementation are inseparable and evolve iteratively
Rationality	Technical/functional	Substantial
Theoretical and/or philosophical roots	Logical positivism, scientific method	Action learning, John Dewey's pragmatism, phenomenology

Source: Dybå & Dingsøy (2009, p. 7).

2.2.3. Classification of agile methods

The family of agile methods includes a number of methods, which have much in common but distinguish in practices they offer. All methods received a different degree of attention in the literature (cf. Abrahamsson et al., 2003; Abrahamsson et al., 2010; Cohen et al., 2004; Rico et al., 2009). For example, extreme programming is well documented, while there is far less information on dynamic systems development method (Cohen et al., 2004, p. 12). Next, such agile methods, as adaptive software development, agile modelling, agile software process model, crystal family, dynamic systems development method, extreme programming, internet software development, feature driven development, pragmatic programming, lean development, and scrum will be discussed.

Adaptive software development suggests a new way of seeing software development in the company. The method is targeted particularly on the development of large and

complex systems. It suggests iterative and incremental development using constant prototyping. Adaptive software development is a framework providing guidance in order to prevent project from chaos. At the same time, it provides as much guidance as needed to keep space for emergence and creativity. (Abrahamsson et al., 2010, p. 33)

Agile modelling tries to apply the idea of rapid and agile project development to modelling. The method emphasises the importance of modelling practices and cultural issues, as well as value setting required for its application. The logic of this method is to encourage production of sufficiently advanced models to support urgent design needs and documentation purposes. On the other hand, agile modelling tries to keep the amount of models and documentation as low as possible. The method deals with cultural issues by offering various ways of encouraging communication process and organising team structures and ways of working. Abrahamsson et al. (2003, p. 245) and Cohen et al. (2004, p. 22) imply that agile modelling itself is not a complete software development method but rather a complimentary method, which can be used with any other development method.

Agile software process model was originally developed for Fujitsu. It aims at allowing accelerated software development and at the same time keeping development flexibility to deal with changes in product, process and environment requirements. (Abrahamsson et al., 2010, p. 33)

Crystal family of methods was introduced in 1990s by Cockburn, who developed them to address poor communication in software product development (Cohen et al., 2004, p. 7). Crystal family includes a set of twenty agile methods, divided into a two-dimensional grid, from which only one most suitable method is selected for each single project (Rico et al., 2009, p. 31). Each method has its specific colour indicating the method's relative weight. (Abrahamsson et al., 2003, p. 245) The choice of a method to use is based on number of team members involved, which requires a different degree of communication (Cohen et al. 2004, pp. 16-17). Crystal methods consist of seven stages: project cycle, delivery cycle, iteration cycle,

integration cycle, week and day, development episode, and reflection about the process. Crystal methods are based on seven properties, five strategies, nine techniques, eight roles, and twenty five documents. (Rico et al., 2009, p. 31) Crystal methods can be applied with any development practices, tools or work products and allow integration of other agile methods (e.g. scrum or extreme programming). (Abrahamsson et al., 2010, p. 34). The most agile method of Crystal family is Crystal Clear, next in descending order are Crystal Yellow, Crystal Orange, Crystal Red, etc. All crystal methods use a core set of rules, work products, techniques and notifications. (Cohen et al. 2004, p. 17)

Dynamic systems development method implies that instead of fixing the amount of functionality in a product and then adjusting project time and resources needed to reach that functionality, it is better to fix resources and then to adjust the amount of functionality accordingly (Abrahamsson et al., 2003, p. 245). The method emphasises the importance of communication between developers and end users, stable, skilled developers and flexible customer requirements for project success. Besides, further focus is on meeting high priority customer needs, product versus process, and integrated configuration management and testing. Dynamic systems development has such main stages: feasibility study, business study, functional model iteration, system design and build iteration, and implementation. Additionally, the method has fifteen practices, twelve roles and twenty three work products. (Rico et al., 2009, pp. 29-30) Abrahamsson et al. (2010, p. 34) see dynamic systems development method as the first truly agile software development method. At the same time, Cohen et al. (2004, p. 20) argue that it is not a method but rather a framework.

Feature driven development is a process oriented method for developing business critical systems. The method pays special attention to design and building project phases. It underlines quality aspects in product development process and implies frequent and measurable product deliveries, as well as controlling accurate project progress. (Abrahamsson et al., 2003, p. 245) This method includes five phases: developing an overall model, building a features list, planning by feature, designing

by feature, and building by feature. Feature driven development provides roles for project managers, chief architects, development managers, lead programmers, class owners, and domain experts. The method's components are class diagrams, feature sets, and the software product itself. (Rico et al., 2009, p. 31)

Internet speed development method is used when software product has to be delivered fast, thus development cycles have to be short. Internet speed development is a descriptive, management oriented framework, and it is believed to be more business and management oriented than other agile methods. (Abrahamsson et al., 2010, pp. 34-35)

Pragmatic programming is a set of "best practices" in programming, which focus on day to day problems. These tips deal with incremental, iterative development, rigorous testing and user-oriented design. (Abrahamsson et al., 2003, p. 246)

Lean development originated from lean manufacturing approach in car industry in 1980s. Unlike other agile methods, which aim at changing the development process, lean development emphasises the need for change from top down and focuses on management strategies. (Cohen et al. 2004, pp. 19-20)

Extreme programming is a collection of well-known software engineering practices. It aims at allowing successful product development despite uncertainty of project requirements. Extreme programming uses short iterations, small product releases, rapid feedback, close collaboration with the customer, constant communication and collaboration, continuous refactoring, continuous integration and testing, collective code ownership and pair programming. (Abrahamsson et al., 2010, p. 34) The method includes twenty eight rules and practices dealing with product planning, designing, coding and testing (Rico et al., 2009, p. 27). Extreme programming alongside with scrum is one of the most popular agile methods.

Scrum aims at managing software development in changing environment. The term itself comes from rugby (Cohen et al. 2004, p. 14). According to Rico et al. (2009, p.

26), scrum is nowadays the fastest growing agile method used by around half of developers. The method was invented to tackle two problems: (1) failure of already existing methods, and (2) the need for a new method ensuring project success was needed (Rico et al., 2009, p. 26). The method is based on flexibility, adaptability and productivity. It allows developers to choose themselves specific product development techniques, methods and practices for project implementation. As other agile methods, scrum uses iterations (called sprints), at the end of each a part of product is delivered. (Abrahamsson et al., 2003, p. 245) Scrum has five phases: sprint planning meeting, sprint, daily stand-up meetings, sprint review meetings, and sprint retrospective meetings. Key phases are daily stand-up and retrospective meetings, which provide a big amount of communication and process involvement. (Rico et al., 2009, p. 26)

There are a number of other methods, which are suggested to be in line with agile practices. However, these methods are not as widely used as described above methods. (Abrahamsson et al., 2010, p. 35)

2.2.4. Advantages of agile methods

Advantages and disadvantages of agile methods are result of values and principles behind the agile. This relationship is shown in **Figure 4**. Next, advantages of agile methods will be discussed.

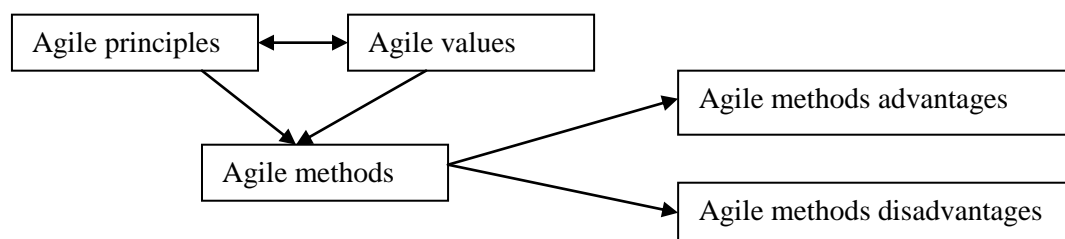


Figure 4: The relationship between agile methods and their advantages and disadvantages.

The use of agile methods brings several advantages. First of all, it ensures improved cooperation and communication through close collaboration with customers, small size of the team, face to face communication and regular product delivery at the end of each iteration (Petersen & Wohlin, 2009, p. 1481). Besides, cooperation and communication with the customer allows a better understanding of his needs at the earliest stage, and increase his impact on the product design (Ekas, 2012; Huo et al., 2004, p. 524). Increased customer satisfaction, in its turn, results in growing competitive advantage of the company.

Secondly, the application of agile methods enables better process control and increased product quality thanks to intensive communication and iterative product development (Cobb, 2011, p. 62; Dybå & Dingsøy, 2008, p. 850; Ekas, 2012). Moreover, Ekas (2012) stresses that agile methods improve project team's productivity by enabling burnouts avoidance and working product delivery from the earliest stage. Besides, sooner discovery of critical defects also increases team's productivity (Ekas, 2012). At the same time, the issue of productivity is ambiguous, since the existing research about these issues does not enable an unbiased comparison of agile and traditional projects (Dybå & Dingsøy, 2008, p. 850). Even in the case of two identical projects, productivity might depend on a number of other factors except the use of agile methods (Cobb, 2011, p. 59). Thus, the statement that agile methods ensure higher productivity is questionable.

Next, the use of agile methods eliminates silos and barriers between departments involved in product development, which also increases team effectiveness. Moreover, employees' high involvement and empowerment in agile projects might lead to increased morale and loyalty to the company. (Cobb, 2011, p. 59)

Besides, Dybå and Dingsøy (2008, p. 850) report that agile methods are easy to be incorporated by the company and show business value more efficiently. Moreover, agile methods can be successfully combined with traditional project management practices (Dybå & Dingsøy, 2008, p. 850). Further advantages are listed in **Table 3**.

Table 3: Further advantages of agile methods.

Better knowledge transfer due to better communication and frequent feedback from each iteration.
Customers' contribution through discussions and early feedback.
Increased process control, transparency, and quality through continuous integration and small manageable tasks.
Small teams and frequent face to face meetings improve cooperation and help getting better insights in the development process.
Customers appreciate active participation in projects, since it allows them to control the project and development process.

Source: Petersen & Wohlin, 2009, p. 1481.

2.2.5. Disadvantages of agile methods

The use of agile methods might cause disadvantages, which will be described next. Firstly, some of agile methods (e.g. extreme programming) are difficult to use in a big organisation. Such methods better fit small teams than larger projects. (Abrahamsson et al., 2010, p. 34; Dybå & Dingsøy, 2008, p. 850) An exception is adaptive software development, which best suits large and complex projects (Abrahamsson et al., 2010, p. 33).

Secondly, the use of agile methods might increase the total project costs and time, since more attempts might be needed for finding an optimal solution. Business resources require a more significant commitment and have to take a more active role in the development process as well. In such a way, agile methods might lead to increasing unpredictability of costs and schedule because requirements are less defined and can change. (Cobb, 2011, p. 58)

Thirdly, cooperation with the customer leads to shared decision making on most of the issues. Due to various interests, goals, and backgrounds of involved parties, such

pluralist decision making is more difficult and slower compared to traditional project management approach. (Nerur et al., 2005, p. 76)

Next, the cuts in documentation suggested by agile principles cause the increasing dependence of organisation on tacit knowledge and employees' expertise (Nerur et al., 2005, p. 76). This complicates knowledge transfer. Thus, when employees leave, organisation has to spend time on training new workers. Moreover, if employees leave the company, it is likely to lose part of its competitive advantage. The use of agile methods will result in considerable and quick changes, which are likely to meet employee resistance. Besides, it might be challenging for the company itself to adapt to rapid changes so quickly. (Cobb, 2011, p. 63)

Moreover, agile methods require team members to possess skills and understanding for working in agile projects. This also requires additional time, preparation and training. (Petersen & Wohlin, 2009, p. 1480) Besides, agile methods are at times exhausting and demanding, especially for customer, because of the required intensive communication throughout development process (Petersen & Wohlin, 2009, p. 1480).

Nerur et al. (2005, p. 76) imply that agile methods are most successful if there is a mixture of autonomy and cooperation within the company. However, it might lead to lack of clear vision about team's goals, work and schedule. Besides, an agile team manager has to show leadership and collaboration within the team. Shifting to such management style might be difficult and requires a manager with certain qualities and experience. (Nerur et al., 2005, p. 76)

2.3. Communication in globally distributed IT teams

In this part, communication process occurring in globally distributed IT project teams will be explored. Firstly, communication features in such teams will be discussed. Secondly, the relationship between agile methods, communication, and distributed teams will be analysed. Thirdly, theories explaining communication will be examined.

2.3.1. Features of communication in distributed project teams

Communication in an organization is usually described as a two-way process of information sharing, which occurs daily in a routine manner (Pikkarinen et al., 2008, p. 304). There are two or more team members involved in this process (Potter et al., 2000, p. 132). Kraut and Steeter (1995) imply that in software development communication means employees working on a common project agree on what they are producing, and share information and coordinate their work. In software development, communication is also used to manage relationships between development teams, management and customers (Pikkarinen et al., 2008, p. 304).

Communication process consists of two parts: informal and formal communication (Holmström et al., 2006, p. 14; Pikkarinen et al., 2008, p. 306) and it is presented in **Figure 5**.

Formal communication refers to explicit communication (e.g., specification documents and status review meetings in software development). Informal communication is communication via informal conversations and messages among the company employees. (Pikkarinen et al., 2008, p. 306) Informal face to face communication is the best way for building trust in project teams and a significant success factor (Highsmith & Cockburn, 2001; Mishra et al., 2012, p. 1068;

Pikkarinen et al., 2008, p. 307), because it gives immediate feedback and non-verbal information (e.g. face and body expressions and emotions). But the information received through face to face communication is contained in the memory only for some time, after which it starts to diminish (Mishra et al., 2012, p. 1068). Thus, if information will be used in future, formal communication is more advantageous.

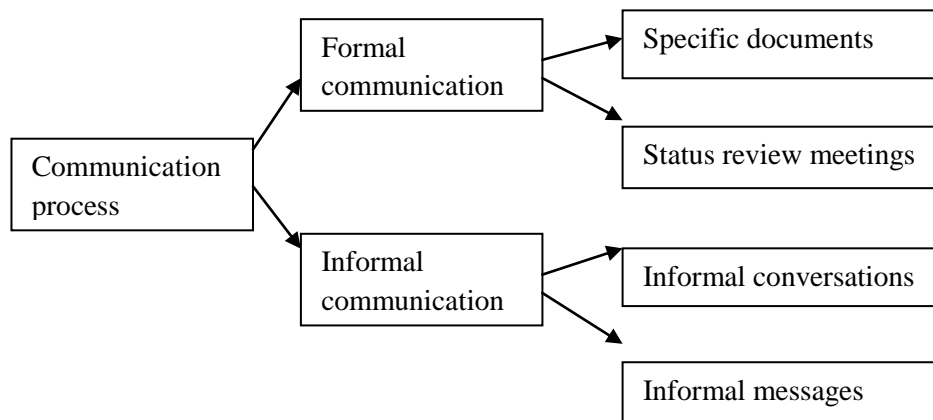


Figure 5: Communication process in globally distributed project teams.

Based on: Holmström et al., 2006, 14; Pikkarinen et al., 2008, p. 306.

Besides, in globally distributed projects, regular face to face communication is extremely difficult to achieve. Therefore, in such projects, informal communication mostly occurs via existing communication technologies such as telephone, video, audio conferences, voice mail and e-mail (Pikkarinen et al., 2008, p. 306). In case of small time zones overlaps in work of a globally distributed team, even informal communication via telephone or video channels might require previous scheduling. This shift to more complex technology mediated communication environment increases the importance of communication in globally distributed software development compared to traditional software development (Holmström et al., 2006, p. 14; Korkala & Abrahamsson, 2007, p. 204).

Research on communication in multinational companies (Lucas, 2006; Minbaeva, 2005) agrees that communication in such settings still largely depends on face to

face interactions, social ties, dialogic practices, shared norms and trust. However, these factors are negatively influenced by physical distance between team members. In distributed IT projects, communication is challenging due to time differences, the lack of face to face interaction, as well as inter-functional and cultural barriers within the MNC (Kauppila et al., 2011, p. 396). Communication problems result from actors' various nationally-based cultural features, language barriers, and limitations caused by information and communication technologies. (Kauppila et al., 2011, pp. 396-397). Furthermore, despite its importance particularly in distributed projects, the average communication time dramatically decreases compared to traditional software development. For example, Niinimäki (2011, p. 82) found that the average time for communication per member of a distributed project team is 45 minutes. At the same time, the average time for verbal communication in a collocated team is 75 minutes (Niinimäki, 2011, p. 82).

2.3.2. Communication, agile methods, and distributed project teams

There are two opinions on the influence of agile methods on communication in distributed project settings. On one hand, agile methods are considered as a tool for overcoming communication challenges in globally distributed project teams (Holmström et al., 2006; Korkala & Abrahamsson, 2007; Pikkarinen et al., 2008). On the other hand, some researchers (Korkala & Abrahamsson, 2007; Nevo & Chengalur-Smith, 2011; Persson et al., 2012, Turner & Boehm, 2003) suggest that agile methods might cause additional communication challenges in distributed context. Next, both of these viewpoints will be discussed.

Agile methods use effective verbal communication to deal with highly changing environment (Korkala & Abrahamsson, 2007, p. 204). In such way agile methods deal with lack of communication and team members' isolation in globally distributed IT project teams by requiring regular communication, which is necessary for implementing agile practices. Besides, agile methods help to improve such

important distributed environment issues as task awareness and project coordination (Korkala & Abrahamsson, 2007, p. 204). Agile methods also positively influence communication in distributed environment by offering tools and practices for collaboration and interaction within and between different stakeholders groups (e.g. daily stand-up meetings in scrum, rapid feedback in extreme programming) (Pikkarinen et al., 2008, p. 305).

Since agile methods are introduced to overcome communication challenges, these methods also deal with geographical, temporal and sociocultural distances inherent in globally distributed teams. Scrum pre-planning game phase and pair programming are considered to encourage interaction between employees with different cultural backgrounds and team commitment. (Holmström et al., 2006, pp. 14-15) However, agile methods do not completely eliminate the above mentioned distances. For example, in case of small or no time overlap pair programming becomes extremely problematic.

Although agile methods are believed to reduce challenges caused by temporal, geographical, and sociocultural distances in globally distributed teams, Sarker & Sarker (2009) suggest that the use of agile methods in globally distributed projects might cause additional communication challenges to already existing ones. Boehm & Turner (2003) support this view by stating that agile methods can increase the existing gap among globally distributed project team members and even cause project failure. Firstly, in distributed environment, communication is further limited, since project requirements are documented on a very general level and synchronous verbal communication is even scarcer compared to collocated teams. This might lead to significant risks if agile methods are applied in globally distributed IT project teams. (Korkala & Abrahamsson, 2007, p. 204)

Secondly, Turner & Boehm (2003) assume that the use of agile methods might have a negative impact on a company, since agile methods considerably emphasise informal communication and as a result tacit knowledge across a team. In case of employee retention or team rotation, communication will be difficult and less effective at least for the time necessary to train new team members about the project.

However, agile methods do not exclude explicit ways of communication completely, because agile software development cannot be successful only using informal communication. Formal communication such as source codes, test cases, and minimal essential documents are also used in agile software development. But they receive far less attention in description of agile methods. (Pikkarinen et al., 2008, p. 305) Together with difficulties in informal communication in distributed settings, this lack of focus on formal communication channels adds further obstacles for distributed agile software development.

Thirdly, physical distribution of employees makes the application of agile methods challenging (Nevo & Chengalur-Smith, 2011, p. 2) for two reasons: (1) many of agile practices and tools were developed for collocated teams and thus require some adaptation for globally distributed teams, and (2) technology-mediated communication cannot fully replace face to face communication. Thus, daily stand-up meetings even through video or audio technology are still difficult in globally distributed project teams. Moreover, lack of face to face communication will, in its turn, increase the role of project manager who has to provide each team member with all relevant information. Such situation might even create information bottlenecks, because all employees would have to appeal to project manager for information. Project manager might even have to share his/ her time between fulfilling project tasks and information sharing. (Mak & Kruchten, 2006, p. 606)

Thus, agile methods require a careful approach and adaptation when they are used in globally distributed IT project teams, since there is a risk that agile practices in distributed settings may further deepen difficulties related to communication, collaboration and product quality (Persson et al., 2012, p. 412)

2.3.3. Communication theories

Despite the initial creation of agile methods for collocated teams, agile methods have been successfully used distributed projects as well (Abrahamsson et al., 2002; Hossain et al., 2009). To explain this phenomenon, communication theories will be discussed to ensure a better understanding of communication in distributed agile software development. For this purpose, constructs from social presence, media synchronicity, and transactive memory theories will be employed.

Social presence describes the ability of a certain communication medium to allow team members feeling each other's presence and the joint involvement in communicative interaction. *Social presence theory* suggests that during interactions employees prefer to perceive others as co-present. The theory was originally developed to explain the effect which telecommunication media can have on communication. (Short et al., 1976) Communication media vary in the degree of social presence, which depends on the amount of communication channels available to transmit rich information. These channels include among other things verbal cues, facial expressions, gestures etc. Short et al. (1976) imply that the fewer channels are present in a communication medium, the less attention an employee pays to the presence of other team members involved in the communication. As result, an employee pays less attention to the transmitted information and perceives it as less important. (Andres, 2002, p. 40) A medium with a high degree of social presence is perceived by employees as sociable, warm and personal, while a medium with a low degree of social presence is seen as less personal (Lowenthal, 2010, p. 117). Communication media can be classified according to the degree to which they transmit social cues and ensure social presence. For example, e-mail ensures the lowest degree of social presence, since it has a very limited feeling of physical presence and transmits a small number of cues. On the contrary, face to face communication allows a transfer of information rich in verbal and non-verbal cues. (Andres, 2002, p. 40; van den Hooff et al., 2005, p. 6) Social presence theory explains challenges experienced by globally distributed IT project teams (i.e. lack of

trust, difficult decision making, coordination and control, etc.). According to this theory, face to face communication is more beneficial than any other communication medium. This corresponds to the agile philosophy ("people and interactions over processes and tools). Since in globally distributed agile software development face to face communication is extremely rare, such IT teams using agile methods would experience more difficulties and would be less productive in communication compared to collocated teams. However, Ocker et al. (1996) and Turoff et al. (1993) found that teams using asynchronous communication media (e.g. e-mail) were more productive than teams using face to face communication. This paradox is not explained by social presence theory. But Andres (2002, p. 41) suggests that asynchronous communication has a benefit of "anytime, anywhere" engagement, i.e. team members are not temporally or geographically constrained. At the same time, Nevo & Chengalur-Smith (2011, p. 4) imply that modern ICT (information and communication technology) media might at least partially compensate the lack of face to face communication and create a feeling of social presence among globally distributed IT project teams.

Next theory, *media synchronicity theory* was suggested by Dennis & Valacich (1999) to explain effective task performance when using various media for the team function and communication process. The theory is based on a three dimensional model (presented in **Figure 6**), which examines five media capabilities, which support the two communication processes of conveyance and convergence across three team functions (production, well-being, and member support). According to the theory, the combination of the media capability and communication process and team functions determines the total effect on communications (DeLuca & Valacich, 2006, p. 327; Kahai, et al., 2007, p. 63).

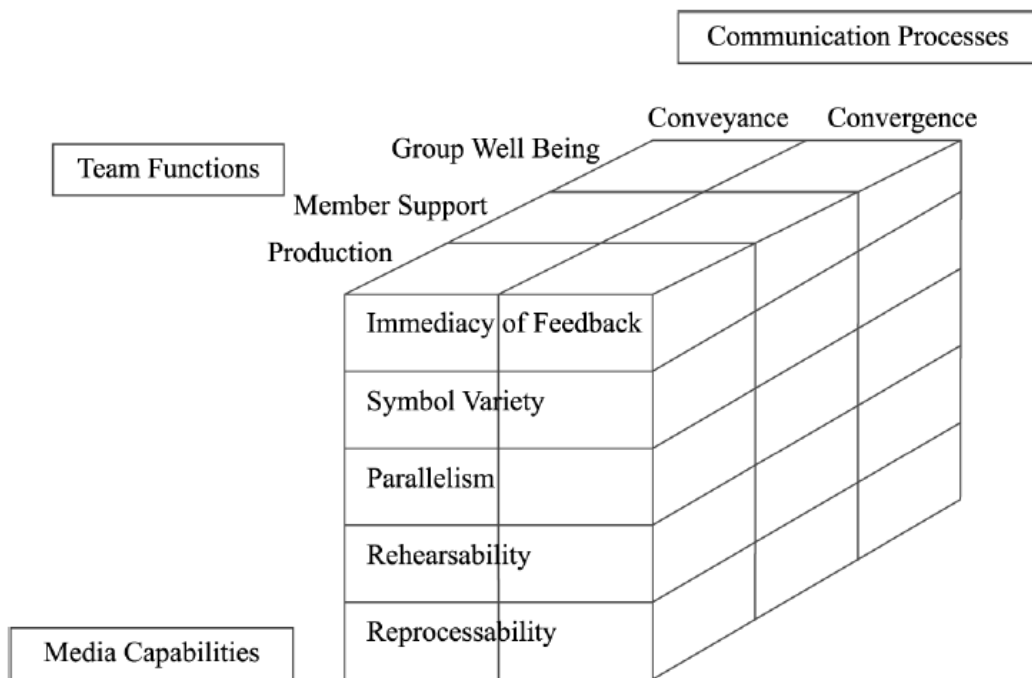


Figure 6: Dimensions of media synchronicity theory.

Source: DeLuca & Valacich, 2006, p. 326.

These capabilities include immediacy of feedback (receiving rapid feedback from communicators), symbol variety (format by which information is conveyed including verbal and non-verbal symbols), parallelism (number of effective simultaneous conversations), rehearsability (tuning a message before it is transmitted), and reprocessability (readdressing the message within the context of the communication event). Different media can be placed along the media synchronicity continuum according to the communication capabilities they possess and the functionality they enable (as shown in **Table 4**). A particular medium may be variously rated in any of five capabilities. (DeLuca & Valacich, 2006, p. 327; Nevo & Chengalur-Smith, 2011, p. 3)

Media synchronicity is formed by two communication processes: conveyance and convergence. Conveyance refers to the transmission and processing of new information, while convergence describes the establishment of the information meaning. (Nevo & Chengalur-Smith, 2011, p. 3) DeLuca & Valacich (2006, p. 327)

imply that for team tasks, which require only conveyance, low synchronicity media are acceptable and even preferable, since they ensure anytime, anyplace access. On the contrary, highly synchronous media are required for convergence of information, since such media are richer in symbol variety (i.e. context) and allow fewer possibilities for misinterpretation. Complex tasks, e.g. business process improvement, involve both synchronous and asynchronous communication media for an effective result. (DeLuca & Valacich, 2006, p. 327)

Table 4: Media capabilities.

Media	Immediacy of feedback	Symbol variety	Parallelism	Rehearsability	Reprocessability
Face to face	High	High	Low	Low	Low
Video conference	Medium-High	Medium	Low	Low	Low
Telephone conference	High	Medium	Low	Low	Low
Synchronous instant messaging	Medium-High	Low-Medium	Low-Medium	Low-Medium	Medium-High
Synchronous electronic conferencing	Medium-High	Low-Medium	Low-Medium	Low-Medium	Medium
Asynchronous bulletin board	Low-Medium	Low-Medium	High	High	High
Asynchronous e-mail	Low-Medium	Low-Medium	High	High	High
Written mail	Low	Low-Medium	High	High	High

Source: DeLuca & Valacich 2006, p. 327.

The third dimension of media synchronicity theory includes such team functions as production, well-being and member support. DeLuca & Valacich (2006) found that

as a team tries to complete a project (production), it cannot ignore the social needs of the individuals (member support) and the team (well-being). This reconciliation usually takes place face to face or, if it is done electronically, it takes more time. (DeLuca & Valacich, 2006, p. 328)

Transactive memory theory suggests that within the team knowledge is not limited to the information possessed by a single team member, but an employee can access other team members' knowledge. Transactive memory does not belong to each member, but it is property of a group. (Wegner, 1987, p. 191) In such way team members may benefit from each other's expertise and knowledge if they develop a shared understanding of who has what kind of information in a team. According to the theory, team members can exchange knowledge and increase each other's expertise by interacting with each other (Wegner, 1987, p. 191). The research showed that transactive memory enables teams to reach higher levels of performance (Moreland & Argote, 2003; Reagans, et al., 2005). Besides, transactive memory was found to play a positive role in communication in globally distributed project teams (Griffith et al., 2003; Kanawattanachai & Yoo, 2007). Since globally distributed software development is difficult due to geographical, temporal, and sociocultural distances, transactive memory development is a challenging task for globally distributed IT project teams. But Nevo & Chengalur-Smith (2011, p. 5) propose that transactive memory can be developed also in such teams but after a long period of time. This process can be facilitated by key activities of agile methods. Since agile methods pay less attention to documentation, stand-up meetings are crucial for knowledge sharing among team members. Such activities assist in transactive memory development among globally distributed project teams. (Nevo & Chengalur-Smith, 2011, p. 5) However, low focus of agile methods on documentation together with lack of face to face communication negatively influences transactive memory development in globally distributed IT project teams.

2.4. Theoretical framework

This section introduces a theoretical framework aimed at exploring the research problem, which examines the usage of agile methods in globally distributed IT project teams. The research question of this study is dedicated to investigation of how agile methods influence communication in globally distributed IT project teams. The core of the theoretical framework consists of the studies by Short et al. (1976) and Andres (2002) on role of social presence in communication process; Dennis & Valacich (1999), DeLuca & Valacich (2006) on media richness communication theory; and Wegner (1987) on transactive memory theory.

In order to answer the research question of this study, the actual theoretical framework (presented in **Figure 7**) focuses on three sets of communication media characteristics pulled by agile methods and influencing communication in globally distributed IT project teams. The influence of agile methods on communication in globally distributed IT project teams is mediated by the ability of communication media to ensure social presence feeling of project team members. Besides, in globally distributed settings, the synchronicity of communication media is an important determinant, since it provides a feeling of presence and overcomes distances. Finally, transactive memory allows team members to use each other's knowledge and develop collective knowledge. To answer the research question, present theoretical framework will be empirically tested by using a case study method on a Ukrainian subsidiary of an IT company.

2.5. Summary of Chapter 2

Modern MNCs are trying to overcome distance and carry out projects all over the world regardless of the project team's physical location. To achieve this, companies

use globally distributed project teams. Such teams work on an interdependent task, heavily rely on electronic communication, and in their work overcome geographical, time, and organisational boundaries. In globally distributed project teams, communication is chiefly done via electronic media, since face to face meetings with other team members and clients are seldom possible. There are several classifications of globally distributed teams (Griffith et al., 2003; Dorn et al., 2007; Duarte & Snyder, 2001). This paper uses the typology offered by Duarte and Snyder (2001) and focuses on project teams consisting of experts in a certain field brought together to fulfil a new project. Globally distributed project teams offer companies benefits in the fields of human resources management, finance, social capital, competition, and create an equal workplace. At the same time, disadvantages of globally distributed project teams are caused by the need to overcome geographical, temporal, and sociocultural differences, which can make work in such teams more challenging compared to collocated teams.

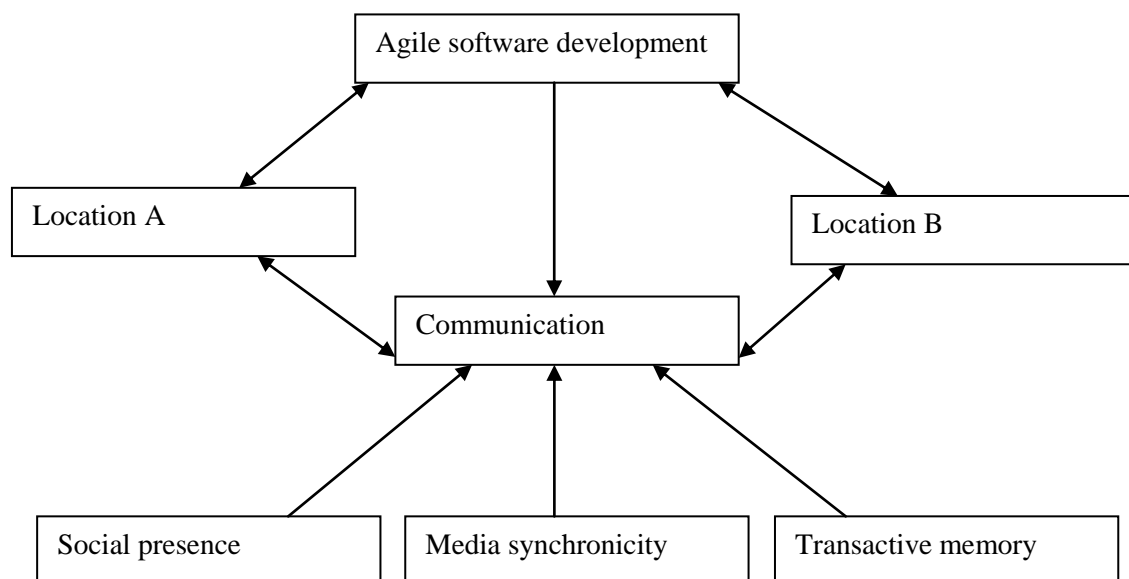


Figure 7: Theoretical framework.

Agile methods, in their turn, were developed to tackle high project costs, long development time and quality issues in IT. These methods focus on establishing a close relationship between the project team and a customer. Agile methods require

frequent informal face to face communication, thus they are widely used in collocated project teams and not in globally distributed project teams. But there is a number of successful cases of adjustment and use of agile methods in globally distributed project teams. Agile methods include adaptive software development, agile modelling, agile software process model, crystal methods, dynamic systems development, extreme programming, internet software development, feature driven development, pragmatic programming, lean development, and scrum. Extreme programming and scrum are the most popular among agile methods at the moment. While agile methods improve product quality and cooperation and communication inside and outside the project teams, they might negatively influence team performance (e.g., increased dependence on knowledge and expertise, adaptation difficulties etc.).

Communication in globally distributed project teams, as in any organisation, is a two way daily routine process of information sharing (Pikkarinen et al., 2008, p. 304). In globally distributed project teams, informal communication is restricted and mainly occurs not face to face but electronically. Although agile methods imply informal instead of formal communication (daily close cooperation of business people and developers, face to face communication as the best method of conveying information), in globally distributed project teams, communication is more formalised compared to collocated teams.

The existing research in the field of agile methods mainly focuses on collocated teams (Abrahamsson et al., 2002). Thus, the usage of agile methods in globally distributed teams is the gap, which requires further investigation. The present study is aimed at fulfilling this research gap. The research question will be examined from three perspectives: social presence theory, media synchronicity theory, and transactive memory theory. According to social presence theory, people choose such communication media, which allows transmitting more social cues (e.g. gestures, facial expressions) and thus creating a feeling of social presence. Media synchronicity theory implies that each communication media is used depending on its media capabilities, team function needed to achieve (production, well-being, or

member support), and task requirements in communication (conveyance vs. convergence). Finally, transactive memory theory implies that team members may build a shared knowledge via information exchange. Despite the difficulty of such process in globally distributed IT teams, agile methods might facilitate this process by offering regular stand-up meetings. At the same time, agile methods might negatively impact formation of transactive memory in globally distributed settings, since they pay less attention to documentation. The present study addresses all of these issues in its research question, and will examine them on the case study example of an IT's company subsidiary located in Ukraine.

3. Methodology

This chapter describes a research strategy used in this study. Then data collection technique utilised in this study is presented, followed by discussion of measures taken to provide reliability and validity of the research. Finally, this chapter provides information on the case company.

3.1. Research design

For this study, qualitative research methods were chosen, since they allow an in-depth investigation of a phenomenon. Moreover, because qualitative methods are more subjective compared to quantitative ones, they allow investigating why individuals act or think the way they do. (Saunders et al., 2007) Additionally, qualitative methods are more applicable for case study, which was chosen as a research strategy for this thesis. The research approach of this study is an exploratory one, as the research question is a “how” question (Yin, 1994, p. 6). An exploratory study attempts bring new insights on the phenomenon and to understand what is happening with the subject in the new light (Yin, 2003). Such studies are conducted in order to understand a problem, when its nature is uncertain (Saunders et al., 2007). Exploratory studies are undertaken when previous research is insufficient and incomplete. Thus, these studies are aimed at discovering new ideas, which will be later tested in future investigations. (Yin, 2003) Since the majority of previous studies on agile methods and communication described them in collocated teams, the exploratory nature of this research will assist to understand this phenomenon in the case of globally distributed IT project teams.

A present study uses a combination of deductive and inductive research approaches. The use of a deductive approach is justified, because it is aimed at developing of a theory based on already existing research, then a hypothesis is created and tested through a selected data collection technique. (Saunders et al., 2007) For example, the present study used already existing research on globally distributed IT project teams and communication in agile software development. Combining globally distributed IT teams with agile methods influences on communication in order to understand this influence, media richness, social presence, and transactive memory theories are used to investigate impact on communication in globally distributed teams using agile methods. These will be observed, tested, and verified whether the discussed theories will stay applicable to the context of this study.

On the other hand, inductive approach is also suitable for this study, which uses data collection techniques in order to develop and build a theory. This approach allows understanding why a certain phenomenon occurs, rather than what occurs. (Saunders et al., 2007) Similarly, the present research via in-depth interviews also aims at discovering how agile methods can cause communication differences in globally distributed project teams and whether they were already described in previous studies. Therefore, a combination of both deductive and inductive approaches is the most applicable for this thesis, since this study cannot be carried out without a theory based on the existing research (deductive approach) and it will discover new insights according to the research question (inductive approach).

In the existing literature, impact of agile methods on communication was examined from qualitative (Holmström et al., 2006; Pikkarinen et al., 2008) and quantitative perspectives (Nevo & Chengalur-Smith, 2011). However, the current study will use solely qualitative approach through case study as a research tactic and in-depth interviews as a research technique. The following section will examine those approaches, tactics, and techniques more closely.

3.2. Research method and strategy

Qualitative research is different from physical research or natural sciences research, since it allows examination of individuals' social behaviour. Since this type of research can examine behaviour and opinions of people, who form organisations, such research is important for business and management studies. Additionally, qualitative research addresses “what” and “how” questions rather than “how many” questions addressed by quantitative research. (, Yin, 2003) Since the studied phenomenon is broad and complex, it has to be investigated within its context (Yin, 1994, p. 15).

Therefore, due to qualitative research approach characteristics, it is the most suitable for this study, since it permits to examine behaviour and opinions of company's employees regarding communication process during agile software development in globally distributed IT project teams. Besides, this research type will allow understanding in the best manner through in-depth investigation how agile methods influence communication in globally distributed IT project teams.

A case study was chosen as a research strategy, because it allows examining a particular phenomenon occurring in real life context using multiple sources of evidence (Yin, 2003). Since the boundaries between the studied phenomenon (communication in globally distributed project teams) and its context (company specific factors, agile methods used by the company) are not clear, a case study is the best strategy, as it allows studying the subject within its context. Thus, a case study as a research strategy is the most suitable for selected research approaches, since it enables a simultaneous testing of the existing theory and provides a source for new ideas and future research. (Saunders et al., 2007)

3.3. Data collection and data analysis

When the case study research strategy is used, such data collection technique as interviews has to be used (Saunders et al., 2007, p. 146). Thus, for this thesis interviews were chosen as a data collection technique. In order to find comprehensive answers to the research question, semi-structured interviews will be used. Semi-structured interviews imply a certain degree of flexibility. While for such interviews a researcher develops a list of topics and questions, it may vary from interview to interview depending on the conversation flow. At the same time, additional questions may be added in order to adapt to the particular context and clarify interviewee's responses or interview questions. Moreover, some of the questions might be skipped if they were already answered while answering to other questions during the interview. (Saunders et al., 2007, p. 320) Next, semi-structured interviews are an optimal technique for exploratory studies, as they provide new insights and prompt topic discussion (Saunders et al., 2007, p. 322).

Skype interviews are believed to be the most effective way of conducting semi-structured interviews, when respondents and the interviewer are in different locations. Such interviews establish a contact with the interviewee and exclude travel costs. Although Skype interviews are poorer in social context than face to face communication, they still allow observing the interviewee's reactions to the research questions. In such way a researcher can interpret the answers in a more correct way. (Saunders et al., 2007)

In order to keep balance between having enough data for analysis and interpretation and time and budget constraints, it is necessary to reach saturation point and not go over it. In the current study, the saturation point was 10 interviews. The main criterion for selection of the interviewees was their involvement in the globally distributed project teams working with colleagues abroad. The interviews were conducted during September and October via Skype. The duration of an interview varied between 45 and 70 minutes. All the interviews were first tape recorded and then decoded into text to make the data analysis easier. The interview questions were tested in a pilot interview to ensure the interviewee's understanding of the questions. All of the interviews were conducted in Russian and Ukrainian languages,

which are mother tongues of both the researcher and the interviewees. Therefore these languages were the most convenient way of communication. Later on the interviews were translated into English.

To conduct interviews, an interview guide was developed, which is provided in the Appendixes. It has the following structure. It starts with the open questions regarding interviewee's back ground, work experience, and role in the company. Then there are questions related to the use of globally distributed project teams by the company and interviewee's experience in such teams. Finally, there are questions related to the communication process in globally distributed IT project teams and possible influence of agile methods on it.

To be useful, qualitative data need to be analysed and understood. Qualitative data analysis procedures assist in this. Due to their non-standardised and complex nature, qualitative data have implications for their analysis, during which they are summarised, categorised as a narrative to support meaningful analysis. (Saunders et al., 2007, p. 482) To achieve this, qualitative data analysis has to begin simultaneously with data collection process and continue after the data are gathered. (Saunders et al., 2007, p. 485) Data analysis started with transcription of the interviews taken. All interviews were word-processes and then translated into English. All of the interviews offered opinions about communication in globally distributed IT project teams in a particular company. These opinions were further supported by facts and examples reported by the interviewees from their experience.

There are two possible approaches to qualitative data analysis: deductive and inductive approaches. A deductive approach suggests that theoretical propositions used to create a research framework are also used for organising data analysis. Such approach allows integrating the research into already existing knowledge in the field, as well as providing an initial analytical framework. If an inductive approach is used, then data collection occurs first and then it yields themes for further analysis. However, such approach is likely to be difficult to implement, since there is no examination of emerging themes during data collection. In this case, data have

to be analysed as they are collected, and a conceptual framework has to be developed to guide further work. In present research a deductive approach to data analysis was used, where the theoretical framework offered in Chapter 2 was used to develop interview guide and themes to look closely at during the data analysis. (Saunders et al., pp. 489-490)

After the transcription and translation, the achieved information was summarised. Thus, key points from each interview were listed depicting the main themes emerged from the interviews and relationships between these themes. (Saunders et al., 2007, pp. 491-492) This data summary might be later used for triangulation of other collected data. Next, categorisation of the data occurred. It includes categories development and their attachment to meaningful information sets. This process allows finding themes and relationships in the analysed data. Thus, the researcher attempted to analyse how communication process looks like in a company's globally distributed IT project teams, which use agile methods, and then compared it with the theories discussed in literature. Finally, the key features of agile methods influence on communication in the company were identified and compared with the theoretical framework created during the literature review.

3.4. Reliability and validity of the research

Reliability and validity are an important part the research results evaluation. Reliability and validity evaluations are used to reduce the possibility of getting inaccurate answers. Reliability refers to the extent to which the data collection techniques used in the research can provide the same results if the research is repeated by another person (Yin, 1994, p. 36). A study is considered reliable, when the research techniques generate the same results every time the techniques are used, and that any variations in the results are caused by the changes of the research instrument.

According to Saunders et al. (2003, pp. 156-157), there are four threats to reliability. The first one is subject of the participant bias, which means that the interviewee might be saying what is socially desirable. In order to avoid this, the interviews were done not on the interviewee's workplace but in a neutral location. The second threat is participant error, which means that the answers may differ depending on time of the week. Therefore, no interviews were held on Monday mornings and Friday afternoons. The third type of threat is the observer error, which implies that a different interviewer might approach the question differently. Finally, observer bias might occur, which means that there might have been different approaches to the interpretation of replies. Using a semi-structured interview questions, reflecting the main points to be covered, helped to deal with these two problems. Moreover, the interview guide was pre-tested by the supervisor in order to avoid possible bias caused by the inadequate and/ or unclear question formulation. Besides, to improve the accuracy of results and avoid possible interviewee's misunderstandings, the interviewer explained the meaning of all terms used during the interview. Moreover, to avoid "leading to the answer", all questions were formulated in a neutral manner and asked in the same tone of voice.

Validity is concerned with the degree to which the research findings are really what they seem to be. It means the extent to which a research is able to conclude information that the interviewee to give in response to a question. Validity has a wide range of concepts and can be viewed from three perspectives: construct, external and internal validity. Construct validity means the correctness of research measures. To achieve this, all interview questions are based on framework and theories from existing literature. Additionally, a pilot interview was conducted to test the questions wording. Moreover, all the interviews were recorded and followed the interview guide. Next, internal validity means the quality if results interpretation. For that purpose, all data obtained from the interviews were classified, re-read, coded and categorised. Afterwards, empirical findings were compared to the theoretical framework. External validity refers to the possibility to generalise the research findings on a bigger scale in similar research context. If a research has strong external validity, it can be easily generalised to other organisations working

in similar settings. (Yin, 2003) Since the given study is a single case study, its results can be generalised to companies working in similar but not exactly the same conditions.

3.5. Case company information

Case company, in this thesis referred to as company ABC for anonymity reasons, is an IT services company headquartered in the USA. It was established in 2000 and has 1900 employees around the world. ABC's offices outside the US are located in Canada, Western Europe (Belgium Germany, Latvia, Lithuania, Sweden, UK), Eastern Europe (Belarus, Russia and Ukraine), Australia and China. These offices were mainly established as a result of mergers with other companies. Thus, ABC uses mergers as a way to penetrate new markets and uses already existing companies to ensure a quick access to local clients and resources. The most recent merger occurred in 2013 with another U.S.-based company.

ABC's key business activity is application development for financial services, telecommunication, healthcare, public sector, technology and media industries. **Figure 8** represents markets, where ABC's clients are from. The company also entered management consulting and insurance markets through its merger in 2013. In such way, it acquired global additional resources, partnerships and intellectual property and thus offers complementing solutions for its clients. This merger is in line with the IT industry trend, which states that software development becomes more and more integrated into business solutions in all industries (Higley, 2013, p. 3).

Since organizational structure of company is directly related to its strategy, size, technology, environment and culture (Griffin & Pustay, 2007, p. 384), ABC's organisational structure has a global matrix design, where management is split

between area managers and project managers. Such design allows ABC to flexibly respond to changing environment and combine expertise needed for each project with corresponding functional area. Global matrix design also enables ABC to successfully use globally distributed IT project teams and agile methods, because global matrix structure allows company's resources to be flexibly allocated depending on the project. At top level, a Board of Directors is responsible for the strategic, financial, legal or other important issues. Board of Directors elects the CEO.

Besides, ABC implemented more than 400 agile projects, which were aimed at reducing time to market, creating high quality software, and improving communication between different stakeholders groups.

Thus, this chapter discusses the research strategy, data collection technique, measures taken to provide reliability and validity used in this study. Next, information on the case company was provided.

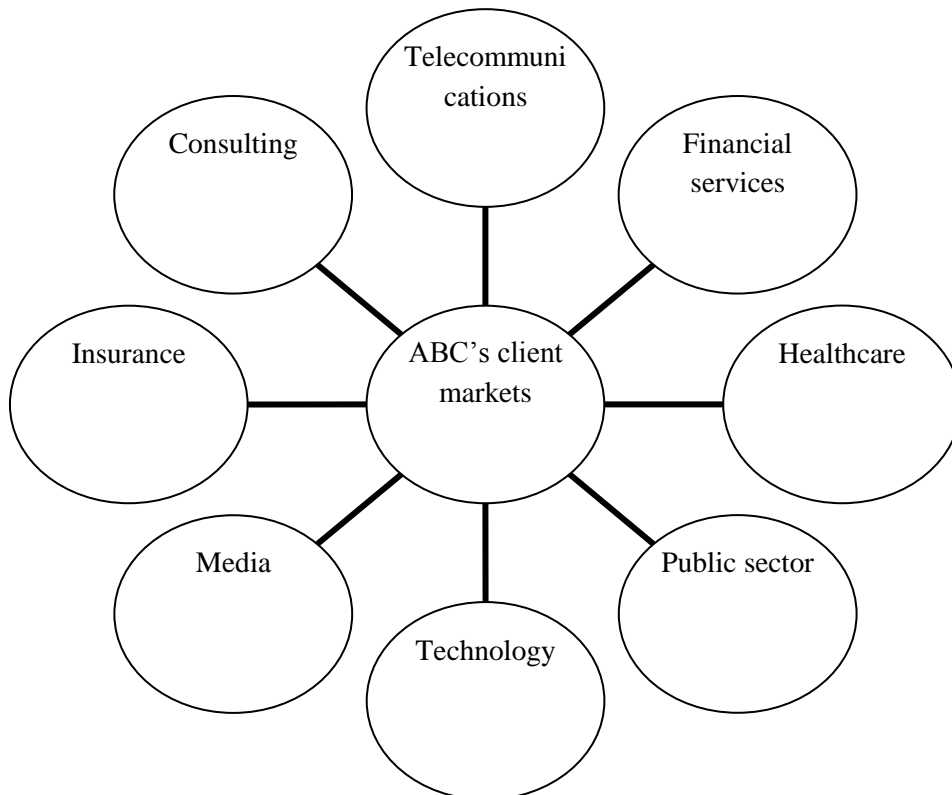


Figure 8: Markets, where ABC's clients operate.

4. Empirical findings of the study

This chapter will present the empirical findings of the study, obtained during data collection, and will link them to previously discussed theory. The purpose of this research is to investigate the influence of agile methods on communication in globally distributed IT project teams. The research question of the study aims at exploring how agile methods influence communication in globally distributed IT project teams. The results of the study will be presented according to the structure of literature review. Thus, the first part will deal with the data regarding globally distributed IT project teams at ABC. The second part will focus on the agile methods used in such teams at the company. Finally, influence of agile methods on communication will be discussed.

4.1. Use of globally distributed IT project teams at ABC

The research showed that ABC is a multinational company specialising on large scale projects, which can last for several years. The duration of the project is also depicted in product backlog:

“Such backlog can cover time period of one or two years.” (Interviewee 1)

“...our backlog covered a time period of a year.” (Interviewee 8).

All of the interviewees have experience of working in globally distributed teams, which varies from once till five times (Interviewee 10). The main reason of using such teams at ABC to carry out large and long projects. Another reason for the use of such teams is outsourcing of software development to Eastern Europe and China,

where there is a possibility to decrease labour costs, capture local talent, and manage project size without layoffs (Sutherland et al., 2009, p. 277). This reason was confirmed during the interviews:

“...it is typical for ABC and many other IT companies to outsource the product development itself to Eastern Europe. So in a project we typically have the majority of developers and testers working from Russian and Ukrainian offices.”
(Interviewee 8)

According to Sutherland et al. (2009, p. 277), globally distributed IT project teams can successfully implement these advantages. At ABC, a globally distributed project teams usually consists of team members residing at two or three locations. For example, ABC’s Ukrainian office works in cooperation with Russian, American, and Swedish subsidiaries:

“One of such projects was connected with software for an American company working in industrial printing. In this project, programmers, testers and project manager were situated in Ukraine, while a designer, web programmer, and a business analyst were in the U.S.A.” (Interviewee 1)

“We have a project for American insurance company, where we work with American and Russian team members. The majority of software developers are located in our Russian office, while web-designers and business analytics are in the U.S.A.”
(Interviewee 4)

“One of such projects was with our Russian and Swedish offices. We developed a website for a Swedish newspaper together. Another recent project is for American insurance company, where we work with American and Russian team members. Software developers are located in our Ukrainian Russian offices, and web-designers and business analytics are in Stockholm, Sweden.” (Interviewee 5)

The use of globally distributed IT project teams enables ABC to turn time difference into an advantage, and thus shorten product development time, since it is possible to work more on the product – work is done around the clock. Although some authors (Sutherland et al., 2009, p. 277) suggest that collocated teams are more productive than distributed ones, ABC uses globally distributed IT project teams, which allow more working hours on the project during the same time span. After one team finishes its work in Russia, team in Ukraine still has two hours more to work, while another team starts its day in the U.S.A. Therefore, there are less interruptions and the product is constantly developed.

“Between our Russian and Ukrainian offices there is a two hour time difference, and the difference between our Ukrainian and American offices is eight hours. So when our Russian team finishes its day, we have two more hours to work, and our American team members will start their work in two hours.” (Interviewee 2)

“We developed the code for 18 hours a day because of the time differences. So in total we had more working hours spent on the project compared to a traditional collocated team.” (Interviewee 7).

4.2. Agile methods used by ABC

The data collection revealed that ABC uses such agile method as scrum in its work. As suggested by scrum methodology, at ABC scrum includes product backlog, sprint backlog, and a burndown chart. While sprint lasts typically for three weeks, product backlog might cover tasks up for two years’ time. Product backlog is shared with all team members regardless of their location. Sprint backlog includes tasks from product backlog, which have to be done during the sprint. Finally, a burn down chart is used during the sprint as a control tool of team progress. At the end of each sprint a piece of working software is delivered to the customer. The structure of scrum at ABC is presented in **Figure 9**. ABC also runs daily stand-up meeting for team

members collated within the same office, where each person involved in the project answers three questions: (1) “What did you accomplish yesterday?”, (2) “What will you do today?”, and (3) “What obstacles are getting in your way?”. Such meeting lasts for 15 minutes.

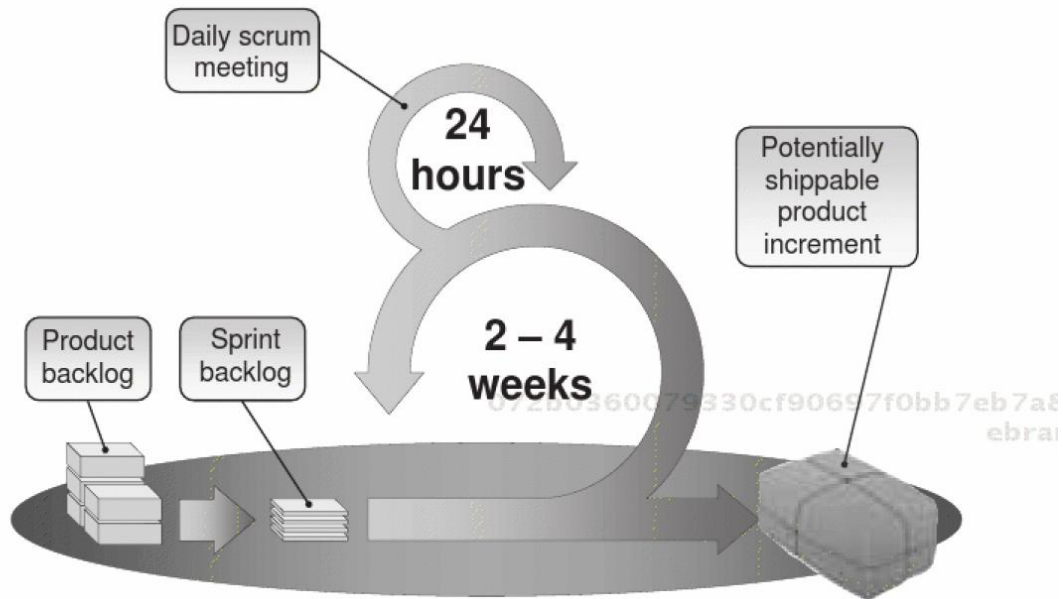


Figure 9: Scrum at ABC.

Source: Rico et al. 2009, p.26.

However, because scrum was initially developed for collocated teams, ABC had to adjust it for globally distributed IT project teams. Thus, instead of running isolated scrums at each location, company uses scrum of scrums, which integrates smaller local scrums (**Figure 10**). Sutherland et al. (2007, p. 276) describe such practice as a distributed scrum model. Because of time differences between offices involved in ABC’s projects (e.g. between Ukraine, Russia and the U.S.A.), it was impossible to organise daily distributed stand-ups for the whole team. Therefore, ABC conducts them two or three times a week, so that team members and project manager learn about the progress of each office. Such meetings are conducted at the time, which suits all of the offices. The research revealed that these meetings are held when it is 5 p.m. in Ukraine, 9 a.m. in the U.S., and 7 p.m. in Russia.

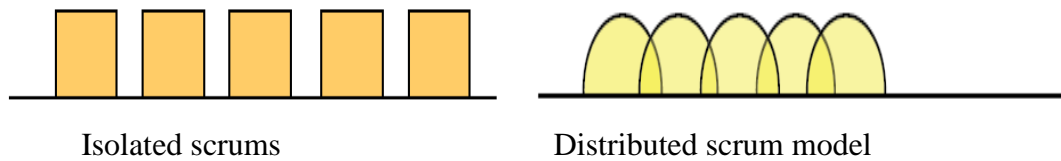


Figure 10: Scrum adaptation at ABC.

Source: Sutherland et al., 2007, p. 276.

“Because of time and physical distances we cannot conduct daily face to face stand-ups for the whole team. So we have daily stand-ups only for part of the team, working at the same office. But two or three times a week we have a stand-up, where everybody has a chance discuss the project.” (Interviewee 7)

“In our company, a sprint lasts for three weeks. We have a backlog with tasks, which is shared across all offices involved in the project. For example, in the above mentioned project in industrial printing, our backlog covered a time period of a year. This backlog is divided into tasks, which have to be covered during the sprint. For controlling the progress, a burn down chart is used. Next, we have daily stand-ups for collocated part of the team, where everybody reports about his progress. With our off-site team members we have similar stand-ups but via video-conferencing two or three times a week.” (Interviewee 8)

“We have a three week sprint, during which we have daily stand-ups for team members from the same location and two or three times a week we have a joint stand-up for everybody. In such way we can talk and discuss the project with all team members, not just within the same office.” (Interviewee 9)

“...we use scrum. Instead of using traditional scrum, we have adapted it for distributed team settings. The main difference is that we have daily stand-ups in each office, plus a joint stand-up twice (sometimes three times) a week via internet”. (Interviewee 10)

Regarding other agile methods, ABC tried to implement pair programming, which belongs to the family of extreme programming methods. However, this attempt was unsuccessful because in pair programming was possible only for collocated team members. As team members are located in different offices, the use of pair programming increased product development time:

“We have also tried once to apply one of the extreme programming tools – pair programming, but it was not successful because then the development process took much more time. It happened because in that project developers programming together were located in different offices and time zones, so they could not really work simultaneously.” (Interviewee 4)

“We tried once to use pair programming in globally distributed teams, but we failed. Our developers from different locations could not really work simultaneously.” (Interviewee 5)

Although ABC follows such agile value as “working software over comprehensive documentation”, it uses more documents in globally distributed IT project teams compared to collocated teams using agile methods. This is done in order to make everyone informed about product requirements and spare the project manager from answering general questions of team members:

“... as a project manager I have to send much more e-mail to make sure that all team members know the main product requirements or about some changes”. (Interviewee 10)

4.3. Communication process in agile globally distributed IT project teams at ABC

As revealed from the interviews, communication process at ABC consists of two parts, as shown in **Table 5**. One is communication among collocated team members, which is done mainly face to face during the day and during stand-ups. Another part is communication with other locations. This part of communication occurs with the help of ICT (e-mail and video-conferences). Such ICT mediated communication, in its turn, consists of synchronous and asynchronous parts. Synchronous communication is represented by stand-ups conducted two or three times a week with the help of video-conferences. Asynchronous communication takes place daily via e-mail.

Table 5: Communication process at ABC.

Communication place	Communication type	
	Synchronous	Asynchronous
Within the same location	Face to face, daily stand-ups	E-mail
Across locations	Joint stand-up	E-mail, shared documents

The interviews revealed that at ABC the use of communication media depends on whether communication occurs within the same office or across locations. When team members from the same office interact with each other, they communicate mainly face to face, because such communication is easy and quick. However, team members communicate with their overseas colleagues using e-mail and video-conferencing:

“We communicate primarily face to face with people working at the same office. With other team members we talk during stand-ups.” (Interviewee 4)

“With our team members located in the same office we often just talk face-to-face, because it is often easier and quicker than writing an e-mail. If something important has to be told to the whole team or has to be saved for the project history, then we send e-mails. We communicate with other team members working from the U.S.A., via virtual stand-ups and between them via e-mail.” (Interviewee 1)

“In our office we communicate a lot face to face about the project and have stand-up meetings every day. We communicate with our American and Russian team members through e-mail and we also conduct internet-mediated stand-ups with them twice or three times a week. Of course, if some of them come to visit our office, we talk to them, but this happens only once or twice during the project. We do not call them spontaneously via Skype or phone because of time differences and the fact that at the moment a person might not be near his/ her computer.” (Interviewee 3)

Thus, in both cases of communication within the same office and across offices, the most common communication means are stand-ups and e-mail. However, in case of collocated team members, most of the communication is done orally, and e-mails are used only for sharing information regarding all team member. In communication across locations, e-mail is the primary source of general information and a tool to solve arising issues between joint stand-ups. ABC uses a larger volume of documentation in its agile distributed projects compared to collocated ones. This is done to compensate lack of face to face communication and to provide equal access to information for all team members at anytime and anywhere. Besides, documentation helps in task sharing and project control:

“In our globally distributed projects we cannot easily talk to any other team member as in a traditional team. So we write e-mails to our Russian and American colleagues. Although agile methods do not require many documents on the project, we have more such documents in our distributed projects compared to traditional teams. We need these documents because otherwise, it would not be clear what we need to do and who is doing what.” (Interviewee 2)

Moreover, at ABC there is a practice of short visits to other locations. These visits are done only by several team members. Despite the unavailability of such visits for all employees, they described this practice as useful, since it helps to establish trust and interpersonal relations and thus overcome communication barriers:

“I find short visits of other team members to our office also important. This gives us possibility to know each other. After such visits it is easier to work with them because we feel more as a one team. I also like a bit of informal feedback via e-mail from other team members quite useful, it is good for our project and the team.”

(Interviewee 1)

“I find that short visits of some of team members to other locations improve communication. This helps to meet real people and understand their perspective.”

(Interviewee 5)

“I think that short visits to another office or to client’s premises improve our communication. I believe that when people meet in person, then they will have less difficulties working together.” (Interviewee 8)

ABC tried using other communication media as well, namely instant messaging. But this experiment was unsuccessful, since during several hour time overlap between the offices, instant messages were reported to disturb team members and alias these messages acted as e-mails:

“We also tried to using instant messaging but because of time difference it was not effective in case of our American colleagues, and in our Ukrainian office it was disturbing our work.” (Interviewee 1)

“We also tried to using instant messaging but because of time difference it was not effective. Plus employees complained that it disturbed their work.” (Interviewee 8)

4.4. Other factors affecting communication in globally distributed IT project teams

The interviews revealed that not only agile methods have impact on communication in globally distributed IT project teams, but a number of other factors as well. Some of the interviewees mentioned that language, temporal, geographical and sociocultural distances influence communication process. Next, these factors, as shown in **Figure 11**, will be analysed.

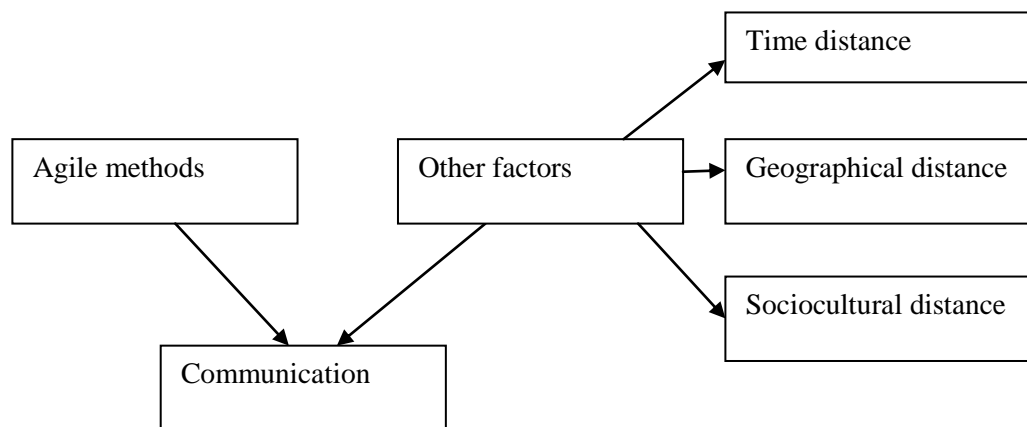


Figure 11: Factors affecting communication in globally distributed IT project teams at ABC.

Firstly, language affects communication in globally distributed IT project teams. At ABC, communication during distributed agile software development is done in English. Although sufficient English skills are a must for ABC's employees, this factor is still relevant for communication process, because not all of the team members speak English at the native speaker level. Furthermore, some of the respondents mentioned that there is more communication with their Russian colleagues than with the American or Swedish ones.

“Sometimes it is a bit difficult to understand what another person is saying, because I am not an English native speaker. So I cannot speak very quickly and if somebody talks very quickly I do not understand everything.” (Interviewee 1)

“For me it is quite easy to work with our Russian office, because we are both fluent in Russian and we have a huge time overlap. It is more challenging to work with American colleagues, because I am not fluent in English, so it takes a bit more time to answer their e-mail or to talk during stand-ups.” (Interviewee 2)

“I think that distance and language skills influence communication in globally distributed project teams. For me it is easier to communicate with team members, with whom I speak the same language, even if we talk and write in English. Maybe it is because we make the same mistakes.” (Interviewee 5)

While some of the interviewees indicated that language influences communication in globally distributed IT project teams, this is not a problem for all of the ABC’s employees. For example, interviewee 6 thinks that impact of English on communication is insignificant. Besides, it was found that knowing several words in a person’s native language improves communication in globally distributed IT project teams:

“I also find it important if project manager tries to say a couple of words like “thank you” or something in a person’s native language.” (Interviewee 5)

Next, time and geographical distances affect communication as well. It was revealed that team members interact more with offices, with which time difference is smaller. For example, employees from Ukrainian office have more possibilities to interact with Russian employees than with American ones. However, this situation is also influenced by the fact that Russian and Ukrainian employees both have the same native language. Moreover, team members communicate more within the same office than with other offices, because employees prefer face to face communication

and rapid feedback, which it offers. Therefore, the amount of information communicated within the same office is bigger than between different offices:

“I communicate much more with the people from my office than with my Russian and American colleagues.” (Interviewee 3)

“We talk face to face in the same office. With employees from other offices we communicate via e-mail and talk via video-conferencing during stand-ups.” (Interviewee 10)

The research showed that sociocultural differences do not significantly affect communication in globally distributed IT project teams, because ABC’s culture, which dominates over local cultures, *“is more global”* (Interviewee 6). English as the universal communication language at ABC is also part of this global culture.

Thus, the chapter present the empirical findings of the study on the use of globally distributed IT project teams, agile methods, and communication process at ABC.

5. Discussion

The purpose of this study was to investigate the influence of agile methods on communication in globally distributed IT project teams. The existing research in the field of agile methods mainly focuses on collocated teams. Thus, the use of agile methods in globally distributed teams is the gap, which requires further investigation. Therefore, the goal of this study was to analyse how agile methods influence communication in globally distributed IT project teams. In order to answer this research question, a theoretical framework was developed, which focuses on three sets of communication media characteristics influencing communication in globally distributed IT project teams: social presence, media synchronicity, and transactive memory. This chapter will link the existing research in the area with the research findings of the current study.

5.1. The influence of agile methods on communication in globally distributed IT project teams

As mentioned in literature review, communication is an essential part of agile software development. Without it, agile software development would not be possible in distributed project settings (Pikkarinen et al. 2008, p. 304). According to Holmström et al. (2006, p. 14) and Pikkarinen et al. (2008, p. 306), communication process is composed of formal (e.g. project documentation) and informal communication (e.g. informal conversations and messages), as well as synchronous and asynchronous communication. This classification will be used here to explore agile methods influence on communication in globally distributed IT project teams (see **Figure 12**).

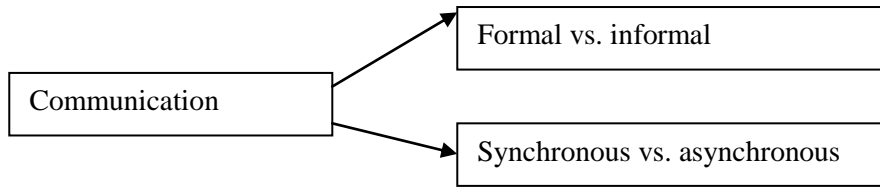


Figure 12: Criteria for analysis of agile methods influence on communication.

5.1.1. Influence on communication formality

At ABC's globally distributed IT project teams, formal communication consists of project documentation, burndown charts, and e-mails. Although agile principles imply that documentation is less important than people, team's distributed nature requires more documents compared to collocated project teams, where employees have higher chances of informal communication. Thus, the company puts additional efforts into promoting formal communication in its globally distributed IT project teams in order to overcome geographical and temporal separation of team members. On the other hand, the use of formal communication gives a benefit of repeatable access from any office at any time (Andres 2002, p. 41; Deluca & Valacich 2006, p. 327). Therefore, necessary information can be easily retrieved for future use. Moreover, agile methods offer tools and practices improving and structuring formal communication (e.g. a burndown chart).

The current research revealed that in globally distributed IT project teams ABC uses more documentation than in collocated projects. But team members still find that there should be more documents with clear project instructions. This finding supports the suggestion (Korkala & Abrahamsson', 2007, p. 204; Pikkarinen at al., 2008, p. 305; Turner & Boehm 2003) that agile methods due to their low focus on documentation might cause negative effects on communication in globally distributed IT project teams.

Furthermore, it was found that the amount of formal communication is different depending on whether the interaction occurs within the same office or between different offices. Within the same location, team members prefer to communicate informally face to face, since such communication is easy. This is in line with Pikkarinen's et al. (2008, p. 328) assumption that within the same office the use of agile methods facilitates informal communication and decreases the need for formal communication.

Regarding informal communication, the use of agile methods has a mixed impact on communication process in globally distributed IT project teams. On one hand, the research showed that the use of agile methods certainly increases informal communication among team members. This supports findings of Highsmith & Cockburn (2001), Mishra et al. (2012), and Pikkarinen (2008) who consider informal communication as the key success factor of agile software development. On the other hand, the research findings imply that in globally distributed IT project teams informal face to face communication is still limited and occurs mainly among team members working at the same office or during short visits to other locations. Informal communication across offices is ICT mediated. This happens because of time and geographical distances between offices involved in the project. At the same time, the use of agile methods improves informal communication across locations by offering interaction tools (e.g. joint stand-ups at ABC).

Stand-ups as well as joint stand-ups contain features of both formal and informal communication. On one hand, they are a part of formal communication, since they follow a standardised reporting procedure, i.e. each team member answers the same three questions during a limited time period. However, stand-ups possess features of informal communication too, since they per se occur in form of conversations, which are ICT-mediated in case of joint stand-ups across locations. Besides, information obtained during stand-ups is not available for future retrieval and is thus easily forgotten. Stand-ups are mainly used for project control, task coordination and interpretation of information contained in project documentation.

5.1.2. Influence on communication synchronicity

Next, the influence of agile methods on synchronous and asynchronous communication in globally distributed IT project teams will be analysed. The research showed that synchronous communication across locations occurs only two or three times a week and is ICT-mediated (video-conferencing). Although agile methods require intensive synchronous face to face communication, time and geographical distances does not allow such communication to happen. On the contrary, in globally distributed IT project teams the amount of asynchronous communication dramatically increases. The research findings support Holmström's et al. (2006, p. 11) assumption that in globally distributed IT project teams, asynchronous communication creates challenges because of delays in communication, which leads to team members frustration and irritation. For this reason the attempt to use instant messaging and pair programming at ABC was unsuccessful. However, at the same time, the use of asynchronous communication gives team members a repeatable access to information and thus lessens the communication burden for the project manager. Because agile methods increase the amount asynchronous communication in globally distributed IT project teams, ABC employees are often unsatisfied by its amount, which they find overwhelming and not always productive.

Since the use of agile methods in globally distributed IT project teams increases the amount of asynchronous communication, they also result in increased interpretation challenges due to lack of communication context when asynchronous media are used. Holmström et al. (2006, p. 15) imply that in globally distributed IT project teams, there are likely to be difficulties in understanding and interpreting information received during asynchronous communication. These difficulties are caused by the lack of social context (Deluca & Valacich 2006, p. 327) as well as by language and culture differences (Holmström et al., 2006, p. 15). However, the findings of current research partially support this assumption. The evidence was found that team members may experience problems caused by lack of

communication context (e.g. unemotionality of the e-mails). At the same time, language differences have only limited influence on communication, because at ABC all of the employees have sufficient knowledge of English. Employees mentioned that language has more influence during synchronous than during the asynchronous communication. Culture does not significantly impact communication, which can be explained by the ABC's company culture dominating over national cultures.

Therefore, although agile methods suggest that synchronous communication, even face to face communication if possible, is the primary way of conveying information, asynchronous communication is also an essential part of agile distributed software development. As seen from the literature and research findings, agile methods have negative influence on asynchronous communication. On one hand, ABC employees would like to have more documented instructions. On the other hand, they report having too many messages. Thus, asynchronous communication tools at ABC do not fully compensate the lack of synchronous communication. As mentioned before, ABC is in a deadlock situation regarding communication synchronicity, because considerable time differences do not allow using instant messaging or conducting daily joint stand-ups.

5.2. Factors explaining agile methods influence on communication in globally distributed IT project teams

Previous subchapter examined the mechanism of agile methods influence on communication through observing their effects on such communication process features as its formality and synchronicity. The following subchapter will discuss how this influence occurs through a combination of theories drawn in literature review and results of the research findings.

5.2.1. Social presence

Social presence theory assumes that the result of communication depends on choosing a certain communication medium containing as much social cues as possible. Social presence is described as the ability of communication medium to ensure the feeling of other team members' presence during communication. (Short et al., 1976) According to social presence theory, employees prefer face to face communication over other media, as it is the richest in social cues. The researchers imply that video-conferencing is poorer in social cues than face to face communication but richer than e-mail (Short et al., 1976).

Attention to information (transmitted) depends on strength of social presence feeling created by communication medium. Accordingly, a medium with a low degree of social presence (e.g. e-mail) is perceived as less important. Therefore, in globally distributed IT project teams, team members would consider information received during joint stand-ups as less important than the one received during face to face interactions, but more important than information received via e-mail. According to the social presence theory, team members would prefer face to face communication over ICT mediated communication.

The research shown that this suggestion is true for collocated parts of the team. However, it is not so in communication across locations. Although the use of agile methods requires synchronous communication, which creates a feeling of presence of team members, in globally distributed agile software development it is not the primary type of communication. The interviews revealed that in globally distributed IT project teams the choice of a communication medium does not entirely depend on the number of social cues it can transmit. It is also influenced by other factors, which make face to face communication or video-conferencing not always possible in globally distributed IT project teams. Therefore, ABC employees use e-mail to substitute synchronous communication.

Although project documentation and e-mails are poor in context and do not create a feeling of social presence, they are still widely used in globally distributed IT project teams at ABC. This paradox is caused by necessity to interact between joint stand-ups. Therefore, the application of Short's et al. theory (1976) assumes that globally distributed IT project teams using agile methods and asynchronous communication media would be less productive compared to teams using face to face communication. However, the research findings on successful application of agile methods at ABC do not support this suggestion. On the contrary, they support Anders's (2002, p. 41), who explain that although asynchronous communication media (e.g. project documentation and e-mail) do not create a feeling of social presence, they offer other benefits, which overcome this disadvantage. For example, at ABC, e-mail is the best way of interaction across locations in case of time differences, since it does not disturb team members from their main work. Another benefit of such asynchronous communication is that each team member can repeatedly access information contained in the documents and e-mails. Furthermore, such communication enables keeping track on the project progress and solving non-urgent problems.

5.5.2. Media synchronicity

Authors of media synchronicity theory use a three dimensional model to explain the effect media have on communication. This model includes a combination of three factors: media capability, communication process (conveyance vs. convergence) and team function. (Deluca & Valacich, 2006, p. 327) This theory proposes a better explanation of agile methods influence on communication in globally distributed IT project teams, since it takes into account not only features of a specific communication media but also of the task performed by the team. The interviewees indicated that at ABC's globally distributed IT project teams the following media are used for communication: face to face communication, video-conferencing, and e-

mail. Next, media capabilities of these communication tools will be analysed with the help of **Table 4**.

Face to face communication is characterised by immediate feedback and high symbol variety. However, it is difficult to have several conversations simultaneously (low parallelism). Besides, during face to face communication a message is seldom customised before transmission (low rehearsability). It can also hardly be readdressed to another receiver within the conversation context (low reprocessability). Next, video-conferencing provides a little less immediate feedback. Symbol variety is also poorer compared to face to face conversation, as not everything (e.g. body language) can be transmitted via technology. Video-conferencing is also low in parallelism, rehearsability, and reprocessability. Next, e-mail has low to medium immediacy of feedback rate, depending on time of the day, time difference between locations etc. E-mail also can transmit only a limited variety of symbols, i.e. namely text, while emotions and feelings cannot be transmitted via e-mail. At the same time, it is possible to manage several e-mail conversations at the same time (high parallelism), customise a message before sending it (high rehearsability), and readdress an e-mail to another recipient or a group of recipients.

Since the use of solely face to face communication is very limited in globally distributed IT project teams, ABC uses other communication tools in agile software development as well. The interviews discovered that different communication media are used during different team tasks. It supports media synchronicity theory. For example, findings imply that for team tasks, which require only conveyance (transmission of information), low synchronicity media such as e-mail and project documentation are used at ABC, since these media ensure repeatable access to information. On the contrary, highly synchronous media (e.g. face to face conversations, video-conferencing, short visits) are used for convergence (establishment of the information meaning), since such media are richer in context and allow fewer possibilities for misinterpretation. Moreover, they are rich in symbols and context. The ABC's failure to implement instant messaging in globally

distributed agile projects further supports the theory, because the communication media properties in this case did not match the task requirements. Besides during several hour time overlap between the offices, instant messages were disturbing team members and alias this messages acted as e-mails. Thus, complex and large projects require a combination of synchronous and asynchronous media for an effective result.

5.2.3. Transactive memory

Transactive memory theory suggested by Wegner (1987) implies that people can use not only their own knowledge but also knowledge of others. This use occurs through communication. If team members know each other's' fields of expertise, they have access to information not available locally. In such way, transactive memory makes them dependent on communication, i.e. if there is no interaction, information cannot be accessed. However, in globally distributed IT project teams it takes more time to form transactive memory, since communication in such team rarely occurs face to face. Besides, ICT mediated communication and physical and time differences add additional challenges to transactive memory formation. While transactive memory may be quickly formed within a collocated part of the team in daily conversations, its formation across offices requires additional efforts.

Transactive memory theory explains the agile methods influence on communication in globally distributed IT project teams, because these methods offer tools for interaction and creation of transactive memory. For example, stand-ups at ABC provide a regular overview of team members' work and thus let every employee learn about tasks, experience and knowledge of each other. For the same reason, team members write e-mails to access additional information from a colleague or a project manager. Moreover, ABC has a practice of some team members visiting another office for a short time. Therefore, ABC's employees create a transactive memory of a team, which is created from information of all team members and their

communication. As a result, a transactive memory system is not a property of a single team member, but of the whole team.

This theory explains communication in agile globally distributed IT project teams at ABC, since it describes how knowledge transfer and interaction benefit the project. Therefore, the use of agile methods helps to overcome communication challenges typical for globally distributed IT project teams (e.g. geographical, temporal and sociocultural differences). At the same time, agile methods application does not completely overcome these challenges, but result in some of them, because agile methods were originally tailored for collocated teams.

6. Conclusion

Agile methods are wider and wider used by modern IT companies, because they provide the possibility of improving communication process within the organisation (Pikkarinen et al., 2008, 332). Still, the literature discussing the effects of agile methods on communication is limited. The current research examined how the use of agile methods influences communication process in globally distributed IT project teams in a specific company. It further explores how agile methods are adapted for use in globally distributed software development as well as distinguishing features of communication in these settings.

In the literature review part, the concept of globally distributed IT project teams and their classification were discussed. Next, advantages and disadvantages of these teams were analysed. It was found that the use of globally distributed IT project teams yields advantages in the fields of human resources management, finance, social capital, competition, and workplace equality. On the other hand, disadvantages of globally distributed project teams include geographical, temporal, and sociocultural communication challenges.

According to the previous research, agile methods better fit collocated project teams, since they require frequent informal face to face communication. But a number of researchers report successful application of agile methods in globally distributed IT project teams (Holmström et al., 2006, p. 8; Jalali & Wohlin, 2010, p. 46). The agile methods family includes adaptive software development, agile modelling, agile software process model, crystal methods, dynamic systems development, extreme programming, internet software development, feature driven development, pragmatic programming, lean development, and scrum. Extreme programming and scrum are the most popular among agile methods at the moment.

The empirical research showed that in globally distributed IT project teams, communication differs depending on whether it occurs within the same office or across offices. For example, within the same location, team members prefer to communicate informally face to face, since such communication is easier. It was found that the use of agile methods has a mixed impact on communication process in globally distributed IT project teams. On one hand, agile methods facilitate informal communication among team members. However, the research findings show that in globally distributed IT project teams, informal face to face communication is still limited and occurs mainly among team members working at the same office and/ or during short visits to other locations. The use of agile methods may further limit informal communication, which is ICT mediated. This happens because of time and geographical distances between offices involved in the project. At the same time, the use of agile methods does not offer effective tools for formal communication improvement.

6.1. Theoretical implications

This subchapter will discuss theoretical contributions made by the present study. The existing literature on agile methods and distributed teams chiefly focuses on general level, e.g. on the advantages and disadvantages of both methods and teams. Moreover, the literature lags behind the technological progress. Therefore it describes the past rather than present state of the art in the field. For example, the literature emphasises that members of globally distributed IT project teams almost never meet face to face. However, the study discovered that short visits are used to improve communication in globally distributed IT project teams.

Next, the research revealed that not all of the agile methods can be successfully used in globally distributed settings. For example, the case company failed in using

extreme programming in its projects. Besides, methods undergo changes in order to be used in distributed software development.

Moreover, the research revealed that various challenges have unequal influence on communication. While the impact of time and geographical distance was confirmed, influence of culture was proved to be less important in IT industry than it was expected to be. Language differences were found to have impact on communication process. However, it was found that their influence is bigger during synchronous than asynchronous communication. Besides, it was stronger, when English non-native and native speakers were interacting with each other.

The existing literature uses social presence, media synchronicity and transactive memory theories to explore agile methods influence on communication. However, when applied to the research findings, these theories do not fully explain this influence. For example, social presence assumes that communication success depends on a chosen communication medium. The empirical findings do not support the theoretical assumption that employees would prefer a medium, which transmits more context. The findings showed that the choice depends on other factors in globally distributed IT project teams. Thus, the use of e-mail as a substitute for face to face communication in such teams is not explained by the social presence theory.

Next, the research findings were in line with the media synchronicity theory, which explains the use e-mail and documents for transmission and video-conferencing for interpretation of information.

Transactive memory theory also provides a sufficient explanation of agile methods influence on communication in globally distributed IT project teams. The findings proved that agile methods (e.g. scrum) offer a possibility to quicker form a transactive memory system. Moreover, the theory explains the negative impact of communication challenges, present in globally distributed settings, on communication.

6.2. Managerial implications

This part will discuss the current research's managerial implications, which can be used in the business world. The research results suggest that the agile methods can be successfully adapted for use in globally distributed IT project teams. At the same time, the success of this adaptation depends on the careful use of ICT media for every specific company.

Besides, the findings show that effective communication depends on how well team members understand each other. Therefore, companies should pay special attention to this factor. Short visits could be used as a tool to solve this problem.

Next, the research indicates the importance of language skills for successful communication in globally distributed IT project teams. Therefore, a company should not only hire employees with sufficient English language skills, but also invest into these skills improvement, which will further ease synchronous ICT mediated communication.

Furthermore, a company should invest into effective ICT media and software to facilitate the use of agile methods in globally distributed IT project teams. Without these media and software agile software development in distributed settings would be extremely problematic, since an effective communication is a necessary condition for distributed agile software development.

Moreover, the choice of agile methods to be used should be carefully done, because the research findings show that the methods have a different degree of suitability for globally distributed settings and may depend on temporal and geographical distances between offices as well as on the nature of the project.

Finally, the research showed that although agile methods cannot completely overcome communication barriers existing in globally distributed IT project teams, they can significantly lessen these barriers.

6.3. Limitations of the study

The main limitation of the current research is that it was conducted based on one company. Besides, data were collected only in one of its subsidiaries. It was impossible to compare the use of agile methods in different subsidiaries. Therefore, the extrapolation of research findings might be biased.

Moreover, the current research was conducted using qualitative data, which is subject of interpretation bias. Furthermore, the data were collected in a moment. Thus, it is impossible to compare the agile methods influence on communication over a period of time.

Besides, the research does not take into account the influence, which the cultural distance between different countries might have on the use of agile methods in globally distributed IT project teams.

Finally, this study focuses only on communication between team members. It does not take into account the external communication with the customer and other project stakeholders.

6.4. Suggestions for future research

As the present study discusses communication within the globally distributed IT project team, the future research can investigate the vertical communication with other stakeholders as well. This would allow a comparison of similarities and differences in how agile methods influence internal and external communication in globally distributed IT project teams.

Besides, future research can compare several companies, in order to make more generalizable conclusions and discover similarities in agile methods influence on the communication in the whole IT industry.

Moreover, a quantitative research can be used to discover ties between agile methods and communication in globally distributed IT project teams. The strength of these ties can be measured with the help of correlation and regression analysis.

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Appendixes

Appendix A

Interview guide

1. What is your professional background?
 - Previous education.
 - How long do you work at the company?
2. What is your role in the company (short description)?
 - Department.
 - Work activities/ responsibilities.
3. Does your company use globally distributed project teams? If yes, could you give examples of projects, where globally distributed project teams are used?
4. What is your experience with globally distributed project teams?
5. Does your company use agile methods? If yes, which methods and how does it use?
6. When globally distributed project teams are used in the company, how does communication process look like?
7. Which internet communication media do you usually use during communication in globally distributed agile software development?
8. Is communication different from the one in a collocated team? If yes, how is it different?
9. Do you face any difficulties when working in globally distributed project teams?
10. How do you think the use of agile methods influences communication in globally distributed project teams?
11. What other factors influence communication in in globally distributed project teams?
12. Is there anything else you would like to add that you think is relevant in this context, but not covered by the questions asked?