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AGILE METHODOLOGY IN MANAGING DIGITAL PROJECTS: EVIDENCE FROM RUSSIA

Master's Thesis by the 2nd year student
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ЗАЯВЛЕНИЕ О САМОСТОЯТЕЛЬНОМ ХАРАКТЕРЕ ВЫПОЛНЕНИЯ ВЫПУСКНОЙ КВАЛИФИКАЦИОННОЙ РАБОТЫ

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АННОТАЦИЯ

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Описание цели, задач и основных результатов	Целью данного исследования является изучение гибких методов управления проектами, а также факторов, которые влияют на решение менеджеров проектов перейти на гибкие методы, с тем, чтобы выявить принятые практики и разработать ряд рекомендаций для руководителей проектов по критериям выбора в пользу гибких принципов. Исследование содержит информацию о самых распространенных гибких практиках среди цифровых и ИТ-компаний в России, а также о том, какие факторы и характеристики проекта и его среды имеют тенденцию влиять на решение о применении гибких методов. Наконец, исследование использует количественные методы для нахождения связи между уровнем внедрения гибких методологий и факторами принятия решений.
Ключевые слова	управление проектами, гибкие методологии, гибкие методы разработки

ABSTRACT

Master Student's Name	Anna Marashlyan
Master Thesis Title	Agile Methodology In Managing Digital Projects: Evidence From Russia
Faculty	Graduate School of Management
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Year	2016
Academic Advisor's Name	Kiran V. Zhukova
Description of the goal, tasks and main results	The goal of this study is to investigate the adoption stage of agile methods and factors that encourage project managers to make the choice of agile transition. A set of recommendations for project managers on choosing agile principles will be derived based on the analysis of the identified best practices. The paper provides information on most adopted agile project management practices among the Russian digital community and IT companies, and environment-related factors that influence the decision to adopt agile methods. Finally, quantitative analysis will be conducted in order to provide evidence of the relationship between agile methods adoption level and the factors, which influence the decision-making process.
Keywords	agile, agile methodology, agile adoption factors, project management, digital industry, software development

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INTRODUCTION

Companies nowadays are heading towards digitalization with an increasing speed, which inevitably affects customer journeys' pathway. As consumers become more and more digitally aware, the way companies organize business processes and work with clients dramatically changes. We are now stepping into the era of "digital Darwinism", when organizations can barely keep up with the socio- and technological advances.

Effective software, web- and application development, as well as digital production in general becomes crucial for reaching competitive advantage and success, especially given increasing level of competition and tightening economic conditions. Companies employ digital solutions for the purpose of marketing, branding, business strategy and product development. For decades, professionals have been searching for ways to organize digital-related projects to reach faster, cheaper, and better results; many solutions were suggested along the way, such as KPIs standardization, various techniques, tools, and practices.

Successful projects require project methodology, which is a particular set of techniques, methods, and artefacts that set the game rules for the development team. Ever since the agile movement appeared in the beginning of 2000s as a new way of handling project work, it managed to hugely impact software development worldwide, and has been recognized as one of the most effective, if not the only one, practice to reach project goals in a more effective fashion in order to build a competitive business.

Regardless of the adopted methodology, project managers should oftentimes tailor the management techniques in order to adapt them better to the internal and external environment of the project. Despite recognition of importance of the external factors and project context, there is a gap between professional project management community and academic management research done on the matter of agile adoption factors identification. This study aims to fill the gap to the possible degree, by exploring the way agile methods are being implemented in Russian digital companies, what challenges and drawbacks exist concerning this, and are there any ways to identify the relation between the factors that influence the agile adoption decision and the actual level of agile approach implementation.

This paper's main purpose is to investigate the same problem with respect to Russian agile community, specifically – digital production studios, IT, software, and web-development teams and companies in order to help then with identifying to what factors they should look more closely while considering transition from waterfall to agile approach.

CHAPTER 1. EXISTING RESEARCH ON AGILE PROJECT MANAGEMENT

1.1. Modern approaches to managing digital projects

Nowadays, software and web-development is more technically complex; more strategic; and brings to the fore the divergent viewpoints of a wider variety of stakeholders (Nerur, Cannon, Balijepally, & Bond, 2010). Software and web-development is a complex activity characterized by tasks and requirements that exhibit a high degree of variability (Boehm & Turner, 2005). At the same time digitization is rewriting the rules of competition, with incumbent companies most at risk of being left behind. This leads to the inescapable conclusion that software and web-development, both today and in the future, is and will continue to be undertaken in a much more uncertain context (Nerur et al., 2010).

Meanwhile the problem remains with keeping the quality of the digital projects and end product quality definition in highly unstable environment; as well as with managing the software and web-development outcomes and restrictions while reducing the cost and time of the project (Petersen, 2010). The models of managing the projects that lay in the digital area typically are divided into traditional, iterative models - Waterfall, RUP, and more flexible, agile methods - SCRUM, XP, LEAN, etc. (Whitaker, 2014).

However, the problem remains with identifying the guidelines on to whether or not use the agile methods, and how to tailor the project management practices to a particular project and organizational environment. According to the popular Cynevin framework (Stacey, 2011), there are three basic types of systems: ordered, complex and chaotic. Ordered systems are, in turn, divided into simple and complicated. Hence, there are five domains in total: simple, complicated, complex, chaotic, and disorder area. This is a decision-making framework that recognizes the causal differences that exist between different types of systems, proposing new approaches to decision making in complex social environments.

In practice it means that depending on the complexity of the environment and characteristic of the project it is possible to choose which type of managerial and project management approach. This Cynevin paradigm (see Figure 1.1.), while providing a philosophical and fundamental conceptual model is, however, quite vague when it comes to actual implementation of the project management and tailoring methods technique. The problem of developing a practical approach, therefore, remains open and to the judgment of managers.

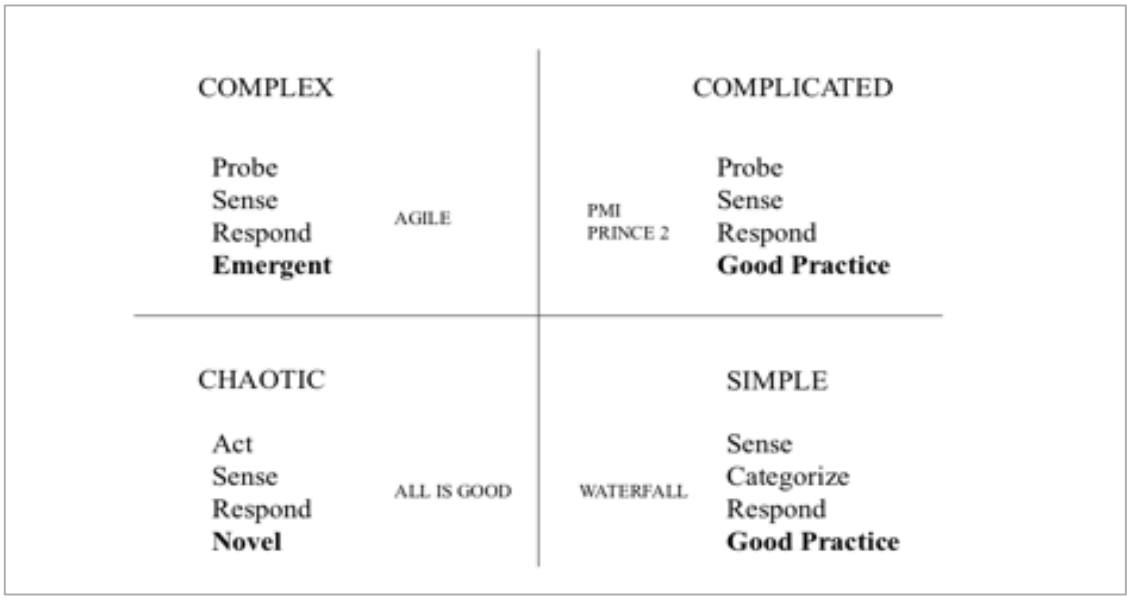

Figure 1.1. Theory of systems and agile paradigm. (Source: Stacey, 2011)

Waterfall software development model appeared in the mid 1950s in the work of Herbert Benington (1956) and officially became one of the first software development model (Royce, 1970) used by the U.S. Army. The model represents iterative, sequential workflow, in which the project progress goes gradually from identifying system requirements to design, coding and testing phase until the end (see Figure 1.2). This system's main advantage is relative simplification of managing process and, given stable system requirements, the development process usually brings satisfactory results (Pedersen, 2014). At the same time, this model is rigid in terms of allowing project change during the implementation phase, which increases costs of possible changes significantly.

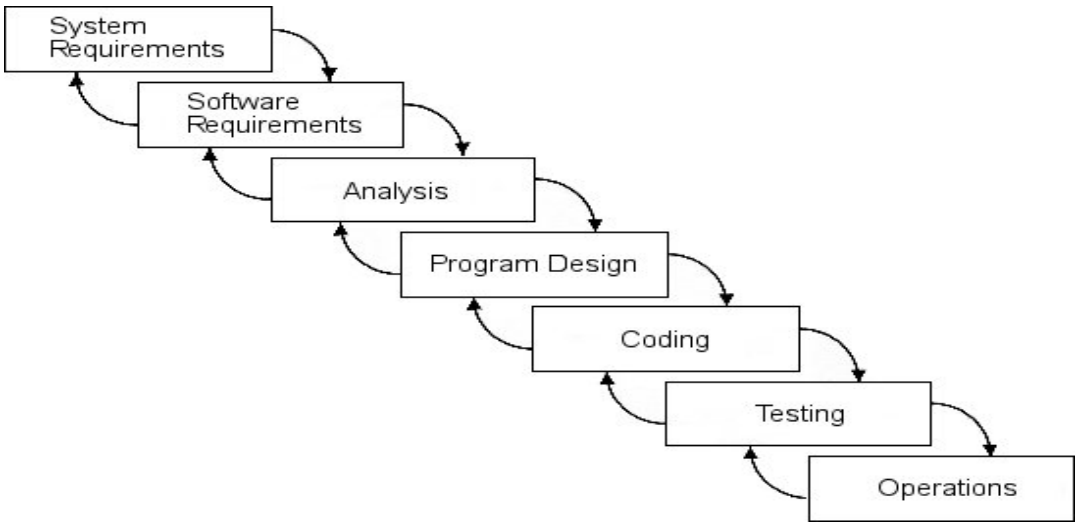

Figure 1.2. Waterfall software development model. (Sources: Pedersen, 2013).

Rational Unified Process (RUP) is an approach that is getting more and more attention recently, represents a modern iterative process for object-oriented system development, and has been created to complement Unified Modeling Language (UML) (Abrahamsson et al., 2002). Its main advantage lays in less rigidity in comparison to Waterfall and PMBOK approach, and it is to strongly uses UML components such as use cases. The life cycle on RUP is composed by 4 phases: inception, elaboration, construction and transition. Regarding adoption, it can be used in a whole or in part, depending on the organization's goals.

Agile methods for software development (see Figure 1.3.) have been increasingly used by the digital, IT, and software development industry based on a set of advantages such as an accelerated time to market, quality and productivity growth, improvement of Information Technology (IT)/business alignment. Agile is about welcoming changes and managing priorities reorganization compared to traditional software development methods (Nishijima & Santos, 2013; Qumer & Henderson-Sellers, 2006).

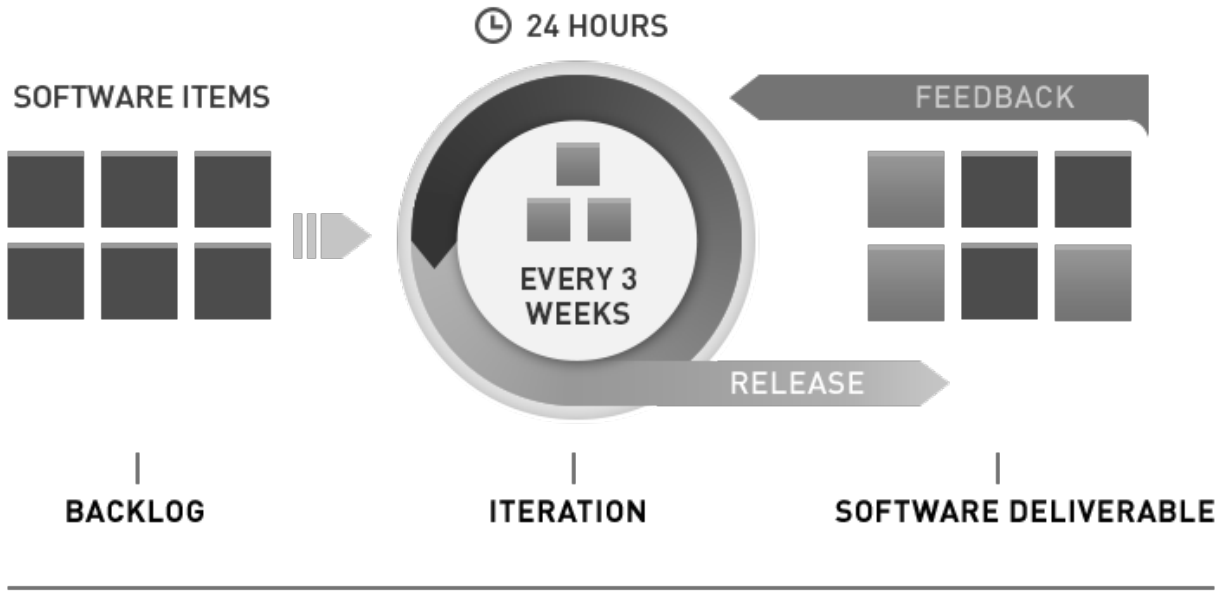

Figure 1.3. Agile web-development cycle. (Source: Scanmarket)

The importance and benefits of agile adoption, such as as ability to manage changing priorities, increased team productivity, improved project visibility, increased morale and faster time to market are well researched both by market consultancies (VersionOne, 2016) and by academic researchers (Jyothi & Rao, 2011; Glaiel, Moulton, & Madnick, 2013). Nevertheless, the issue remains with the adoption process, especially such aspects as resistant culture, inability of management to allow change, employees' inactivity, and so on (Echalar, 2013; Gandomani et al., 2013).

Employees' resistant to change is especially important topic, since not every change should generally be greeted and not necessarily is good for the team and project productivity and morale. Development team must adjust to the new flexible approach, and to be ready to quickly respond to changing business and clients' requirements (Jyothi & Rao, 2011), since the testing oftentimes goes in parallel with coding and clients' communication and updates.

The transition from waterfall approach can be quite difficult and confusing for the project teams and web-studios and companies in general. Important aspect lies in communication of new order within the organizations in order to make it possible minimize the documentation flow and bureaucracy (Moniruzzaman & Hossain, 2013). Communication is the key in agile methods adoption – contrary to traditional detached role of the development team and not full clients' involvement, agile paradigm requires to put people ahead of papers – and thus, to maximize the interaction inside the team as well as with the external environment; this is critical difference between waterfall and agile, and the main reason while waterfall is becoming less and less popular (Santos et al., 2011).

Lastly, we are coming ahead of this paper's timeline, and preliminary state the fact that regardless of the adopted methodology, project managers should oftentimes (if not always) tailor the management techniques in order to adapt them better to the internal and external environment of the project (DeMarco, 1982). In order to do that, they can use the help of their counterparts, and the best practices in the industry.

Substantial amount of research on agile methods is devoted to identifying factors that influence the adoption process and their relationship (Ayed, Vanderose, & Habra, 2014; El-Said, Hana, & Eldin, 2009; Santos et al., 2011; Glaiel, Moulton, & Madnick, 2013; etc.). This paper's main purpose is to investigate the same problem with respect to Russian agile community, specifically – digital production studios, IT, software, and web-development teams and companies. This study is also concerned with the problem of identifying the parameters when it is more effective to apply the agile approach, given the Russian business conditions.

1.2. Paradigms and methods of agile project management

Agile, initially being used as an effective tool during software development in small teams, is now becoming a new vision and culture of managing large corporations (Bonner et al. 2010). For decades there was a dominant, classical approach to managing software projects, so-called "waterfall development" (Nerur et al., 2005), which implied iterative nature of project work. Once approved project plan had to be implemented within initial constructs and limitations, which made project performance extremely vulnerable to changing environment.

In 2001 a new conceptual approach was created (Beck et al., 2001); it changed the way people start think about managing project, since the concept of agility implies innovative re-thinking of a product/service creation, when project alteration can happen at any time due to uncertain external conditions. Since the uncertainty is a constant factor of new business reality, the concept of managing projects with flexibility has quickly become popular and is still highly relevant up to this day.

While the agile concept is a relatively agreed upon definition and there is a common line among most existing definitions, it seems important to highlight different angles and terminological aspects. The most often definition of agility is connected with continual ability to balance and navigate in times of change, to better respond to uncertainty, to better learn and adapt to changing environments and instability (see Table 1.1.)

Table 1.1. Relevant definitions of agility in managerial research.

Author (-s)	View on agility
Larman and Basili (2003)	Rapid, fast and flexible response to change.
Highsmith (2004)	Ability to both create and respond to change in order to profit in a turbulent business environment; it is the ability to balance flexibility and stability.
Conboy (2009)	Continual readiness of an information system development method to rapidly or inherently create change, proactively or reactively embrace change, and learn from change while contributing to perceived customer value (economy, quality, and simplicity), through its collective components and relationships with its environment.
Kettunen (2009)	Mechanism to increase the quality and service factors by meeting the current customer requirements by being flexible to customer demands and market changes.
Conboy and Fitzgerald (2004)	Continual readiness of an entity to rapidly or inherently, proactively or reactively, embrace change, through high-quality, simplistic, economical components and relationships with its environment

Lyytinen and Rose (2006)	Ability to sense and respond swiftly to technical changes and new business opportunities; it is enacted by exploration-based learning and exploitation-based learning.

Additionally, few studies also have been describing agility through several characteristics, or attributes, that further deepen the concept and are relevant for the purpose of this research in providing an insight of what agile management is all about – effective team building, flexibility, involvement, and concentration on the end result, and high speed of project work (see Figure 1.4.).

Important to notice, that definition and main characteristics of agility and being agile are subjects that has already been well researched in the academic literature, and there is nothing conceptually new been discovered in the area of agile epistemology. Hence this study does not state its purpose and is not going to introduce new dimensions of "agile", and, instead, works with existing definitions.

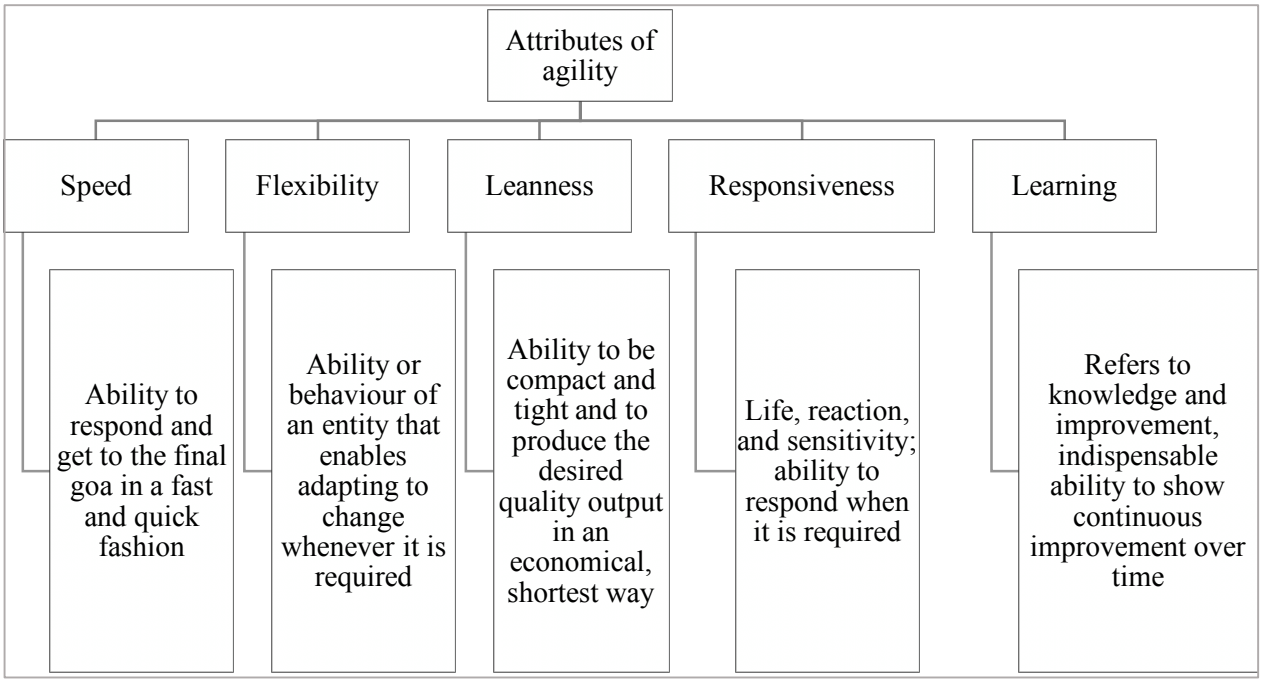

Figure 1.4. Characteristics of agility. (Source: adapted from Qumer and Henderson-Sellers, 2008).

In a recent survey, 84% of organizations stated they were using agile methods, with half having begun in the last two years (VersionOne, 2016). Agile software development practices are believed to significantly improve responsiveness to customer requirements and changes, which results in better quality software products and improved productivity and morale of the development team.

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software

2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage

3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.

4. Business people and developers must work together daily throughout the project.

5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.

6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.

7. Working software is the primary measure of progress.

8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.

9. Continuous attention to technical excellence and good design enhances agility.

10. Simplicity--the art of maximizing the amount of work not done--is essential.

11. The best architectures, requirements, and designs emerge from self-organizing teams.

12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

Figure 1.5. Twelve principles of agile software development. (Source: Beck et al., 2001).

The three most important features of agile are (1) achievement of customer satisfaction through early and continuous delivery of software (2) co-operative working of client and development staff, and (3) the use of face-to-face conversations for communications in the team (Bass, 2013).

The concept of agile methods was first introduced in 2001 by several project management "gurus" and software engineers, and stated the principles of prevalence of communication over processes and tools, effective applications over paperwork, collaboration with customers over contracts negotiations; proactive response to changes over strict plan following (Figure 1.5.).

This approach was significantly different from classic, "waterfall" method of project development, by allowing another level of flexibility and ad-hoc change (Nerur et al., 2010). It

has been argued that the paradigm of agility was one of the main shifts in digital development over the last ten years, that, however could not avoid being the subject of various misinterpretations and subjective individual judgments (Dingsøyr et al., 2010).

With these agile principles, the highest priority in managing projects is being placed on the quality of the end product and customer satisfaction as the main measurement of project success. This view has quickly become popular among other project manager practitioners (West & Grant, 2010), and currently there is a range of recognized agile professionals' certifications available for project managers who work in the agile project management domain and who chose to increase their value as employees.

Speaking of effect of agile methods, it is argued to deliver extreme-quality applications and software, to increase productivity and efficiency, to achieve higher customer satisfaction, to keep clients, to reduce extra-cost and eliminate ineffective budgeting and "waste", to perfect team communication and morale, to improve risk management, etc. (Highsmith, 2007; Kettunen, 2009; Schwaber, 2007).

Nevertheless, there is still some studies that suggest insufficient amount of empirical evidence, not enough to strongly claim the impact of agile methods on abovementioned parameters and overall productivity (Kettunen, 2009). Moreover, some papers show connection between agile application and drawbacks in form of increased ambiguity and time-to-market pressure (Baskerville et al., 2006). The problem of connecting productivity and agility will be covered in the latter part of the chapter.

Table 1.2. Main differences between agile and waterfall methodologies. (Sources: adapted from Nerur and Balijepally, 2007; Salo and Abrahamsson, 2008).

	Waterfall	**Agile**
Fundamental concept	Environment and systems can be predicted, and are subject to thorough planning; once planned project is planned	Software is being developed in small teams, with application of continuous design principle and constant feedback
Paradigm	Positivism	Learning theory, Dewey's pragmatic principle
Style of management	Monitoring and Control	Leadership, communication, and collaboration
Communication style	Formal focus	Informal focus

Development model	Full life-cycle	Evolutionary-delivery
Management structure	Large-scale, bureaucratic, formalized	Small-to-medium sized, organic and flexible
Customers' role	High	Critical
Aim	Budget and optimization	Responsiveness, adaptation, and learning
Knowledge Management	Explicit, open-ended, codified data, stored in physical form	Tacit, non-codified/ hard-to-codify data, personal experiences and knowledge
Main features	Manager controls Single-loop learning Conflict aversion Prevalence of control Implementation after planning and design phase	Manger facilitates Double-loop learning Dialectic approach Embrace of creativity Project phases cannot be separated, and evolve altogether

The main differences that were brought by agile practices (see Table 1.2.) resulted in remarkable transformations in software development approach, and were more suitable for larger, more complicated digital projects (Kettunen, 2009). Traditionally, main frameworks for leading a digital project included so-called life-cycle models: spiral, waterfall, etc. (Nerur et al., 2005).

According to these models, the roles are distributed, and outcomes are stated at each phase of the project. Waterfall approach implies iterative nature of the project management, and also tends to produce loads of documentation and paperwork in order to properly codify information for communication purposes.

As for team management, traditional approach states importance of communication between team members and other project stakeholders; however, external project participants (clients in particular) do not play constant part in project activities and do not have a strong voice except for occasional milestone validation and approval (PMBOK 5th edition, 2013).

Traditional, waterfall approach also stresses the importance of processes, tools, and operations, and comes from the assumption that external uncertainty can be eliminated in the process of risk management activities, and activities related to measurement and monitoring, and control (Nerur et al., 2005). This rational, optimization-based view has been dominating in digital development industry for decades and until to the 2000s with agile methods appearance and adoption.

Adoption of agile principles is claimed by some studies to alter organizational characteristics such as business processes and tools, managerial practices, ways and channels of communication, team roles, group dynamics, and even culture (Moe, 2011). The prevalent view in literature stated that it is better to deal with high uncertainty by relying on individuals, teams, and their creativity, and not on processes and tools, which in practice shortens digital development cycles (Cockburn & Highsmith, 2001).

Consequently, adoption of agile methods increases the role of clients in the decision-making process via communication during all development cycle, from the start of the project. It allows the possibility of getting faster feedbacks and gives opportunity to change project plan and specifications ad-hoc, during the product development. Usually it implies that the development process is divided between smaller teams, and each team is working in frames of project life-cycle (planning phase, implementation phase, integration and testing, and closing) and is responsible for local changes when necessary and for the part of working code to be delivered.

Agility affect the way managers conduct team leading and building – leadership style tends to evolve from control to facilitation and collaboration without overload of documentation and data codification processes. (Nerur & Balijepally, 2007). Lack of extra documentation, therefore, gives more space for tacit knowledge and data, which is transferred between teams via communication and other knowledge management techniques.

At the same time, agile methods allow to concentrate on processes adaptation inside teams, which comes in the form "of on-the-go" improvements being made by professional developers and professionals (Salo & Abrahamsson, 2007) and thus increases flexibility of project management to the point that is unattainable by traditional waterfall approach.

One of the research objectives of the study is to identify the most popular agile methods are that being used in managing digital projects, hence, for the purpose of stated objective it is important to list main agile methods that are currently being used in software development (see Table 1.3.).

Table 1.3. Main agile methods that are used in digital development. (Source: analysis of literature).

Agile method	Description	Influential articles / sources
SCRUM	Approach that was developed specifically for managing projects in times of uncertainty and volatility, which is based on adaptability, flexibility, and productivity. It allows free choice of necessary development tools and techniques by developers. Feedback loops are one of the main elements of project management process;	Schwaber (2007); Schwaber and Beedle (2002), Schwaber and Sutherland (2011)
XP (Extreme Programming)	Extreme programming is a compilation of best and good practices in the industry that are gathered and lined up with each other, with an aim at achieving successful end product. Short iterations, and fast releases are the main elements of XP;	Beck (1999); Beck et al. (2001), Deemer et al. (2010)
Lean	Being developed as the Toyota production system, lean is an adaptation of corporation practices onto project management method and is considered an agile technique by majority of studies; Consists of seven principles, namely waste reduction, team, integrity building and empowerment, fast deliverance etc.	Poppendieck, M. and Cusumano, M. (2012)
Feature-driven development (FDD)	Is a combination of agile software development and model-driven development giving a process-focused method as a result; Most important focus upon which FDD is places is phases of design and building.	Coad et al. (2006); Palmer and Felsing (2002)

Dynamic software development method (DSDM)	Provides a framework for Rapid application development. Includes three phases: pre-project, life-cycle, and post-project. Contains nine principles, among which are high end user involvement, possibility of reversing changes, detailed scope, etc.	Stapleton (1997)
Crystal methodologies (Crystal family)	Branch of agile methods, which can be selected individually for each particular project; at the core of methods is so-called "appropriate-color method" – each project is assigned a colour in dependence of size and weight;	Cockburn (2004)

Currently, the most employed agile methodologies are: Scrum (Deemer et al., 2010; Schwaber & Sutherland, 2011), Lean, Kanban, Extreme Programing (XP), Adaptive Software Development (ASD), Feature-Driven Development (FDD), Dynamic Systems Development Method (DSDM), and Crystal family practices with Scrum being the most adopted one (Versionone, 2016).

Agile methods should be distinguished from agile practices, which will be covered and explained in the second and third chapters of the study. Each agile method is focused with distinct set of values, techniques and terminology, and there is no "silver bullet" approach, and neither there is a one sure way to tell which method would be preferable given the particular circumstances – this decision lies on project leaders and managers.

Moreover, each of agile methods has its own evolution and interrelations between each other, that are important to note for the better understanding of practices (see Figure 1.6.). Earlier papers influences significantly the latter once, hence, intellectual roots of current agile methods go back in 1980s. Problems remain with tailoring agile methods to specific markets, products, and project specifications, so as the time gap between new agile developments and modifications and lack of academic analysis

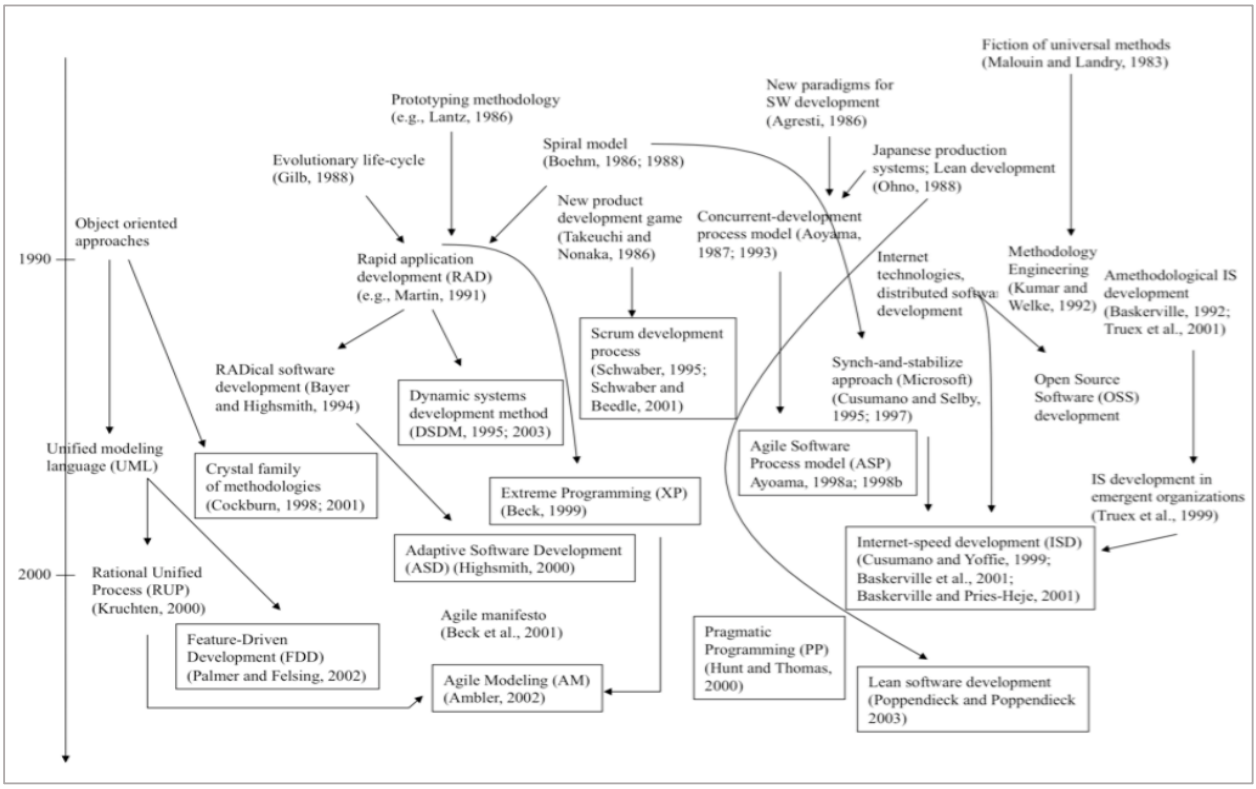

Figure 1.6. Evolution map of agile methods in digital project management. (Source: adapted from Dingsøyr et al., 2010).

1.3. Classification of recent research directions on agile methodologies

Since the emergence of the agile methodology in 2001 there are over 1550 publications that have been published on agile project management; among them, the leading countries of research are USA, Canada, and Western Europe (see Figure 1.7.). Speaking of developing economies, there is still a substantial shortage of research concerning application and adoption of agile project management practices and it influence on productivity, organizational culture, and other factors.

It does seem necessary, though, to put countries like Russia on the "research map", so that the local companies could better be aware of ways of improving project management practices, and academics would have more data concerning local geography.

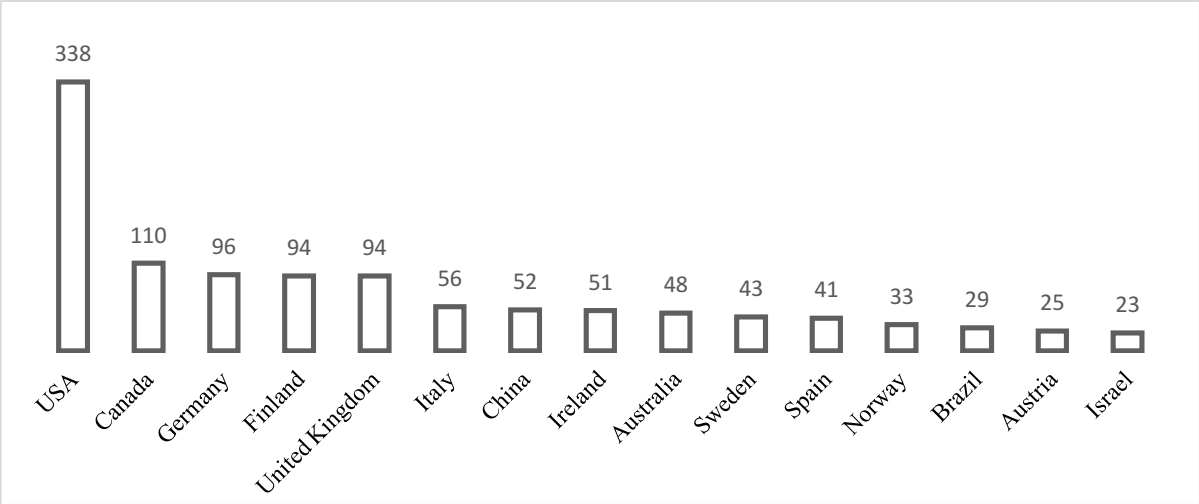

Figure 1.7. Number of academic publications on agile methods by country (Source: ISI Web of Science, Thomson Reuters; eLibrary).

Some papers are investigating particular agile methods application (test-driven development, XP, pair programming, etc.) and their specifics. Moreover, the current "hot" theme is reconciliation and possible harmonization strategies between project management practices, finding ways to combine agile and non-agile in order to eliminate risks and have a synergy effect, so as the role of patterns., which is being developed by several cited articles (Sharp & Robinson, 2010; Sharp et al., 2009).

Due to the vast variety of issues related to project management and agile methods in particular, there are several categories, in which academic papers on the subject are generally tend to fall (Figure 1.8). Firstly, it is about issues related to an introduction and adoption of agile methods, that is still interesting for researchers, and so far there is no single accepted way due to different services and organizational specifics (Layman et al., 2008; Lee & Xia, 2010).

Another stream of research is concerned with building organizational system, organizing business activities in a way that it will help to implementation of agile practices and vice versa. Many papers investigate influence of social behavior, team dynamics, and organizational culture with respect to agile application. Within this area of research there is a large amount of work devoted to knowledge management aspect of agile practices (Salazar-Torres et al., 2008; Chan & Thong, 2009), to the influence if individual behavior and belies (Acuna et al., 2009; Hannay et al., 2010), to organizational learning (Holz & Mauler, 2002), and social facilitation (Balijepally et al., 2009).

There is a distinctive area of research, which is trying to investigate how implementation of agile practices, as oppose to traditional methods, can influence the performance of the project team/ the company and ultimately help to gain competitive advantage (Nerur et al., 2005). This

branch is trying to compare different methods between each other, with possibility of drawing better practice for a particular business case.

The comprehensive map of research direction and research methods employed (see Figure 1.8.) shows that first qualitative findings on many topics already exist, but confirmatory studies in almost all research areas are still lacking.

Speaking of research methods utilized (see Table 1.4), systematic literature review (Hummel, 2014) results show that the case study is by far the most popular approach with almost 40% frequency. This speaks to the fact that agile methods, while being on the edge of popularity for several years, still just on the way of transformation to the more advanced, quantitative methods' utilization.

Table 1.4. Research methods utilized in studies on agile methodology. (Source: Hummel, 2014)

Research method utilized	# of papers	% of total
Case Study	185	38,5%
Experiment	62	13.0%
Survey	39	8.0%
Ethnography	16	3.5%
Simulation	18	4.0%
Literature Review	25	5.0%
Grounded Theory	22	5.0%
Action Research	12	2.5%
Focus Group	6	1.0%

Considering all mentioned above, this study is more related to the adoption branch of the agile methods studies, since there is yet a little evidence from Russian companies and gathered data is used for relatively new research goal. Therefore, the study investigates which agile methods are used in companies, how are they being implemented in practice, what are the parameters that indicate that usage of agile methods would be more preferable.

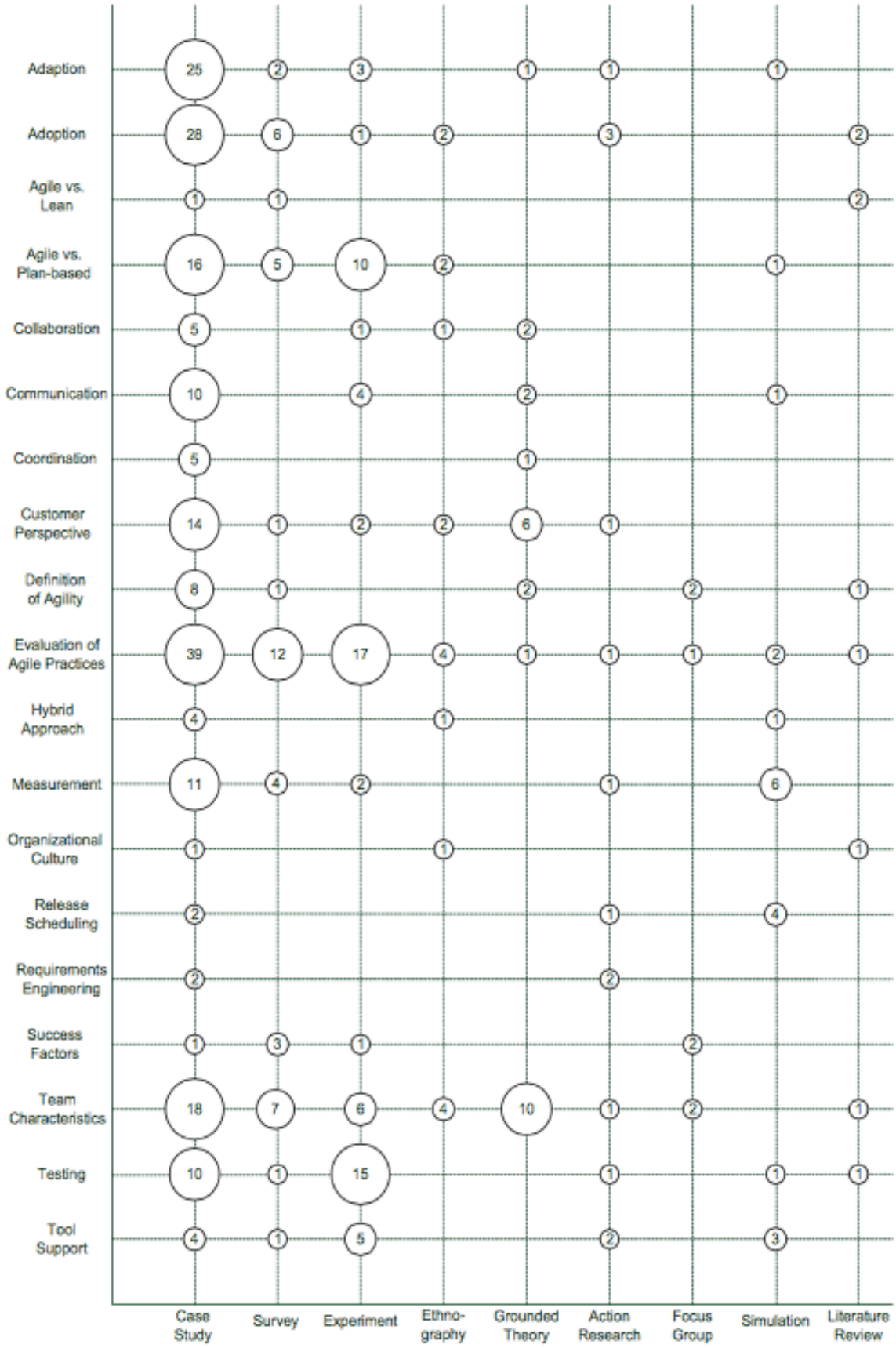

Figure 1.8. Taxonomy of agile software-related project management academic focus and research method employed. (Source: Hummel, 2014).

1.4. Identifying the research gap in agile adoption and tailoring factors

As can be seen from the Figure 1.8., the adoption problems are still a relevant research area, and is appealing for the analysis and further investigation for the local Russian software and digital market. Analysis of e-Library showed that there are currently no scientific research papers conducting primary data analysis on agile methods adoption factors in Russia.

As was stated before, the transition to agile approach can be quite challenging for the development teams, and might face obstacles such as cultural differences, individual and group resistance, upper management refusal or lack of understanding (Echalar, 2013, Gandomani Et Al., 2013). We believe that this analysis can help identifying certain managerial patterns and implicit practices, and, hence, to help teams that are considering agile transition in identifying factors that are require special attention.

Therefore, the adaptation issue is a critical one, and in order to do that, we need understanding of how project context, cultural and external environment influence the agile adoption. The problem of agile adoption reasons identification has already been posed in the global research community, however, yet without consistent results.

There are work on literature on agile practices selection (Ahmed & Sidky, 2009; Abbas, Gravell & Wills, 2010, Esfahani, Yu, & Annosi, 2011; Madi, Dahalin, & Baharom, 2011; Kurapati, Manyam, & Petersen, 2012) but still no final answer to this problem. Agile practices adoption could help organizations bring new ways of performing tasks but also keep existing practices of the organization in place. This combination could make the organization more successful (Kurapati, Manyam, & Petersen, 2012). The research work on agile methods tailoring according to papers above can be divided on the following types: most used practices, quality, business goals, maturity model, agile values and project types.

A review of the research literature on use of agile in global software engineering presented a list of agile practices used or referenced by the analyzed papers (Jalali & Wohlin, 2010). A survey on agile practice adoption proposed to under- stand which practices have been used by the software development industry (Kurapati, Manyam, & Petersen, 2012). The survey analyzed practices adoption at the project and organization levels and also defined the association between practices. Factor analysis was applied to group 58 agile practices and found 15 factors and checked the correlation between them finding application of quality assurance and iterative and incremental practices had a high success rate (Abbas, Gravell, & Wills, 2010). An empirical study identified common adopted practices, listed practices that normally are used together and correlated the customer satisfaction after adopting the practices (Manyam & Kurapati, 2012). This work also tried to identify adaptation by organizations on the adopted practices. A work focused on the

quality aspects of the agile practices showed the main agile practices associated with high quality of the software product (Santos et al., 2011).

SAAP (Strategic Analysis for Agile Practices) framework (Esfahani, Yu, & Annosi, 2011) was proposed with the intent to associate business goals of the organization to the selection process for agile practice adoption. SAAP extended Situation Method Engineering and used concepts from Balanced Score Card (BSC). This work linked the selection of agile practices to the organization's business goals.

Sidky Agile Measurement Index (SAMI) (Ahmed, & Sidky, 2009) showed the adoption of agile practices based on an agile maturity model. SAMI is a 5-step road map to guide teams adopting based in 5 values considered essential to agility: enhancing communication and collaboration (level 1), delivering software early and continuously (level 2), developing high quality, working software in an efficient and integrated manner (level 3), respond to change through multiple levels of feedback (level 4) and establishing an environment to sustain agility (level 5). SAMI is not based on any specific agile method such as XP, Scrum or Crystal, but instead, uses agile values and principles to define the path to agility.

The analysis of papers and books from Agile Manifesto signatories using content analysis (Madi, Dahalin, & Baharom, 2011) identified the key agile values and how frequent they were mentioned in the literature. The agile key values obtained by this work were: Flexibility, Customer-centric, Working Software, Collaboration, Simplicity, Communication, Natural, Learning, Pragmatism and Adaptability.

A methodology to select the best agile practices for projects based on the association between project's characteristics and the abilities of the agile practices has been defined (Saleh, 2013) and the key project's areas analyzed in the work were team size, iteration duration and distributed teams.

Case study was the most utilized empirical research technique and demonstrated that those researchers were trying to prove that the proposed approaches could be used on real case and with the feedback obtained by the case studies the approaches could be improved. Experiments are rare among the analyzed papers and the cause could be the lack of wide real adoption of the agile method tailoring technique, since experiments should have to involve multiple cases in a controlled setup (Tonella et al., 2007).

More than half of the analyzed papers are non-specific to any agile method. This data indicates that the majority of the research on agile methods tailoring could be applied to organizations independently of the agile method chosen. The rest of the papers use agile methods tailoring approaches mainly focused on Scrum or XP. Real world organizations have been adopting mainly Scrum and XP (Versionone, 2016) as their agile methods and this shows research

connection with practical agile adoption.

The analyzed agile method tailoring procedures or techniques that were non-specific worked based on a set of agile practices no matter the agile method chosen by the organization and on a model to select the practices to be adopted. There were also approaches combining agile methods to try to get the best of different agile methods (El-Said, Hana, & Eldin, 2009; Ayed, Vanderose, & Habra, 2012).

Finally, a comprehensive analysis of the agile adoption research literature showed that, in general, digital tailoring criteria can be divided into several categories (Kalus & Kuhrmann, 2013), namely team, internal environment, external environment, and project objectives (see Table 2.3). Those criteria are directly or indirectly influence the decision to adopt a particular project management methodology. This study has borrowed this approach for the purposes of the research model synthesis, which is going to be covered in the second chapter. The details of abovementioned papers' results are discussed in the third chapter with regards to compare the results of this work's statistical analysis.

1.5. Summary of Chapter 1

The conceptual issues of agile methodology and overview of agile methods with respect to web- and software development were presented in this chapter. Several research areas, where the majority of research papers fall were identified. This study is concerned with problems of adoption choice agile practices. The current state of the agile methods tailoring literature was summarized in this chapter.

The results of the analysis and classification showed that this is currently still a relevant research topic, as the number of published studies have been growing over time and the studies are originated from multiple countries around the globe. Moreover, there are no similar research studies done in Russia, hence it can be useful not just for the companies, but also in cross-cultural studies if they will take place.

In general, agile methods factors and tailoring research should be considered mature since more than half of the papers use empirical research methods. There are, however, still papers that do not use primary data or which do not provide enough empirical evidence. The literature analysis of the area identifies several influential works, with extensive list of possible agile adoption factors and categories.

For the purpose of this research, the next chapter will contain the synthesis of the factors based on the considered articles. This research's is therefore aims to provide a set of detected factors and to investigate the impact that those factors have on agile practices and methods adoption among Russian IT and digital companies, since there is a lack of research on this matter

in the country.

From the practical point of view, the proposed recommendations which is derived from the analysis could help project managers to select agile methodology for adoption based on the level of importance of each of the criteria has on the organization's context.

To sum up, there are currently no studies that study the factors that influence factors of agile adoption for digital Russian teams, and this thesis aims to fill this research gap. This analysis will help identifying certain managerial patterns and implicit practices, and, hence, to help teams that are considering agile transition in identifying factors that are require special attention. The goals, research questions, and the details of the research design and adopted theoretical model are covered in the next chapter of this study.

CHAPTER 2. THEORETICAL FRAMEWORK FOR INVESTIGATING FACTORS INFLUENCING THE ADOPTION OF AGILE METHODS

2.1. Identifying research goal and research questions

In previous chapter a review on existing agile methods and problem of their adoption and application with respect to digital projects and web- and software development have been provided. The information was provided also on the general state of project management approaches to modern software development, the main differences between waterfall and agile approaches were overviewed, main agile techniques were reviewed, the problem of method choice to a particular IT projects and project effectiveness was stated, and modern research gaps were found.

As has been shown above, while being extremely recognized methodology in the professional project management community, details of agile application and adoption are still not fully investigated in academic research and there is a need for a "bridge" between professional community and academic research.

At the same time, there is still not enough evidence from developing countries developments on the matter, whereas many of those countries have been experiencing significant growth in software and digital markets, and, hence, present an interest for the investigation. This gap is currently being filled with increasing number of research papers from Brazil, India, Republic of South Africa, etc.

Several current "hot topics" for the research were identified in the previous chapter, however, they cannot all be investigated due to the limit nature of master's thesis itself and the time given; instead, this study will be mainly concerned with problems of adoption and practical implementation of agile methods in managing digital projects, namely with identifying what factors are the most important for management decision of agile practices adoption, and the way the implementation process of agile methods adoption should be held.

Having stated that, this work is also being limited by looking only at Russian companies, operating in high-tech, digital, and IT fields, since there is lack of literature that investigate this geographical area, and instead rather concentrate either on global level, or on developed countries with more acceptation of agile practices.

There are several research frameworks that had been developed in the recent years, which help to identify the characteristics of the project which incline the sense to use agile methodology. This chapter's aim is to make a reasonable choice of a research model, and to create a research framework which will make it possible to analyse Russian digital market.

The rest of the study is devoted to gain practical evidence of the adoption and implementation of agile project methodology in Russian digital companies, with purpose of deriving managerial recommendation and drawing some possibilities for further research development. Particular additional interest of research with this matter, is to provide an insight on what managerial implications concerning agile adoption and tailoring might be derived from the results of the study.

The goal of this study is therefore to investigate the state of agile methods adoption and factors that encouraged project managers to make this choice in order *to reveal good practices* and to develop a set of recommendations for project managers on choosing agile principles

In order to reach stated goal, this study is aiming to answer the following **research questions**:

Q1 what factors in the research literature are said to influence the decision to adopt the agile practices?

Q2 which agile methods and practices are being used in Russian digital projects?

Q3 what is the relation between adopted agile methods and the implicit factors for Russian digital development teams?

Hence, this study is going to provide, first of all, an evidence from current situation of Russian agile adoption for the global research community, and secondly, to be of a value to digital companies and project managers working in Russia, and to agile teams in general, so that they are able to employ agile project management initiatives and increase their competitive advantage.

As well it might be of use for Russian software and digital teams that are trying to improve their productivity by adopting some practices or methods but do not have practical framework or insights for the importance of factors that influence the decision to adopt certain practices.

2.2. Choice and justification of the research design

Previous literature review on the subject indicated a “boom” on publications concerning various aspects of agile software development. At the same time, the problem remains with identifying what factors, according to development teams and project managers help to decide to whether or not adopt the agile methods to a particular project or organizational context.

At the same time there is a gap between the professional project management and academic research community, i.e. a disparity when it comes to academic investigation of agile methods adoption, since the majority of agile publications refer to professional conferences and management journals, and not the academic once. Moreover, this problem particularly concerns Russian development and project management community, that historically have less relied on methodology guidelines and oftentimes do not possess any KPIs and adoption guidelines.

The **objectives** of the study are as follows:

(1) To identify to which agile methods and techniques are being implemented in Russian digital companies;

(2) To identify factors and project characteristics that imply that the agile methods are more preferable to the traditional approach according to the Russian digital project managers and development teams;

(3) To produce insights on how to improve the adoption of agile methods in an average representative Russian IT company / digital agency;

According to the appropriate research identification framework (see Table 2.1.), the choice of research design should be based on the state of previous investigation of the researched area (Edmondson, McManus, 2007). The study was divided into several parts in order to fulfil the stated research goals.

Previous literature review on the subject indicated quite a gap between the professional project management and research community in Russia, i.e. a disparity when it comes to academic investigation of productivity increase due to agile methods application in companies. With respect to this inconsistency the nature of this research is exploratory. At the same time, the method was chosen as quantitative due to the maturing of the research area and more frequent usage of quantitative techniques (via survey design, in particular).

Table 2.1. Categories of methodological fit in field research. (Source: adapted from Edmondson, McManus, 2007.

State of theory	Nascent	Intermediate	Mature
Research questions	Open-ended investigation of the phenomenon	Hypothesis about the relationship between new and established phenomena	Focused questions/ hypotheses concerning existing constructs
Type of gathered data	Qualitative, open-ended data which has to be interpreted	Both qualitative and quantitative data	Quantitative data, focused on specific area
Theoretical contribution	Suggestive theory, invitation for further research, set of new problems opened by the study	Provisional theory, which oftentimes integrates previous parts of different studies done before	Supported theory, which might add new processes, views, mechanisms to already existing theories

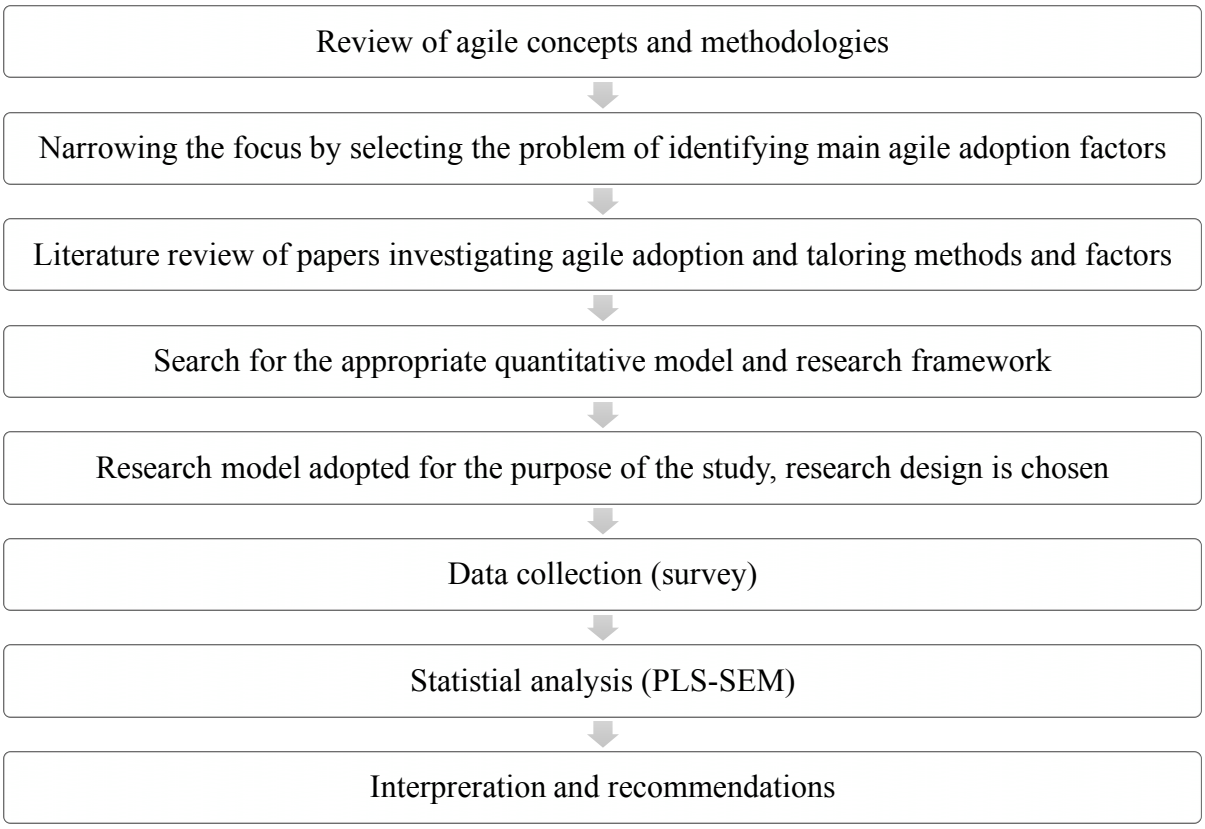

Figure 2.1. Research process: from literature review to the statistical analysis. (Source: author).

With respect to all this, the study was divided into three parts (see Figure 2.1.):

(a) synthesis of research framework in order to fulfil the goal of the study (*section 2.3. of the second chapter);*

(b) identification of agile methods used in Russian digital project management, gaining more understanding about why project managers choose to adopt agile practices, and, consequently, an identification of IT project characteristics that would most probably require an agile approach (*section 3.1. of the third chapter*);

(c) interpretation of research results and deriving of managerial recommendations on agile methodologies adoption that will suit an average Russian digital studio / IT company. In that way, the study is going to have both theoretical and managerial contribution to the area of agile project management methods (*sections 3.2. and 3.3. of the third chapter*);

It is important to characterize the nature of this research fully. Therefore, firstly, we state that the research is *exploratory*, according to the goal and objectives, because we are trying to identify and explore the relationship between the set of explicit variables and implicit factors and constructs. Hence, this research's objective provides with expectation of providing the patterns and relationships between abovementioned parameters (Hair et al., 2016).

This research is also *applied*, since we are planning to add new knowledge for the concrete industry and with the purpose of deriving practical recommendations for the digital project mangers, scrum-masters, or other people involved in the digital project development and management.

Finally, the research is quantitative, since we believe that the exploratory purpose can be better reached with combination of factor analysis and path dependence analysis. The data analysis framework will be explained later in this chapter. Our goal is objective measurement and reliable results which can be interpreted in more comprehensive way; which ca be better guaranteed with qualitative measures.

Speaking of the *procedures*, this research uses bibliography secondary data analysis and a survey that focused specifically on Russian project management teams. Bibliographical research intended to review previous academic achievements and models proposed on the topic to research gaps, and was covered in the first chapter. We analyzed published articles on the agile methods and agile tailoring topic. With the application of bibliographical research, we analyzed several existing approaches to agile factors identification and agile implementation issues, which in turn let us derive the research framework, which will be explained in section 2.3.

The survey has been sent to targeted groups, and has been posted on LinkedIn, Facebook, and Vkontakte groups, devoted to agile project management, or digital project practices. In total 83 answers have been received. Data has been gathered using an on-line survey form available during the whole research process. We investigated how commonly used individual agile practices are, combinations of practices (which are not the same thing) and their frequency of usage, as well as the degree of compliance to agile methodologies (Scrum and XP), and as how successful practitioners perceive the adoption.

2.3. Deriving theoretical research model

The first research question **[Q1]** was formulated as: *what factors in the research literature are said to influence the decision to adopt the agile practices*? In the end section 1.4 of the first chapter, we have stated that this study is mainly going to adopt the comprehensive adoption factor list (or 'tailoring criteria') from the systematic literature review of Kalus and Kuhrmann (2013), since the literature review of this study identified that this is one of the most recent and comprehensive research papers on the matter (127 papers researched in total out of 1600 population, see Table 2.2).

Table 2.2. Number or researched papers on agile methods adoption (Source: Kalus and Kuhrmann, 2013).

Source	Number	Number (cleaned)	Selected
ACM	210	210	44
Springer	60	60	13
IEEE	210	210	22
Wiley	1120	329	44
Misc			4
Sum	1600	809	127

This study identified four categories of agile tailoring factors, or "tailoring criteria", including *Team, Internal Environment, External Environment, and Objectives* (see column *Constructs* in Table 2.3.). Those criteria are said to influence the managerial decision to adopt agile practices in a particular project context, but are quite difficult to observe directly, which makes them latent constructs in terms of factor analysis terminology.

For the sake of clarity, we are providing the definition of constructs. They are defined as "ideas which are generated in mind" (Hair et al., 2016). It is therefore more generalized categories of similar factors, that exist implicitly, and are quite difficult to measure directly. The construct is therefore must be represented by the set of variables in order to be measured quantitatively. Those constructs are based on the results of the literature review we provided earlier and will describe in more detail below (see also Chapter 1).

In order to evaluate constructs contribution to adoption of agile methods, we need to look at their presence indirectly, partially by looking at behavior of specific factors inside those categories (see column *Factors* in Table 2.3.) and their connection to agile practices adoption level in Russian digital studios. The aim of this chapter is to explain the adapted research model in full detail.

Table 2.3. Full set of factors for software-related projects (Source: adapted on Kalus and Kuhrmann, 2013)

Constructs	Factors
External Environment	Client availability Client process Legal aspects

	Number of Stakeholders Requirements stability Stakeholder availability Stakeholder background Type of contract User availability User background
Internal Environment	Clear project proposal COTS products Database system Financial controlling Management availability Management support Maturity model Measurement system Operating system Programming language Project budget Project duration Project role Project type Prototyping Sub contractors Technical support Tool infrastructure

Project objectives	Complexity Conceptual solution Degree of innovation Documentation Domain Hardware development Legacy system Neighboring systems Safety & security Technical solution, User Interface and system integration testing
Team	Distribution Domain knowledge Good cooperation Previous cooperation Previous Knowledge Process knowledge Size Technology knowledge Tool knowledge Turnover

In order to simplify the research and make it possible to gather primary data, the number of factors has been found too large, and it was decided to shorten the number of factors to the reasonable quantity. The factor set was chosen based on similar works that investigated agile factors influence (Mukhtar et al., 2013), which was in turn slightly modified by adding two additional factors, 'maturity level' and 'previous knowledge', and is presented in the Table 2.4 in the final form. In conclusion, we can state that these tailoring criteria allow clear classification and the results of the literature review were used as a basis for the research model, and the follow up survey construction.

After researching the literature, the following set of factors and latent constructs were adopted. Figure 2.2. shows the constructs of the proposed model. On the right side of the model, there are four constructs representing the criteria adopted for this research (see Table 2.4.). The proposed model evaluates the impact of the exogenous factors on agile practices adopion. Those

“tailoring criteria” are independent and are grouped into following categories: internal and external environment, objectives, and team as it is in the original Kalus and Kuhrmann’s work (2013).

Table 2.4. List of final set of Categories and Factors (Source: synthesis of Kalus and Kuhrmann, 2013; Mukhtar et al., 2013; Ahmed & Sidky, 2009).

Category	Factors
External Environment	Requirements Stability
	User Availability
	Type of Contract
Internal Environment	Communication
	Project Type
	Management Support
	Project Budget
	Organization Size
	Culture
	Maturity Level
Objectives	Business Goals
	Innovation
	Complexity
Team	Technology
	Domain Knowledge
	Team Size
	Team Distribution
	Previous Knowledge

The “team” construct represents aspects related to the communication and characteristics of the team involved in digital project development and management, and also with accumulated knowledge, experience, learning curve, geographical distribution, and roles distribution and management style.

The “objectives” category is describing the business and project goals and requirements, as well as certain characteristics of the project such as the degree of complexity and newness of technology involved, which represent the complexity, safety and security of the work.

The “internal environment” is the largest category that contains the context of the organization, its size, culture, and the way the communication and processes are managed. It includes also the main project characteristics, such as budget and type.

The “external environment” includes factors outside of the organization and project team, such as client’s and end users’ goals and requirements, contract and sub-contracts’ types and legal

issues. The definition of chosen set of factors is shown in the Table 2.5. and is directly taken from the mentioned sources.

Table 2.5. Description of agile adoption factors taken for the purpose of this research (Kalus and Kuhrmann, 2013; Mukhtar et al., 2013; Ahmed & Sidky, 2009)

Requirements Stability	The stability of requirements directly influences the entire approach in a project, e.g., the strategy for requirements elicitation, architecting the solution, implementation and test.
User Availability	The end user availability is important during the requirements engineering, and the integration and testing phases
Type of Contract	The type of the contract directly influences the software process, e.g., a fixed-price model vs. time & material leads to different strategies in handling change requests
Communication	If the team works in a good and collaborative way the need for formalized communication/documentation may decrease
Project Type	Depending on the project- or service type, different facets of a software process need to be emphasized, e.g., kind of requirements elicitation, addressed life cycle phases, system migration. This criteria influences the software process's structures in general.
Management Support	The top management should actively support a project. This is important to have the management's support in critical situations
Project Budget	Project budget influences the degree of formalism in a project. A little project budget usually implies a non-formalized process (less documentation), but also requires a strict controlling w.r.t. costs.
Organization Size	The higher the number of involved stakeholders the more time is required to negotiate all needs and requirements. Plus, the coordination effort increases

Culture	Culture is the key success factor in the software development business and decisions to adopt agile practices.
Business Goals	A clear mission and goals are an essential artifact. They also contain basic requirement and is essential for the project's success. Blurry goals are a risk.
Innovation	The degree of innovation may cause a more explorative approach to mitigate project risks
Complexity	The complexity of a project directly influences the process, e.g., by creating prototypes or following a divide and conquer strategy (creating sub projects). A higher complexity usually causes a more comprehensive software process, more (formalized) communication, a more formalized configuration and change management and so on.
Technology	Little or missing knowledge w.r.t. the technology is a risk
Domain Knowledge	Little or missing knowledge w.r.t. the actual domain is a risk
Team Size	The team size is an indicator for the effort of team coordination. While smaller teams located in a single room can directly communicate the need for formalization increases if the team grows (also if distributed/virtual teams become relevant). Team size is one of the key criteria when selecting a software process
Team Distribution	Team distribution influences the interaction pattern in a project. Teams located in a single room can directly communicate while distributed teams need a more formalized communication.

The new factor, "*maturity level"* was adopted from the work of Ahmed and Sidky (2009), and represents the maturity and learning level of the software development company. It reflects the organizational motivation to reach the certain development capacity level, and is quite known among the professional community (Sutherland, 2009; Macriver, 2015). Another added item "previous knowledge" reflects on the previous projects done, and represents the accumulated

experience of the development team (Mukhtar et al., 2013), and is definitely missing from the original "team" construct.

The research model is represented in Figure 2.2. On the left side of the model, there is one construct representing the agile practices adoption. The selected 40 agile practices are based on previous studies (Esfahani, Yu, & Annosi, 2010) and also on the Version One State of Agile 2016 Research (Versionone, 2016). Table 2.6. shows the list of agile practices used as indicators on this research. To sum up, the research model is serving the purpose of the research to explore the relationship between implicit factors and explicit agile adoption level.

Table 2.6 List of agile practices used in this research as indicators of agile adoption level. (Source: VersionOne2016, Esfahani, Yu and Annosi, 2010)

Indicator ID	Practice
PR_01	40-hours per Week
PR_02	Acceptance Testing
PR_03	Analog Task Board / Analog Story Board
PR_04	Behavior-Driven Development
PR_05	Brainstorming
PR_06	Coding Standard
PR_07	Collaborative Teams
PR_08	Collective Ownership
PR_09	Continuous Integration
PR_10	Customer Focused Group Review
PR_11	Daily Meeting / Daily Scrum / Daily Stand Up
PR_12	Dedicated Product Owner
PR_13	Developing by Feature / Developing by Component
PR_14	Digital Task Board / Digital Story Board
PR_15	Domain Object Modeling
PR_16	Empowered Team
PR_17	Features Team
PR_18	Inspection
PR_19	Interview - Structured
PR_20	Interview - Unstructured
PR_21	Iteration Planning / Planning Game / Sprint Planning
PR_22	Iteration Review / Sprint Review

PR_23	Kanban Board
PR_24	Metaphor
PR_25	On-Site Customer
PR_26	Open Office Space
PR_27	Pair Programming
PR_28	Product Backlog / Features List / Sprint Backlog / Release Backlog
PR_29	Prototyping
PR_30	Refactoring
PR_31	Reporting / Visibility of Results
PR_32	Retrospective
PR_33	Reversible Changes
PR_34	Short Release
PR_35	Simple Design
PR_36	Test-Driven Development
PR_37	Time-Boxed Planning
PR_38	Unit Testing
PR_39	Velocity
PR_40	Waste Elimination

As it was stated previously, this research is exploratory since it aims to search for patterns and understand the relevance of the indicators and the relationships between the variables (Hair et al., 2016) based on the data collected applied to the proposed model for agile practices adoption. Based on the results of literature review, we cannot propose the model to further quantitative research the agile methodology implementation before we do not have the study of the importance of different factors, which makes the exploratory design quite relevant. The full research model is shown on Figure 2.2 with all constructs and indicators/variables.

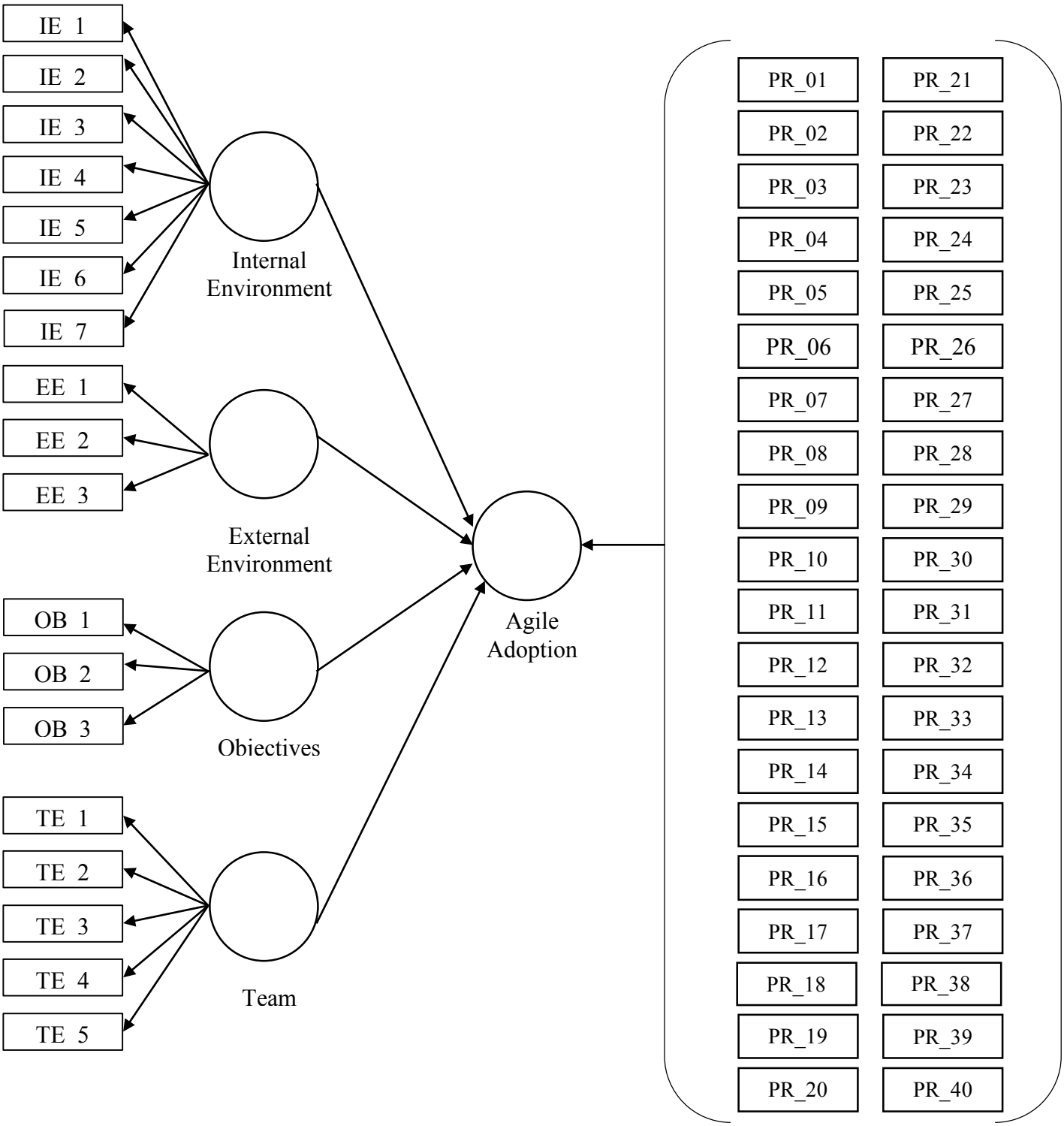

Figure 2.2. Full research model showing latent constructs and all indicators: Hierarchical Component Model, Formative-Reflective (Source: Afthanorhan, 2014).

2.4. Data collection and analysis technique

The purpose of survey research is to get the details on particular topic in order to collect enough data for the subsequent qualitative or quantitative analysis and to perform data mapping (Denscombe, 2010). Critical success factor in survey research is its construction because the wording of the questions oftentimes influences and biases the respondents (Bell, 2010); it is therefore necessary to be very careful with stylistic and clarity of the questions posed.

Practitioners can use the knowledge of the commonality of individual practices and combinations of practices as support in focusing future research efforts, and as decision support in selecting agile practices. The survey for this work gathered data regarding adoption factors used by practitioners for agile practices implementation.

A survey has been conducted during a two months, from March 2016 to May 2016. The sample on this research includes practitioners working with agile methods and/or practices, who also work in the area of digital project management and IT. There was a previous selection of the positions occupied by the agile practitioners to answer the survey and there was a field on the form the gather the position of the respondent. Data has been gathered using an on-line survey (via Google forms) available during the whole research time.

The survey was divided into 3 main parts. Part one of the survey consisted of demographic questions and profile of the organization. The importance of the tailoring criteria on the decision to adopt the agile practices was assessed on part two. Part three identified the level of adoption of the listed agile practices on the organization according to the agile practitioner's point of view. Parts two and three used a 5-point ordinal Likert scale to represent the answers in an equidistant manner (Hair et al., 2016). The survey questions are presented in details on Appendix 1. We have received a total of 83 answers coming from on-line form.

In this case use **multivariate data analysis** methods in order to analyze multiple variables simultaneously, to develop and prove research findings: "multivariate analysis techniques can be used to confirm theories testing predefined hypotheses or to explore relationships between variables and data patterns when there is no consistent knowledge about it to formulate a theory and hypotheses" (Hair et al., 2016).

Our research goal is to understand the impacts of selected factors (project criteria) on agile practices adoption. Since both the tailoring criteria and agile practices are represented by multiple indicators, the simultaneous multiple variables analysis feature multivariate data analysis fits well into our objective. We are going to establish of the relationships *between the constructs and indicators* generated by multivariate data analysis.

Currently, researchers use second generation multivariate analysis techniques such as

structural equation modeling (SEM) (Wong, 2013). This model allows latent constructs to be included in a model and measured indirectly by indicator variables, since they cannot be directly measured or they are hard to measure. All constructs in proposed model are unobservable since we cannot measure them directly. There are two types of SEM that are suitable for our analysis: Covariance-based SEM (CB-SEM), and Partial Least Squares (PLS-SEM) (Wong, 2013). The goal has narrowed to, therefore, just choose the best fit technique.

First option, CB-SEM is applied for theory testing and confirmation on *large samples sizes* through hypothesis testing (Wong, 2013) using a technique to verify if the proposed model can estimate the covariance matrix for a sample data set. It is a combination of path modeling and factor analysis (Iacobucci, 2010). It requires some assumptions such as normally distributed data, minimum number of indicator per construct, minimum sample size and the theory to model mapping to be correctly implemented (Wong, 2013). If the assumptions are violated, then gathered results could be biased.

Second option, PLS-SEM can be applied to prediction and to theory development working with complex models and smaller sample sizes (Hair et al., 2016). It is a combination of path modeling and principal components (Iacobucci, 2010). The idea behind the model is to maximize explained variance and at the same time check data quality of the measurement models. PLS-SEM can work with no data distribution assumptions; it works with small sample size; it is not concerned with model specification correctness; and it fits exploratory research approaches (Wong, 2013). Research areas such as information systems, business and marketing adopt PLS-SEM (see Table 2.7.). Since the PLS-SEM is far more flexible and can be applied more frequently than CB-SEM, we have decided to proceed with this option.

Table 2.7. PLS-SEM review studies from business disciplines. (Source: Hair et al., 2016).

Business discipline	Authors	Time period	Number of studies	Top three reasons for PLS-SEM usage[a]
Marketing	Hair *et al.* (2012b)	1981-2010	204	Nonnormal data: 50 percent Small sample size: 46 percent Formative indicators: 33 percent
Strategic management	Hair *et al.* (2012a)	1981-2010	37	Nonnormal data: 59 percent Small sample size: 46 percent Formative indicators: 27 percent
Management information systems	Ringle *et al.* (2012)	1992-2011	65	Small sample size: 37 percent Nonnormal data: 34 percent Formative indicators: 31 percent
Productions and operations management	Peng and Lai (2012)	2000-2011	42	Small sample size: 33 percent Formative indicators: 19 percent Nonnormal data: 14 percent
Accounting	Lee *et al.* (2011)	2005-2011	20	Not analyzed

The prediction features of PLS-SEM pair well with our objective and also allow future

theory development. Other characteristics of PLS-SEM that are need by our research are: constructs with few indicators; it handles well both formative and reflective constructs; it works with complex models composed of multiple constructs and indicators; and it has a great statistical power to identify significant relationships in the population. The iteration process of this statistical method is represented in Figure 2.3.

1. **Defining individual constructs:** The first step is to define the constructs theoretically. Conduct a pretest to evaluate the item. A confirmatory test of the measurement model is conducted using CFA.
2. **Developing the overall measurement model:** The measurement model is also known as path analysis. Path analysis is a set of relationships between exogenous and endogens variables. This is shown by the use of an arrow. The measurement model follows the assumption of "unidimensionality". Measurement theory is based on the idea that latent constructs cause the measured variable and that the error term is uncorrelated within measured variables. In a measurement model, an arrow is drawn from the measured variable to the constructs.
3. **Design the study to produce the empirical results:** In this step, the researcher must specify the model. The researcher should design the study to minimize the likelihood of an identification problem. Order condition and rank condition methods are used to minimize the identification problem.
4. **Assessing the measurement model validity:** Assessing the measurement model is also called CFA. In CFA, a researcher compares the theoretical measurement against the reality model. The result of the CFA must be associated with the constructs' validity.
5. **Specifying the structural model:** In this step, structural paths are drawn between constructs. In the structural model, no arrow can enter an exogenous construct. A single-headed arrow is used to represent a hypothesized structural relationship between one construct and another. This shows the cause and effect relationship. Each hypothesized relationship uses one degree of freedom. The model can be recursive or non-recursive.
6. **Examine the structural model validity:** In the last step, a researcher examines the structural model validity. A model is considered a good fit if the value of the chi-square test is insignificant, and at least one incremental fit index (like CFI, GFI, TLI, AGFI, etc.) and one badness of fit index (like RMR, RMSEA, SRMR, etc.) meet the predetermined criteria.

Figure 2.3. Steps while performing PLS-SEM. (Source: Wong, 2013)

2.5. Summary of Chapter 2

In the chapter we have covered the research process, identified research goal, questions and objectives. The goal of this study is therefore to investigate the state of agile methods adoption and factors that encouraged project managers to make this choice in order *to reveal good practices* and to develop a set of recommendations for project managers on choosing agile principles

We have stated that this research has applied, quantitative, and explorative nature and uses bibliographical analysis of secondary data and a survey for primary data analysis. Findings of the literature review was an extended classification for software and web-development factors based mainly on the work of Kalus & Kuhrmann (2013) and other similar articles.

Finally, all the steps above allowed us to form a research model based on multivariate analysis technique, aiming to explore the relationship between factors of agile adoption and it's actual degree. PLS-SEM was chosen investigate the relationships between the factors and constructs on the one hand, and the agile practices adoption construct on the other hand. Survey was designed in order to gather necessary primary data for the statistical analysis. Survey's details and design can be seen in details on Appendix 1. The results of data analysis and interpretation are going to be covered in Chapter 3.

CHAPTER 3. RESULTS OF THE SURVEY AND FACTORS INFLUENCING DECISION ON AGILE METHODOLOGY ADOPTION IN RUSSIAN DIGITAL INDUSTRY

3.1. Descriptive statistics on respondents and organizations

83 respondents in total have participated in the survey (the structure of the survey can be found in the Appendix 1). Most of them are employed as project managers and/or SCRUM masters [менеджер проекта/скрам-мастер] (45.78%). The second largest position were being a part of the development team [разработчик] (18.07%). The "Other" category comes on third place with total of 14 professionals (16.87%), and decoded as follows: 5 product managers, 3 product owners, 4 marketing specialists and 2 technical training specialists. 10.84% of all respondents were testers [тестировщики], and finally, 8.43% identified themselves as IT Consultants.

Therefore, the sample size was quite diverse and, hence, allowed to take into account not only project managers and developers point of view, but reflected views of other stakeholders as well (see Figure 3.1.).

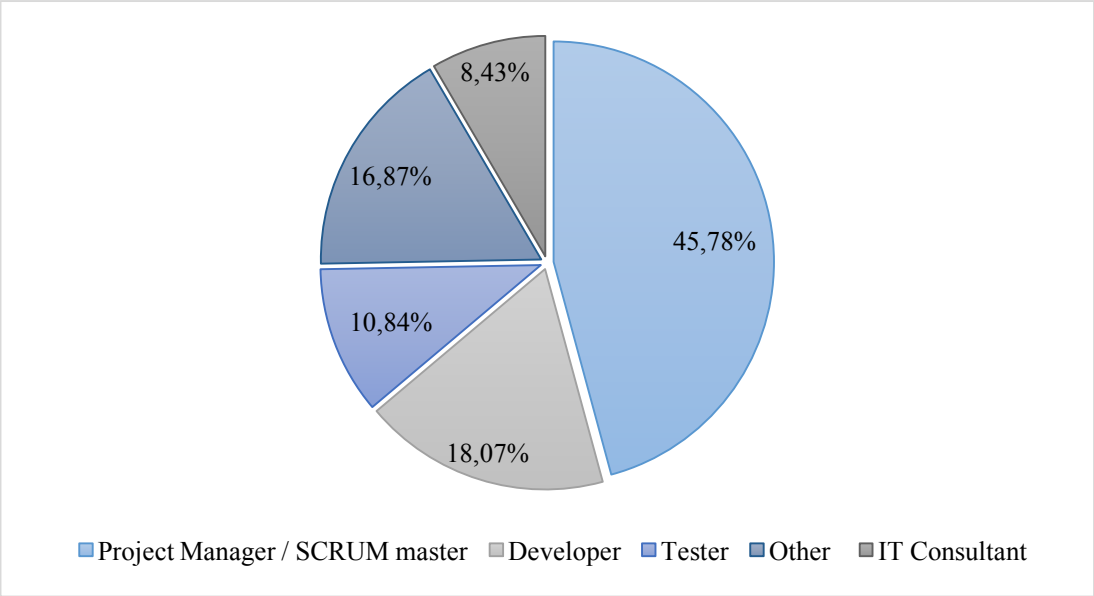

Figure 3.1. Respondents: roles in the team. (Source: analysis of survey results).

Figures 3.2. and 3.3. provide the statistics on the sample population's both general level of experience with agile methods and years of experience with agile approach. Approximately half of the respondents (49.4%) have been working with agile methods for 1 to 2 years. Consequently, 48.19% of respondents claim they have moderate experience with agile approach [умеренное владение практиками]. 34.94% evaluate themselves as possessing beginner-to-medium knowledge of agile methodology [начальное понимание практик].

A substantial portion of the respondents (32.53%) have from 3 to 4 years of experience with agile methods and practices, and together with those who have more than 5 years' expertise (6.02%) they comprise 38.55% of the total number of answers. 13.25% of professionals evaluate themselves as "experts" [экспертное знание] in the area of agile management. This makes us believe that the sample is of a high quality and the expert opinions gathered are of a great value in investigation the state of agile management practices implementation in Russian digital companies.

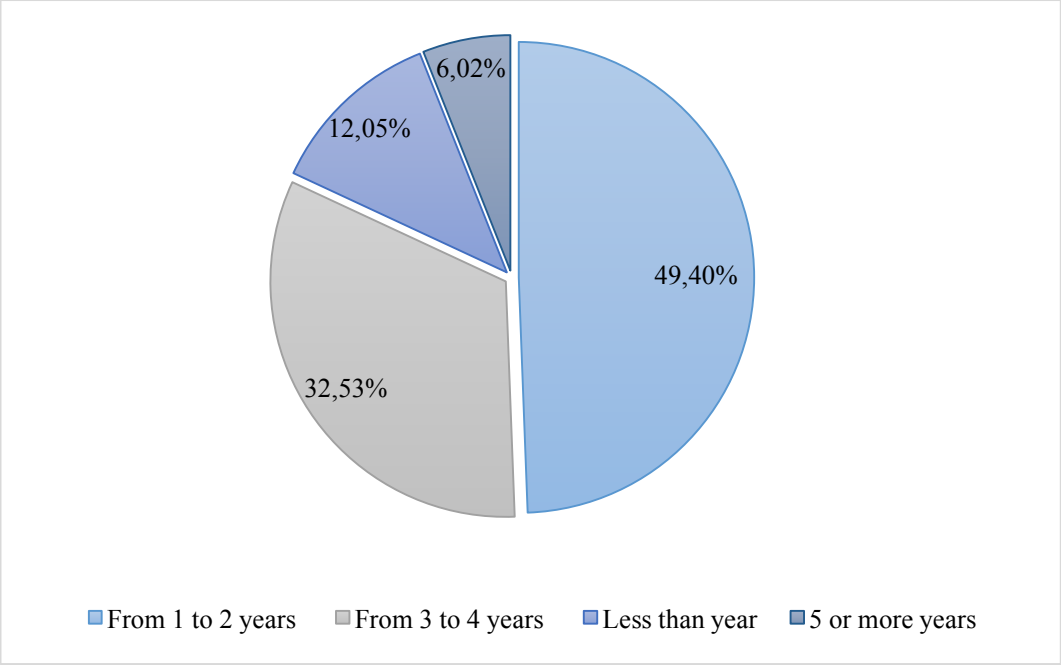

Figure 3.2. Respondents: years of experience. (Source: analysis of survey results).

Finally, there are 12.05% of respondents have less than a year experience with agile approach, and only 3.61% say that they possess almost no knowledge and understanding of agile methods. Nevertheless, answers that were gathered from this category were useful while analyzing initial challenges with agile adoption as well as make it more cleat as to which factors let the managers make that decision.

Generally, we can say that the data on years of experience and level of self-perceived knowledge level complement and correspond with each other. Further statistical analysis were not performed due to the fact that this is not directly a research question of this study.

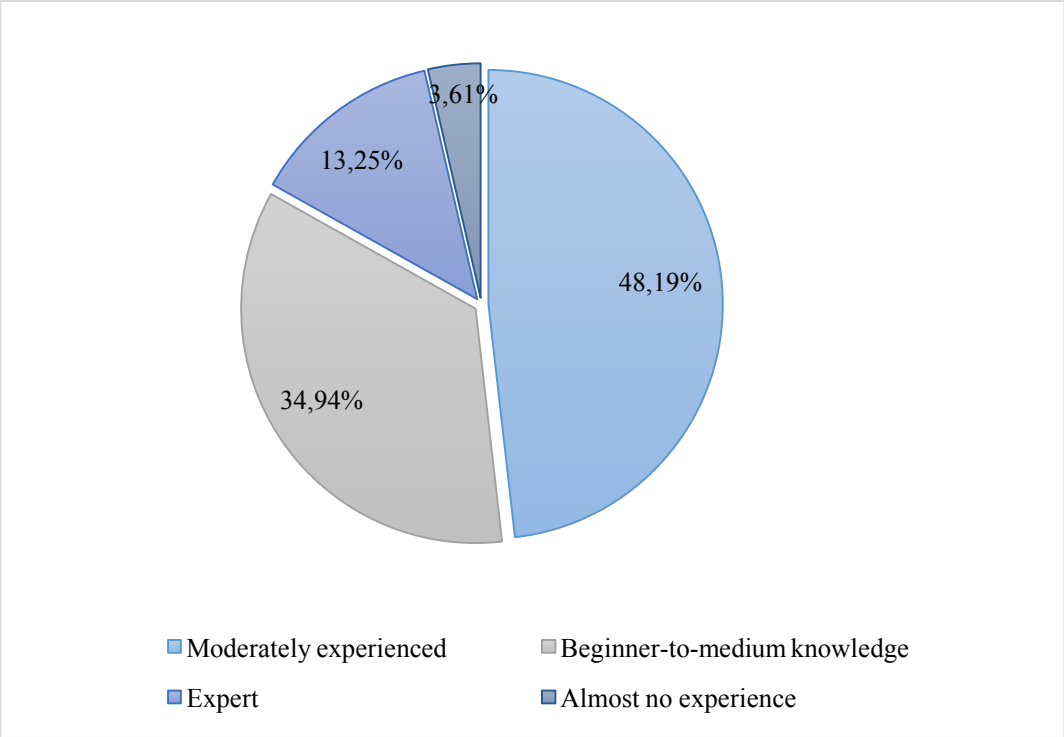

Figure 3.3. Respondents: level of expertize with agile methods. (Source: analysis of survey results).

Speaking of the organization's size, the relative of them (33.73%) are comprises of 20 to 50 employees, and the second item is those companies with less than 20 people working (28.92%) This reflects with the fact that average digital agency's size is balancing around 30 people according to leading digital consulting agency, Tagline (see Figure 3.4). At the same time, more approximately 29% of respondents work in companies with more than 100 employees, which speaks to the fact that agile methods are being actively used in larger companies as well. Important to note that, according to international statistics, around 60% of software organizations using agile methods have more than 100 employees (VersionOne, 2016).

Second research question [**Q2**] was formulated as follows: *which agile methods and practices are being used in Russian digital projects*? Scrum is the expectedly by far the most used agile method among Russian digital (75.90% of all companies), followed by Kanban techniques (55.42%). With a large gap come methods such as Lean, FDD, Hybrid methods (18.07%, 13.25%, and 13.25% accordingly) (see Figure 3.5.). Crystal, XP, and DSDM are not largely employed among respondents (less than 10% companies in total have adopted them). NB: agile method and agile practice are not on the same generalization level and agile method can be composed of several agile practices / techniques.

Different agile practices are ranked on Table 3.1. by relative agile practices adoption level, and, as can be seen, SCRUM practices, such as Features list / Product backlog / Sprint backlog / Release backlog are on the top of the list. At the same time, there is a tendency to use multiple

agile practices at a time, which we can already derive as an accepted project management practice among digital managers. Hybrid methods are not popular, however, companies tend to mix techniques from distinct agile methods, which is the global tendency (VersionOne, 2016).

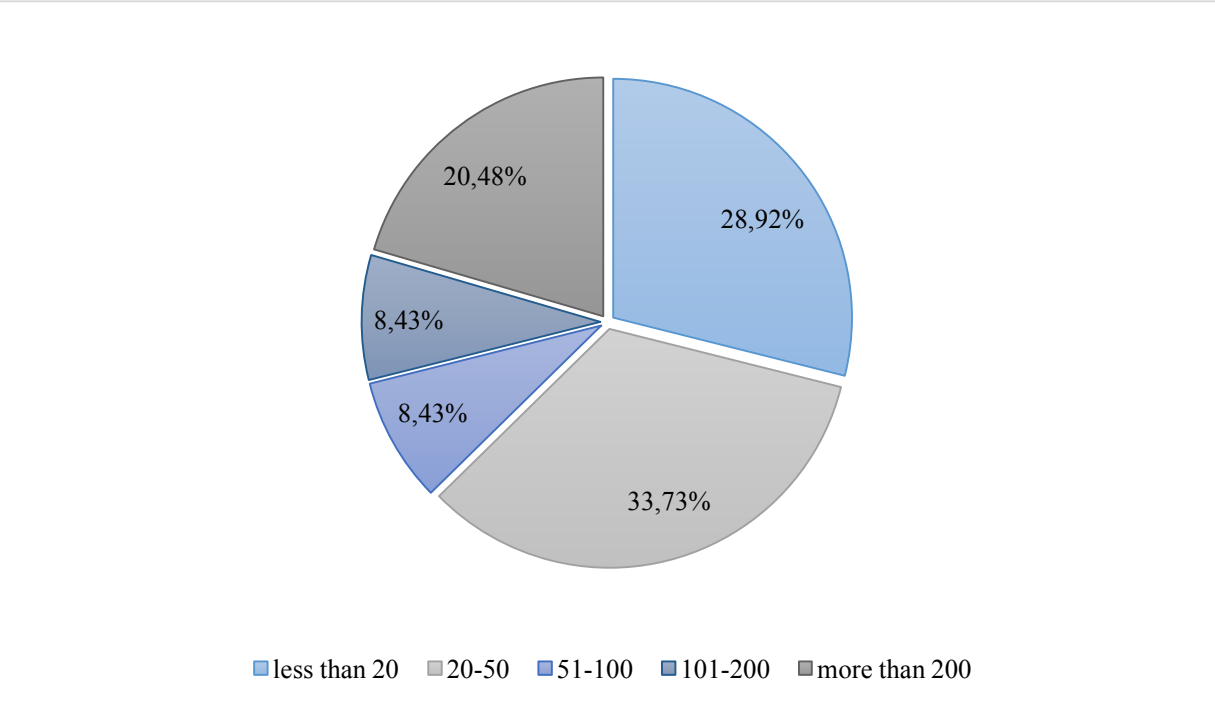

Figure 3.4. Companies / agencies' size. (Source: analysis of survey results).

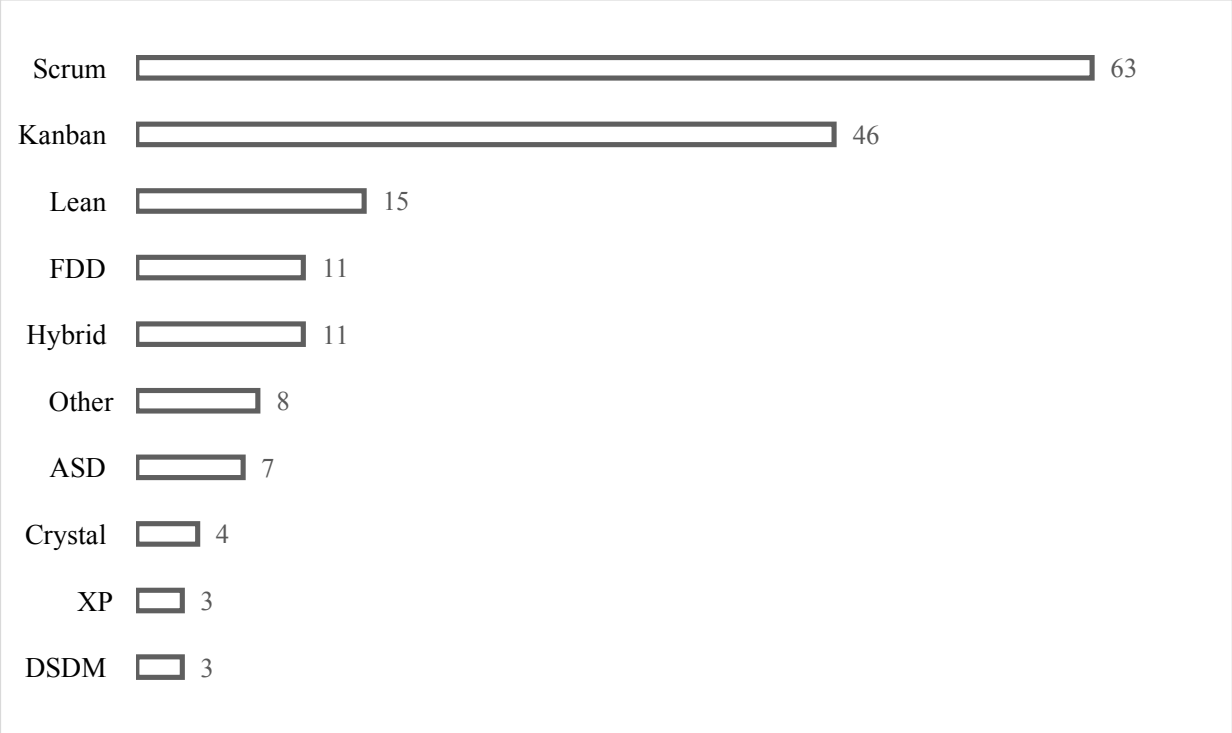

Figure 3.5. Adopted agile methods ranking. (Source: analysis of survey results. NB: sum does not come up to 83 since the majority of companies employ several agile methods at a time).

Table 3.1. Top-20 agile practices adopted in Russian agile digital teams. (Source: analysis of survey results).

#	Distinct agile practice	Statistical Indicator
1	Features list / Product backlog / Sprint backlog / Release backlog	PR_28
2	Reporting / Visibility of results	PR_31
3	Digital story board / digital task board	PR_14
4	Brainstorming	PR_05
5	Prototyping	PR_29
6	Retrospective	PR_32
7	Development by feature / by component	PR_13
8	Refactoring	PR_30
9	Short release	PR_34
10	Iteration planning / Planning game / Sprint planning	PR_21
11	Daily meeting/ Daily Scrum / Daily stand up	PR_11
12	Open Office Space	PR_26
13	Empowered team	PR_16
14	Kanban board	PR_23
15	Iteration review / Sprint review	PR_22
16	Continuous integration	PR_09
17	Features team	PR_17
18	Analog story board / analog task board	PR_03
19	Acceptance testing	PR_02
20	Collective ownership	PR_08

3.2. Data assessment process and results of the data collection

The rest of this chapter covers the model assessments, discussion of results and possible validity threats. As was mentioned in the previous section of the study, in order to get to the results, we applied the guidelines proposed by several papers (Hair et al., 2016; Wong, 2013) and the tool used for modeling and evaluation was SmartPLS 3.0 (Ringle, Wende, & Becker, 2015). The evaluation step included the execution of the PLS*, bootstrapping and blindfolding algorithms*.

After the bootstrapping and blindfolding algorithms were executed and necessary adaptations of the model was performed, we then started to assess and evaluate the measurement models of the adjusted structural model. The purpose of the different assessments and evaluations of the model was to provide the most relevant set of indicators to increase the prediction aspects of the model.

The PLS-SEM model should be validated by *three assessments (*Wong, 2013. The reflective model assessment [1] analyzes the relationship between the reflective constructs and its

indicators. The idea is to validate that *all indicators are caused by the construct*. On the formative model assessment [2], the idea is to check *if the indicators cause the construct*. The structural model assessment [3] defines if there is empirical support the proposed model/concept.

3.2.1. Reflective Model

The constructs and its indicators in our model represent the reflective measurement model. The reflective measurement model was assessed for *reliability and validity*. Composite reliability indicates the constructs internal consistency and in exploratory research, and values between 0.60 and 0.70 are considered to be satisfactory (Hair et al., 2016).

Convergent validity and discriminant validity compose the validity assessment. The convergent validity evaluation used average variance extracted (AVE). In this approach, each construct's AVE value should be *higher than 0.50* to indicate a sufficient degree of variance (Hair et al., 2016). Discriminant validity defines how a construct is distinct from the other constructs using empirical standards and for that purpose we took Fornell-Larcker criterion (Henseler. Ringle and Sarstedt, 2015), which can be calculated by using the square root of the AVE and must be greater than the correlation values for all other constructs (Wong, 2013).

Table 3.2. Composite reliability and average variance extracted (AVE) for the four constructs.

Construct	Composite Reliability	AVE
AA	Formative	Formative
EE	0.817	0.573
IE	0.789	0.631
OB	0.799	0.678
TE	0.725	0.581

Table 3.3. Fornell-Larcker test results

Construct	AA	EE	IE	OB	TE
AA	**Formative**				
EE	0.643	**0.718**			
IE	0.678	0.417	**0.748**		
OB	0.118	0.076	0.175	**0.821**	
TE	0.326	0.302	0.553	0.276	**0.745**

The results for composite reliability and AVE are summarized in Table 3.2. and present satisfactory results for the evaluation criteria (composite reliability higher than 0.70 and AVE higher than 0.50). The results for Fornell-Larcker criterion confirmed that all the reflective

constructs fulfill the criterion (see Table 3.3.).

The indicator's loadings are also an important measurement for the *reflective model assessment.* The general recommendations tell that the absolute loading value should be higher than 0.70 (Hair, Ringle, & Sarstedt, 2011). The indicators with loadings between 0.40 to 0.70 should be analyzed and only removed if that would result in an increase of the composite reliability value for the construct (Hair et al., 2016). Indicators with absolute loadings below 0.40 should be removed from the model.

During the reflective model assessment, we removed a total of 7 out of 18 indicators from the model. The final loading values for the indicators on the adjusted model are shown in Table 3.4. The removed indicators have no loading value on the table. In other words, after the assessment, only relevant indicators are part of the model. *These are the indicators representing tailoring criteria that can cause impact on agile practices adoption*.

Table 3.4. Reflective indicator loadings after model adjustments.

ID	Indicator	Loading Value
EE_1	Requirements Stability	0.807
EE_2	User Availability	*Removed*
EE_3	Type of Contract	0.721
IE_1	Communication	0.713
IE_2	Project Type	0.786
IE_3	Management Support	0.875
IE_4	Project Budget	*Removed*
IE_5	Organization Size	*Removed*
IE_6	Culture	*Removed*
IE_7	Maturity Level	0.688
OB_1	Business Goals	0.715
OB_2	Innovation	*Removed*
OB_3	Complexity	-0.551
TE_1	Technology Knowledge	-0.609
TE_2	Domain Knowledge	*Removed*
TE_3	Team Size	*Removed*
TE_4	Team Distribution	0.615
TE_5	Previous Knowledge	0.639

3.2.3. Formative Model

The formative indicators only cause latent variables and might not correlate among themselves, making "internal consistency reliability and convergent validity not relevant to its assessment" (Wong, 2013). The "Agile Adoption"(AA) construct and agile practices indicators

represent the *formative* measurement model in the proposed model. The significance of the formative indicators should be validated using bootstrapping and after that, by applying multicollinearity analysis.

The bootstrapping analysis relies on the indicator's weight (relative importance of the indicator) and the indicator's loading (absolute importance of the indicator) analysis to assess the indicator's significance (Hair et al., 2016). The bootstrapping results, based on significance level of five percent for the indicators weights or loadings, should be at least 1.96 to justify the retention of the formative indicator on the model. If both weight and loading values are not significant, the indicator should be removed.

Table 3.5. shows the weight and loading values for the indicators retained in the model after bootstrapping analysis. During the assessment, we removed some indicators if both measurements were not significant then, the indicator was not relevant for the construct. Even though low weight values have been found in some indicators these have been retained on the adjusted model based on significant loading values. Three indicators of agile practices (Pr_04, PR_24, and PR_40) have been removed from the model, leaving 37 practices in total.

The multicollinearity analysis can show if the indicator is not significant based on redundancy. Redundancy can impact on the weight estimation and on the statistical significance of the indicator (Hair et al., 2013). The variance inflation factor (VIF) is a collinearity measure and for each indicator it should be less than 5.0.

After this assessment, only relevant indicators continue to be part of the model. These formative indicators represent relevant agile practices for the model based on the data gathered from the sample via the survey.

3.3.3. Structural Model

The structural model assessment intends to check if empirical data supports the structural model based on coefficients of determination (R^2) evaluation and on path coefficient analysis. Another approach also includes collinearity, effect sizes and predictive relevance assessments to validate the structural model. We used both approaches in our assessment. Strictly speaking, this assessment validates the level of influence between the constructs on the model and the predictive aspects of the model.

The collinearity assessment is the same as the one applied to the formative model but, in this case, it is applied to the predictor constructs (Hair et al., 2016). The VIF values should be under 5.0 to avoid collinearity problems and in the adjusted model.

Path coefficients assessment provides the statistical significance of the relationships between the constructs and also the relevance of their relationships. The statistical significance of

the relationships can be determined using the bootstrapping algorithm resulting *t* values and the significance level used as a parameter for the algorithm.

We have considered a significance level of five percent resulting in a *t* value threshold of 1.96. Meaning that the *t* values of the indicators should be higher than the threshold of 1.96 to be significant. The relevance of the *relationships between constructs* should be evaluated using the path coefficients from the PLS algorithm execution (Hair et al., 2016). The values can vary between "+1" and "-1" where "+1" represents a strong positive relationship, where "-1" represents a strong negative relationship while values close to "0" represent a weak relationship.

Table 3.5. VIF values for exogenous constructs

Construct	VIF
External Environment	1.890
Internal Environment	1.753
Objectives	1.137
Team	1.714

Table 3.6. Statistical significance and relationship relevance results for the adjusted model using a significance level of 5 percent.

Relationship	t Value	Statistically Significant1	Path Coefficient Size
External Environment ->Agile Adoption	**3.731**	**Yes**	**0.447**
Internal Environment ->Agile Adoption	**2.671**	**Yes**	**0.351**
Objectives ->Agile Adoption	0.187	No	0.017
Team ->Agile Adoption	**2.481**	**Yes**	**0.341**

Table 3.6. summarizes the *t* values for statistical significance and path coefficient relevance analysis and Table 3.8. represents the validated final adjusted model according to all the assessments and tests. The results of this figure show that the relationships between the "External Environment" and "Agile Adoption" constructs, the "Internal Environment" and "Agile Adoption" constructs, and "Team" and "Agile Adoption" constructs are statistically significant at an error level of five percent.

The structural paths between the "Objectives" and "Agile Adoption" constructs, and the were not considered statistically significant since they did not reach the *t* value threshold (0.187) of 1.96 for the two-tailed test (Hair et al., 2016).

The path coefficients on Table 3.6. indicate that "**External Environment"** criteria have the strongest predictor positive effect on agile practices adoption (0.447), and is followed by the

“Internal Environment” factor with a positive effect (0.351) and the “Team” factor with a positive effect (0.341). The “Objectives” do not produce any relevant effect on agile practices adoption.

The coefficient of determination (R^2 value) defines the model’s predictive power and is the most common measure for structural model evaluation. It represents the combined effect of all exogenous latent variables on the endogenous latent variable and can be obtained using the PLS algorithm. The model showed the R^2 value of of **0.596.** This means that all the factors have a *moderate impact* on agile practices adoption.

Effect size (f^2) was measured to analyze the impact of the exogenous construct on the endogenous construct by using the R^2 value of the adjusted model and R^2 values calculated when the analyzed construct is omitted (see Table 3.7). "External Environment" and "Previous Knowledge" constructs have a medium effect size on the "Agile Adoption" construct. The rest of the constructs have a small effect size on the "Agile Adoption" construct.

The prediction aspect of the model is one of the major objectives when executing PLS-SEM procedures. The adjusted model’s predictive relevance for the endogenous construct "Agile Adoption" has been evaluated using the blindfolding algorithm. The result of cross-validated redundancy for the "Agile Adoption" construct was above zero and supported the claim of predictive relevance of the model. It means that the adjusted model shows predictive behavior for the provided dataset.

All the assessments on the structural model showed that the adjusted model has moderate explanation of 59.6% of the relevance on the "Agile Adoption" construct and predictive relevance of the model has been confirmed. The results showed that the model can predict agile practices adoption based on the set of project-related criteria.

Table 3.7. Effect size f^2 values for the exogenous constructs.

Construct	f^2 Value	Effect size
External Environment	0.234	Medium
Internal Environment	0.078	Medium
Team	0.031	Small
Objectives	0.000	Small

3.3. Results interpretation and discussion

The results are being discussed following: researched criteria impact and agile practices adoption among Russian digital teams. The researched criteria impact section shows the effect of

each of the factors on the agile practices adoption process. The agile practices adoption section can be found in shows the most adopted practices for the sample of this research and provides insights on the results patterns compared to the literature.

3.3.1. Analysis of relation between researched factors and adopted agile methods

Third research question **[Q3]** was formulated as follows**:** *what is the relation between adopted agile methods and the implicit factors for Russian digital development teams*?

Table 3.8. shows the final list of identified critical factors. The "External Environment" category has a moderate positive impact on agile practices adoption, but still highest impact among the rest categories. The items of the "External Environment" that has lest after all the adjustments are "Requirements Stability" (EE_1), and "Type of Contract" (EE_3) with the fist having higher influence (0.807) than the latter (0.677). On the other hand, "User Availability" (EE_2) item, which is also part of the external environment tailoring criteria, did not impact the agile practices adoption.

Among four important factors of "Internal Environment" category, there are "Project Type" (0.786), "Communication" (0.713), and "Maturity Level" (0.688). The highest positive effect has the "Management Support" factor (0.875), which corresponds with the results gathered from open survey questions (see the next section).

Meanwhile, the "Team" category, while having statistically significant impact on the agile adoption construct, it has the lightest one among the rest factors. This might be explained by different cultural approach and differences with leading Russian business. "Technology knowledge" is the one factor that have a negative influence on the adoption (-0.609).

Table 3.8. Final list of all relevant factors that influence agile adoption (from the most positive to the most negative).

ID	Indicator	Loading Value
IE_3	Management Support	0.875
EE_1	Requirements Stability	0.807
EE_3	Type of Contract	0.721
IE_1	Communication	0.713
IE_7	Maturity Level	0.688
IE_2	Project Type	0.677
TE_5	Previous Knowledge	0.639
TE_4	Team Distribution	0.615
TE_1	Technology Knowledge	-0.609

Reviewing the literature, we have found papers using the external environment criteria as part of their approaches. For instance, Khan and Beg (2013) proposed a contingency factors approach based on project profile, external environment, internal environment and objectives. Kruchten (2013) used criteria to define a method to adopt and adapt agile practices to the organization's context. Sidky et al. (Sidky, Arthur and Bohner, 2007) developed a very sophisticated procedure for agile adoption prediction based on method engineering that used multiple criteria (team, internal environment, external environment and maturity level) to evaluate the projects and the organization and define agile practices to be adopted.

Results of our adjusted model showed that the "External Environment" construct is statistically relevant and has a moderate positive effect on the "Agile Adoption" construct (see Table 3.7) and highest among all the other factors researched for Russian companies. This means that the external environment indicators of the adjusted model such as "requirements stability" (EE_1) and "contract type" (EE_3) positively affect the adoption of agile practices among Russian digital teams. It also indicates that "user availability" (EE_2) was found irrelevant to indicate impact on agile practices adoption.

Mukhtar et al. (2013) used case based reasoning on previous experiences as the unique factor for agile practices selection method implemented with artificial intelligence techniques. McHugh et al. (2014) reviewed the literature to understand the barriers for agile adoption in the medical domain. Main barriers were related to items in the team and internal environment tailoring criteria groups such as team size, management support and project type. Sultana et al. (2014) proposed a hybrid model mixing agile practices to resolve issues in the Pakistani software industry and evaluated it with a case study and expert review. The tailoring criteria of the paper were also based on internal environment indicators. This corresponds with our findings since the "Team" category was found statistically significant for the agile adoption prediction.

In the literature we were able to find references that team size (TE3) is an important factor for agile methods adoption (Deemer et al., 2010) but our results have not supported that fact for the Russian population since the "team size" (TE_3) was removed from the model. Another important discussion on the literature is about "distributed teams" (TE_4) (Bass, 2013, Shrivastava and Date, 2010), and our finding here are similar on that issue.

Interesting issue to point out and speculate about is the fact that "Management Support", "Requirements Stability" and "Type of Contract" are among top-3 influencing factors, and such "soft" factors as "Communication" and "Team Distribution" have less positive impact on the agile adoption. This might be preliminary explained by the local business culture and can be supported with some of the statements that we have received during the survey collection:

"Lack of understanding / acceptance by the customers, misinterpretation of the role of Project Owner and agile methodologies in general"

"Desire of the customer to save resources",

"Over-regulated requirements to an end product and wordy project specifications"

"Lack of support and top-managers' fear of chaos"

"The imposition of the top management of agile methods without a clear understanding of when they should be applied"

"Rigid, government contracts"

and other similar description. The reasons behind this can be further investigated, but at this point we can claim that client and management relations are the critical factor that must be take into account while considering the agile adoption.

Generally, around 79% of respondents claimed to be satisfied with agile practices transition, another 15% said that their teams are transitioning at the moment and there is no substantial data yet that would either prove or disprove the efficiency of the agile adoption. Approximately 25% added that there is a difficulty in identifying the effective KPI for the agile methods effectiveness, and this is a topic worth investigating further and should be a subject of further research.

3.3.3. Possible validity threats

We have identified four main sources of possible data validity threats. First of all, it is a researcher bias in identifying and selecting factors that are, in the researcher's opinion are the most important and relevant for the analysis. The only mitigation strategy here has been the careful research on similar studies and taking the examples of most cited papers on the agile adoption.

The second threat to validity is concerned with the survey questionnaire formulation and here is, again, the same technique of synthesizing the best practices of constricting questionnaires was employed. Importantly, the questionnaire was bi-lingual, since the main agile methods and practiced do not have a single translation to the Russian language and are more easily understood by the practitioners.

Thirdly, the problem with validity might lay in the quality of sample itself and with the possibility that sample does not represent the population of digital community practitioners to the full extent. All we can state here is that the diverse respondent's profile might speak to the fact that the sample is enough to represent variety of opinions and experiences, and enough to conduct the statistical model. With respect to that, the findings might be proving to be useful as a part of the general picture of the agile project methods adoption in Russian digital industry and as well

can be of relevance in other comparative cross-culture studies.

Finally, the issue with survey design is always the possibility of inaccurate and sloppy while filling the questionnaire. There is no way to check the accuracy of the data, but we believe that the sample size was enough to mitigate that threat as well.

3.4. Summary of Chapter 3

In this chapter we have answered the remaining research questions, by firstly having identified the most adopted agile methods used in Russian digital community, and by gaining more understanding about why project managers choose to adopt agile practices. We have synthesized the research model based on found factors in the literature on agile adoption (team, internal and external environment, and objectives).

Then we have described the statistical analysis technique and provided with the results on main factors of agile adoption. The external environment tailoring criteria has a positive effect on agile practices adoption, followed by the internal environment and team. The objectives criteria did not prove to be statistically significant.

Finally, we have interpreted the study results and added insight on the reasons behind factors related to clients and management support having the strongest impact on development teams. The details of these findings can be investigated further, especially interesting topic is cultural study on business culture influence, as well quantitative research on how to measure agile adoption effectiveness.

CONCLUSION

All successful projects require project methodology, and artefacts, and rules that set the game for the development team and for the all stakeholders as well. Digital business success is critically related to the client satisfaction which in turn is connected with high-speed of high-quality code.

Given the rapidly changing technology and high degree of uncertainly that is pre-set for this industry, more flexible approaches are required to manage more effectively. After agile development paradigm first appeared in the last decade it has been seen as a new way of project management, a "silver bullet" for technology-intense projects and products, and has been recognized by mane professionals as one of the most effective methods that exist today.

However, popularity comes at a price, and behind the agile movement boom there is strong tendency among adopting teams to overuse the technique, combined with misunderstanding of when it is appropriate to employ it, and when it's not. The existing research on this matter has been carried out, but without clear and comprehensive results. Partially due to the too abstract scope of factors, but also due to the fact that studies in different countries give different results, most probably because of contextual issues.

This study aimed to fill the gap by exploring the way agile methods are being implemented in Russian digital companies, and by exploring the relation between the factors that influence the agile adoption decision and the actual level of agile approach implementation.

This study investigated agile practice adoption by asking practitioners directly about which practices they are using on project and organizational level and what factors influenced the decision to adopt the agile practices in their organizations. We gathered the results that in our opinion prove that cultural differences are indeed important even when we talk about highly globalized and technologically advanced industries.

It is too premature to give more clear frameworks and guidance, but we have pointed out the critical factors that should be taken into account first of all while considering the agile adoption, and these are the practices among managers that is implicitly present, but have not been studied before in the context of Russian digital market.

We believe that the study is going to have both theoretical and managerial contribution to the area of agile project management methods, and that the results of it will be of use to both researchers investigating agile methods adoption and tailoring, and to practitioners in the field, who fight for their projects success everyday.

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APPENDICES

APPENDIX 1. SURVEY QUESTIONNAIRE

The questionnaire was divided into 3 parts: (1) information on respondents' demographics, experience with agile, and organization size (2) information on agile practices implementation in the companies (40 practices in total), (2) criteria for agile method tailoring that influences the decision to adopt agile practices

PART 1. RESPONDENT'S AND COMPANY'S PROFILE

(1)	**What is your current position in the organization?** <single choice>
	Development
	Project manager / Scrum master
	Consultant
	Tester
	Another
(2)	**How long have you been working with agile methods / practices?** <single choice>
	less than a year
	between 1 and 2 years
	between 3 and 4 years
	more than 5 years
(3)	**How would you evaluate your own experience with agile methods / practices?** <single choice>
	Almost no experience
	Beginner-to-medium knowledge
	Moderately experienced
	Expert
(4)	**What is the size of your company / agency?** <single choice>
	< 20
	20-50
	51-100
	101-200
	>200
(5)	**Which agile methods are used in your organization?** <multiple choice>
	Adaptive Software Development (ASD)
	Crystal
	Dynamic Systems Development Method (DSDM)
	Feature-Driven Development (FDD)
	Hybrid (agile & waterfall)
	Kanban
	Lean
	SCRUM
	XP
	Respondent's answer

PART 2. AGILE PRACTICES ADOPTION

(1) Please provide the adoption stage of the following agile practices in your company / agency

	Not adopted	Planning adoption	Adoption in progress	Partially adopted	Completely adopted
40-hours per Week					
Acceptance Testing					
Analog Task Board / Analog Story Board					
Behavior-Driven Development					
Brainstorming					
Coding Standard					
Collaborative Teams					
Collective Ownership					
Continuous Integration					
Customer Focused Group Review					
Daily Meeting / Daily Scrum / Daily Stand Up					
Dedicated Product Owner					
Developing by Feature / Developing by Component					
Digital Task Board / Digital Story Board					
Domain Object Modeling					
Empowered Team					
Features Team					
Inspection					
Interview - Structured					
Interview - Unstructured					
Iteration Planning / Planning Game / Sprint Planning					
Iteration Review / Sprint Review					
Kanban Board					
Metaphor					
On-Site Customer					
Open Office Space					
Pair Programming					
Product Backlog / Features List / Sprint Backlog / Release Backlog					
Prototyping					
Refactoring					
Reporting / Visibility of Results					
Retrospective					
Reversible Changes					
Short Release					

Simple Design	
Test-Driven Development	
Time-Boxed Planning	
Unit Testing	
Velocity	
Waste Elimination	

(2) Are you, in general, satisfied with adoption of agile methodology in your organization? <open question>

PART 3. ADOPTION CRITERIA

(1) How important were the following criteria on the decision to adopt agile practices in the organization?

	Unimportant	Of little importance	Moderately important	Important	Critical
Business goals					
Communication					
Complexity					
Culture					
Degree of Innovation					
Domain Knowledge					
Management support					
Maturity Level					
Organizational Size					
Previous Projects					
Project Budget					
Project type					
Requirements Stability					
Team distribution					
Team size					
Technology knowledge					
Type of Contract					
User Availability					

(2) What, in your opinion, are the factors that make adoption of agile methodology unnecessary / impossible? <open question>

(3) When, in your opinion, it is more effective and more desirable to use agile methodology? <open question>

ASD	Adaptive Software Development
AVE	Average Variance Extracted
CB-SEM	Covariance-Based Structural Equation Model
CS	Computer Science
DEV	Development
DSDM	Dynamic Systems Development Method
FDD	Feature-Driven Development
IT	Information Technology
ITC	Information Technology and Communication
KPI	Key Performance Indicators
RAD	Rapid Application Development
RUP	Rational Unified Process
SAAP	Strategic Analysis for Agile Practices
SAMI	Sidky Agile Measurement Index
SEM	Structural Equation Modeling
PLS	Partial Least Squares
UML	Unified Modeling Language
XP	Extreme Programming
VIF	Variance Inflation Factor