Wrocław University of Economics

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Ph.D. Thesis summary

Relationship model in the agile software development process. The perspective of the collaboration theory

by

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1. Introduction

Nowadays reality requires us to search for newer and more efficient solutions in the area of project management, within which software development is made. Mainly it is crucial for organizing teamwork in the development team, during the realization phase, which is more frequently held in an agile way.

Simultaneously, a well-established approach popularized in project management methods to perform work in waterfall way, associated with the initially detected requirements, makes that changes in the scope of the project are treated as problematic and even undesirable. Each request for change implies many managerial mechanisms, which increase the total cost of the project as a whole. The immediate cause of such state of affairs, what was raised by many authors (including S. Spałek, P. Pietras, M. Szmit, M. Połoński, M. Łada, A. Kozarkiewicz, H. Kerzner, or C. Clegg, S. Walsh), is increasing the amount of time and work required to adapt to new unpredicted previously requirements. Challenges associated with it contribute to the fact that the agile methods are often presented as a more effective solution for the software development, unaffected by the approaches promoted in classic models of software development process, what is raised by A. Cockburn, M. McHugh, O. Cawley, F. McCaffery, I. Ritchardson, X. Wang, K. Petersen, and C. Whlin. Simultaneously, S. Augustine, B. Payne, F. Sencider or S. Woodcock, whom indicate that performing work in accordance to the guidelines of the agile software development is perceived as an approach that reduces the risk of failure for the undetermined ever-changing specification of developed products, what has a significant impact on the success of the executed project.

The organization of work in accordance to the philosophy of agility, and a very precise selection of the proper method and common development of managerial mechanisms, is the way to achieving the currently expected dynamics and flexibility in implementing changes in the scope of the performed work, especially if they occur during the execution of the project. Achieving such state is possible by the effective organization of the teamwork in software development teams by applying appropriate modeling processes, what is associated with precisely defined relationship between precisely defined

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roles. Simultaneously, the combination of the project management methods and the software development processes (which takes place during execution of the projects in which software applications or software systems are developed as a product) contributes to the fact that many authors of scientific publication treat as one and the same both of them. Therefore, they are investigating and describing the managing of the software development process in the same way as of project management methods. It is caused by many similarities of a classic approach to the software development process and process approach to project management. Inter alia similar are: model of the distribution of work into phases, names of performed activities and waterfall approach to the realization of tasks. Additionally, the immaturity of the agile philosophy formalized in February 2001 by writing down four postulates of the agile software development, as well as the dynamic popularization of promoted approaches, makes that many of its elements remain in the sphere of conjectures, understatements and inaccurate translations of the agile postulates.

The competencies of effective project management, where development work is carried out in accordance with the guidelines of the agile manifesto for software development, are becoming crucial to the success of the projects. The managers of such projects, although the agile methods often overlook their role, must demonstrate extraordinary ability to interpretation of work progress in agile methods (e.g. team velocity is measured in a virtual story point unit) and integrate it with measures expected by supervisors (usually it is in man-hours, or other units easy converting to monetary units). It contributes to a number of misunderstandings resulting from the use of the virtual value of story point unit from the agile software development process to well-established methods of measuring earned value, known from the project management.

In the opinion of the author of the dissertation, many of understandings in the interpretation of the agile manifesto for software development are also caused by improper translation of the original text, especially terms like collaboration customer or responding to change, have been translated to the polish language without proper respect to their original meaning.

It is important to indicate that agility in project management is becoming more and more popular in the scientific literature. There are a number of publications presenting successes achieved after the implementation of an agile approach, most of them concern only the development process in executed projects without the proper reference to the project and business environment. In Polish literature the most frequently discussed are the implementation of agile methods (unfortunately, in most of them the software development process is referred to as the methodology of project management), post factum assessment of the effectiveness of used methods, and interpersonal aspects important during the selection of team members. Simultaneously, many authors are omitting guidelines dedicated to projects managers using agile methods described in PM Declaration of Interdependence, published five years after the agile manifesto for software development.

2. The problem statement, research objectives

The research and elaboration of the results, were indirectly related to the utilitarian need of the organization that the author is representing by holding the position of the board member of the International Project Management Association Poland (IPMA Poland), where he is accountable for the area of the certification of project managers (IPMA 4-L-C), as well as the role of the Leading Assessor of the Polish Project Excellence Award. There is a real need in a mentioned organization to get a better understanding of the needs of project managers executing projects where work in the realization phase is carried out in an agile approach.

The author of the dissertation assumed that crucial for the project success is the precise identification of the software development process within the project life cycle, and its reference to project/business environment, as well as identification of the managerial mechanisms related to the organization of the work of the agile teams. Therefore, focusing on the study of ties and dependencies between entities involved in the process of agile software development is a particular research problem, which will allow identify and define a specific relationship important for the success of the project, where development work is performed in accordance with the guidelines of the agile manifesto for software development.

Referring to the above, the author of the dissertation formulated the main problem areas as follows:

- lack in the literature of unambiguous explanation on how to effectively build relationship between entities in the process of agile software development,
- lack in the Polish literature of unambiguous explanation of the English term collaboration, and thus lack of unambiguous explanation of what is a collaboration with the customer, mentioned in postulates of the agile manifesto for software development.

Having regard to above, the author formulated the following main question:

- Is there an effective way to model relationship between entities in the agile software development process, which will consider collaboration with the customer?

This question expressed the author's hypothesis about the validity of the assumptions made regarding the described research problems. Concerning the multiplicity of dependencies occurring in the discussed research problems, the author formulated the following cognitive questions:

- Is there any scientific literature on building relationship in development teams working in accordance with the guideline of the agile manifesto for software development which will consider the collaboration theory?
- Is there a dedicated relationship model of collaboration for entities involved in the process of agile software development?
- If there is such a model, what would be its usefulness referring to success criteria of the IT project within which software development is performed?

The overall objective of the research work was described as follows: **to develop a relationship model between entities in the agile software development process that incorporates the collaboration theory**.

The author of the dissertation formulated specific objectives, which achieving will help to achieve the overall objective:

- identification of the research gap in the scope of the development process performed as part of the project life cycle,
- identification of the research gap in relationship models of actors involved in the agile software development process.
- identification of the meaning of the term collaboration in English and Polish literature,
- identification of the possibility of using the theory of collaboration in models of the agile software development process,

- designing and validation of the relationship model in the agile software development process proposed in a dissertation in terms of practical implementation on the basis of the literature and practice.

The overall research objective, including specific objectives, refers explicitly to the concept of building the relationship model in agile software development that incorporates the collaboration theory.

3. Research approach

The research process has been illustrated in picture 1, where the study was divided into two logically consecutive phases. The outcomes of the first phase named "Designing the research" were: formulation of the research objectives related to the presented problem and formalization of the cognitive questions. The result of this phase, apart from the results of in-depth literature review in the field of the studied issues, was a prototype of the relationship model in the agile software development process that was implemented and validated in practice by the author of the dissertation, and then evaluated during the customer satisfaction survey using the questionnaire.

Picture 1: Concept of the research process

DESIGNING THE RESEARCH	**RESEARCH OBJECTIVES**	Formulation of the research questions. Formulation of research objectives Formulation of cognitive questions.
	LITERATURE STUDIES	Analysis of Polish and global literature (monographs, publications, articles, magazines) from the library, reading room, bookstore, databases (JSTOR, Scopus, Google Scholar)
	THEORETICAL ASSUMPTIONS	Building theoretical assumptions, preparing the initial version of the relationship model.
COLLECTION AND DATA DEVELOPMENT	**PILOT STUDY**	Interview with the use of a questionnaire – the customer satisfaction level of working with a team built on the basis of a prototype of the relationship model. Analysis of collected data and applying improvements to the relationship model.
	DATA ANALYSIS	Analysis of the results in Excel

MAIN STUDY	Research using a questionnaire survey carried out among project managers from the IT industry.
DATA ANALYSIS	Analysis of the results in XLStat365/Excel tools
FORMULATION OF THE FINAL CONCLUSION	Formulation of final conclusions. The proposal of the final version of the relationship model.

Source: translated from the dissertation

The pilot study performed as part of the "Collection and data development/Pilot study" phase was not intended to provide a final conclusion to research questions. The author intended to check the relation between dependent and independent variables, as well as to collect some methical tips and guidelines, which could be applied to the main study. The planned main research using the questionnaire, carried out on the purposeful sample, was supposed to confirm the assumptions about the validity of the presented model, as well as the proposed perspective of the theory of collaboration, as a way of modeling relationship. The author decided to divide the research questionnaire survey into two crucial parts. The first part concerned the significance of identification and precise determination of relationship between teams working in accordance with the guideline of the agile manifesto for software development. The second part concerned the assessment of the usability of the proposed relationship model in the process of agile software development.

In the discussed research sample, the respondents were purposefully selected. The direct reasons for the selection were:

- the specificity of the executed research on the process of agile software development,
- difficulties in determining the approximate population size, and thus the size of the sample represented in statistical meaning,
- subjectivism of respondents in the perception of agility,

- the need to get respondents with experience in managing the work of development teams working in accordance with the guidelines from the agile manifesto for software development.

The author is aware of the popularization of the agility in various industries and sectors, however the research described in this work concerns only the original approach to agility in the context of software development. Used the purposeful selection does not allow to conclude about the whole population of all attempts to model relationship in teams working in an agile approach but is relevant to the relationship in the agile software development process only.

The last part of described research approach was to recommend the final version of the relationship model, improved by the conclusion obtained as a result of the research using the questionnaire and confirmation of usefulness of the proposed solution as a model of relationship in the agile software development process.

4. Structure of the dissertation

The first chapter of the work introduces to the genesis of software development, including evolutionary changes in the area of implemented methods, as well as the business approach of the executed projects. The concepts of classical approach (waterfall) and agile approach in management sciences have been presented in detail, along with an indication of the advantages and disadvantages of both approaches. Particular attention has been paid to the original purpose of the agile manifesto for software development, using the Scrum method as a reference. Essential aspect from the research was to determine the place of the agile software development process in the project life cycle and to highlight the relations between the business environment and the organizational structure of the project. The relationship between the roles taking part in the agile software development process has been referred to project roles, along with the indication of the advantages and limitations of the hierarchical and networked relationship between actors involved in the process of the agile software development.

The second chapter has been entirely devoted to the collaboration theory. The author presented the importance of a proper understanding of the meaning of the English term collaboration, referring to the genesis of the collaboration theory, broadly described in English literature, and almost omitted in Polish scientific literature. Many different approaches to the collaboration theory have been presented, along with the concept of identifying and building ties and dependencies (i.e. relationship) in the organizations. As part of this chapter, the definition of the term collaboration has been systematized and specified, along with the components of this type of organizational relationship (i.e. cooperation, coordination, and communication). Additionally, the identification of the best-suited method of modeling collaboration in the agile software development teams has been proposed.

The third chapter introduces into a detailed description of the research process, starting from developing research assumptions and adopted research procedure, through conceptualization and validation of the relationship model in the agile software development, considering the theory of collaboration, and also through the use of a number

of research tools. As part of this chapter, both the pilot and main study, the characteristics of studied population have been presented in detail, as well as the results achieved by the teams working to the proposed relationship model, the conclusion on the results, and generalized conclusion a complementary complement to the whole.

5. Results and conclusion

The concept of the dissertation focuses on advancing the issue of relationship modeling, presented as ties and dependencies (i.e. relationship) between team members involved in the software development process, as an integral part of the project life cycle, where the agile software development process is executed. On the basis of the identification of the relationship between actors, with their reference to the collaboration theory and situational approach to project organization (i.e. project), a model of relationship in the agile software development process has been proposed.

The most important results of this dissertation, entitled "The relationship model in the agile software development process. The perspective of the collaboration theory" are five specific research objectives, formulated as follows:

(i)   identification of the research gap in the area of development process performed as a part of the project life cycle,

(ii)   identification of the research gap in the relationship models of actors involved in the process of agile software development,

(iii) identification of the meaning of collaboration in the context of English and Polish literature,

(iv)   identification of the possibility of using the collaboration theory in the agile software development models,

(v)   designing and validation of the relationship model in the agile software development process proposed in the dissertation in terms of practical implementation based on literature and practice,

what contributes to the overall objective of the research, that was **to develop a relationship model between entities in the agile software development process that incorporates the collaboration theory**. By identifying the relationship between the actors and their relation to the theory of collaboration and referring them to the situational approach of the project organization (i.e. project), the author has developed and tested in practice the relationship model in the development process, consistent with the philosophy of agility, dedicated to organizations providing software development services.

As part of the research procedure, the author collected valuable information (results and outcomes) obtained during questionnaire survey (conducted as part of the pilot and main study) and empirical data deriving from the analysis of the results achieved by the team in accordance with the theoretical assumptions of the model presented in this work. The main study was attended by over 207 participants, of which 110 were respondents of the survey (55 respondents met the criterion of purposeful selection). Respondents who met the purposeful selection criteria had following experience: working with agile methods, working with agile teams, experience in working as an IT project manager, experience in working with partners/service providers. Collecting the results of the main study using the questionnaire survey began in October 2016 and ended in February 2017, which consisted of 7 rounds that included 5 meetings (lecture + study using a questionnaire survey) in international business entities located in Poland (companies performing a software development service) and 2 meetings (lecture + study using a questionnaire survey) held as part of seminars of Regional Groups of the International Project Management Association Poland.

Developed as a part of this dissertation the relationship model in the agile software development process should be treated as an effective and dedicated solution, which consists of the project organization holarchy, the holonomic meta-model of the project organization, and a multi-layered model of collaboration between actors in the agile software development process. The indicated components of collaboration included in accordance with the theory of collaboration, such as communication, coordination, and cooperation, allow to precisely define inter-organizational ties and dependencies, concerning not only their characteristics but also their scope. The presented solution shows the complexity of connections between entities in the common software development, and simultaneously provides tools for modeling existing ties and dependencies (i.e. relationship).

The proposed model, together with the presented process of its development can be used in practice as:

- a theoretical framework of the main relationship and their scope in the context of building collaboration, dedicated to project managers organizing development works in the projects in a manner consistent with the philosophy of agility,
- a set of guidelines supporting the building of development teams working in accordance with the guidelines from the agile manifesto for software development,
- a tool enabling effective modeling of the project organization where software is produced as part of the agile software development processes,
- tool for diagnosing the correctness of the implementation of collaboration in the agile teams working in projects, in relation to a number of criteria included in key success factors, as well as regarding cohesion of the development team, its productivity, and efficiency,
- training tool providing valuable and verified information for future project managers,
- contribution to the development of a detailed relationship model in a whole project, showing the inter-relationship between involved organizations, the project team and the development team,
- contribution to further research in the field of collaboration theory and its importance in the management of organizations, projects, and processes.

The resultant hierarchical organizational structure of the project, the network character of ties and dependencies between entities included in holonic structures, as well as references to the theory of collaboration, in the author's opinion of this dissertation, make the process of modeling relationship between entities involved in the agile software development processes to be perceived as a complex phenomenon, being the resultant of such elements of the practical trend of management sciences as: project management, process management and management decision-making.