HELENA Study: Reasons for Combining Agile and Traditional Software Development Approaches in German Companies

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Abstract. Many software development teams face the problem of selecting a suitable development approach fitting to their specific context. According to them, the combination of agile and traditional approaches seems to be the solution to handle this problem. However, the current state of practice with respect to hybrid approaches is not sufficiently examined. Most studies focus either on traditional or on agile methods, but the combination of both is not well investigated yet. The "Hybrid dEveLopmENt Approaches in software systems development" (HELENA) study performs a large-scale international survey in order to gain insights into the distribution of hybrid approaches. So far, the study indicates several reasons why companies combine agile and traditional approaches. The hybrid approaches aim at improving the frequency of delivery to customers, the adaptability and the flexibility of the process to react to change. Furthermore, it is the aim to increase the productivity. In this publication, we present the current state of the German results and outline the next steps.

Keywords: HELENA study · Hybrid software development · Empirical study in Germany

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1 Introduction

Nowadays, there exist various methods and practices to develop software. The methods consist of agile and plan-driven processes [6]. However, it seems to be a best practice to combine both approaches. While the plan-driven process provides clear process models with an overall project structure, the agile approach enables more flexibility and individuality by focusing on shorter time-to-market and customer satisfaction [1]. In order to obtain the advantages of both approaches, hybrid software development seems to increasingly spread into industry. To investigate this topic in detail, the HELENA study was brought to life. The study investigates the combinations of agile, traditional, and other kinds of software development approaches in use. Furthermore, the study examines how agile methods and practices are integrated into traditional development approaches and why they are selected.

Currently, 85 researchers from 26 countries contribute to the study of hybrid development approaches. This paper presents the current state of the data collection in Germany, shows an overview of preliminary results and outlines the next steps with respect to data analysis.

2 Related Work

There are only a few publications focusing on the prevalence of hybrid approaches: Boehm and Turner [3] motivate the combination of agile and plan-driven approaches. They mention that a changing world needs agile and disciplined development methods. They characterize "home grounds" where the approaches are most likely to succeed and identify five critical dimensions. With a classification within the critical dimensions, it is possible to set up a balanced strategy for a successful combination of agile and plan-driven approaches. The presented risk-based method takes advantage of the strengths and mitigates the weaknesses of both approaches.

Diebold and Zehler [4] examine the process of combining agile and traditional development methods. They distinguish between the revolutionary and the evolutionary approach, which differ in the order of occurrence of the methods. The authors describe the coexistence of both development methods, but they do not investigate their distribution.

Kuhrmann and Linssen [5] examine the use of process models in Germany. They compare the data from 2006 with the data of 2013 and observe the emergence of many different models and approaches. They point out that the combination of traditional process models and agile development approaches is pervasive. However, agile approaches are not as dominating as promoted by the agile community. Theocharis et al. [7] report of a high popularity of hybrid approaches. They experience the lack of quantitative data representing the use of development methods. The HELENA study aims at examining this research gap in detail.

3 Data Collection in Germany

Since May 2, 2017, the questionnaire of the HELENA survey is available online in German, English, Spanish and Portuguese. The German team of HELENA consists of 14 researchers from 11 different institutions. The researchers encouraged practitioners from different German organisations including SMEs and companies to participate in the study. Therefore, they sent personalized emails to contacts within organisations and used mailing lists of software engineering communities. Like teams from other countries, they also distributed the questionnaire using social media via Twitter, XING and ResearchGate.

The data points collected until this intermediate report seem to indicate selection and response biases resulting from the invitation method (personal emails). To mitigate these biases, the researchers started a Google AdWords campaign in order to find additional participants without a personal relationship to the researchers. (Note that the data collected during this campaign is not included in this report.) After 10 days, advertisements to "participate in the scientific survey" were displayed 40K times and 300 people clicked through the survey. Until now, five people completed the questionnaire over this campaign (one of them from Peru as advertisements were initially not restricted to Germany).

4 Overview of Preliminary Results

Based on the data collection until August 15, 2017, the German team collected 95 complete data records from German software developers. Most of the participants (33%) are employed in very large organizations with more than 2500 employees. 31% work in large organisations with more than 250 employees (cf. Table 1). There have been 45 more responses from larger organisations than from smaller ones. Among the selection bias, a possible reason might be that hybrid approaches are more interesting for large companies because they are more likely to use traditional development processes and aim to speed up development. Hybrid approaches promise them an improved development process. Small software companies tend to apply agile methods and practices right from the beginning. Hence, they often do not think about implementing hybrid approaches so far.

Table 1. Number of companies using hybrid approaches

Company size	# Participants	# Companies using hybrid approaches
<10	10	7 (70%)
10–50	5	5 (100%)
51–250	20	14 (70%)
251–2500	29	22 (76%)
>2500	31	25 (71%)

The HELENA study also asks about the size of the developed software products and the project length. In three of four cases, the product size is more than one person year (76%). Only 2% of the projects do not last longer than two person months. One third of the teams is not distributed (35%). Half of the teams is distributed either globally (26%) or nationally (same country) (24%). 15% of the projects are regionally distributed, i.e. distributed on the same continent.

One third of the participants either works in the automotive domain (16%) or in the financial sector (15%). The automotive sector is strong in Germany. Hence, it is plausible that there is a high participation from automotive software developers. 12% of the participants work in the space domain. However, these 12% do not represent the real-world industry distribution of the space domain in Germany and hence may indicate skewed representation.

26 project or team managers (27%) and 16 developers (17%) from German companies participated in the survey. Eleven participants are quality managers (12%). Most participants have more than ten years of working experience (62%). The findings in Table 1 show that the combination of agile and traditional development methods do not depend from the size of the company. In each company size category, more than 70% of the interviewed participants use hybrid approaches.

39 participants in our study (41%) stated that each project within their company can individually decide which process should be used. 20 participants (21%) report that decisions are made on business unit level. 38% of the projects are operated according to a in-house standard process. Projects either decide about specific practices and methods on demand during the project (37%) or a project manager tailors the process in the beginning (19%). In 15% of the cases, the customer is taken into account when selecting the practices and methods.

Figure 1 gives an overview of some goals, companies want to reach by selecting individual development approaches, such as time-to-market, employee satisfaction and improved delivery pace.

Most very large (>2500 employees) companies combine agile and traditional approaches to improve the frequency of delivery to customers (64%), to improve the adaptability and flexibility of the process to react to change (64%) and to improve the productivity (64%). Large companies (251–2500) also aim at improving the productivity (81%), the planning and estimation (67%) and the adaptability and flexibility of the process to react to change (62%). Micro companies (<10 employees) also want to increase the productivity (57%) and the external product quality (57%). The small companies mostly want to satisfy the employees (80%), which seems to be less important for companies which are either smaller (29%) or larger (33% resp. 19%). The very large companies also want to increase employee satisfaction (50%).

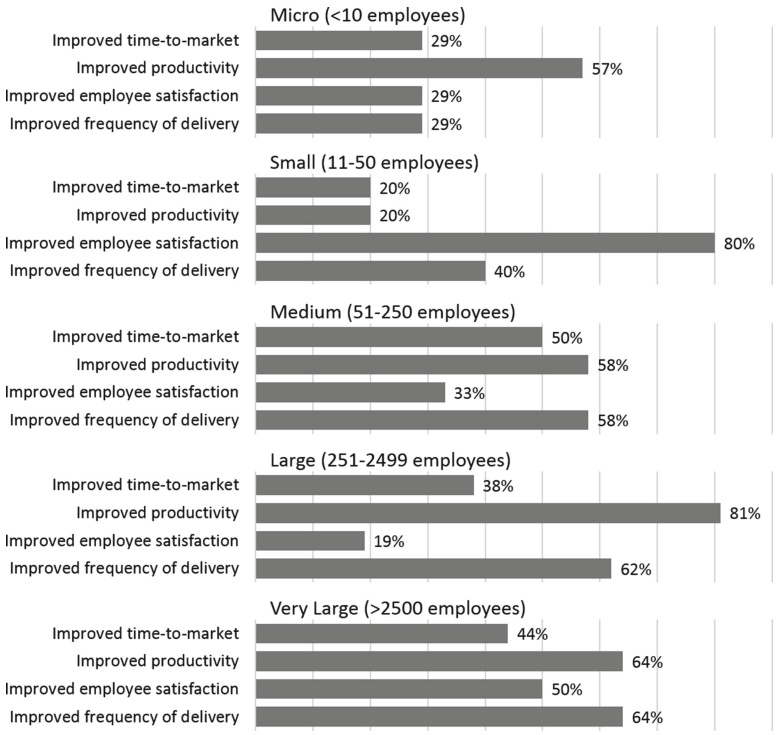

Fig. 1. Reasons for companies to implement hybrid approaches (extract)

5 Future Work

This paper presents ongoing research. So neither the data collection nor the analysis are complete yet. Next, we present a set of initial research questions for exploring the distribution of hybrid approaches in Germany and worldwide.

In order to examine the distribution of hybrid development approaches within different company sizes, we are interested in analysing domain-specific contexts. In the future, we want to examine, if there is a correlation between organization size, the implemented new roles and the way of working in order to gain insights into advantages and disadvantages, difficulties and experiences with more or less suitable combinations. Therefore, we aim at answering the following research questions:

RQ1: Are there any domains working with a purely agile approach?

RQ1.1: Are there context factors that enable the implementation of agile?
RQ1.2: Which agile approaches are in use when implementing agile?

RQ2: Are there any domains working with a purely plan-driven approach?

RQ2.1: Are there context factors that inhibit the integration of agile and lead to the implementation of plan-driven approaches?

RQ3: Which domains primarily use hybrid approaches?

RQ3.1: Which domain-specific context factors support the implementation of hybrid approaches?
RQ3.2: Which combinations are widely distributed and which ones are less suitable?
RQ3.3: Are there best practices when implementing hybrid approaches?
RQ3.4: Do common practice and best practice differ from each other?

According to Boehm [2], agile and plan-driven software development approaches have different home grounds, i.e., agile development is favourable for fast-paced markets, while domains with high failure costs tend to favour traditional development models.

RQ4: What is the effect of software criticality on the choice of development approach?

RQ4.1: Is there a clear relationship between the choice of the development approach and the criticality of developed software?
RQ4.2: Do domains with expected higher failure costs (e.g., aerospace, automotive, medicine) favour more traditional development approaches?

6 Conclusion

The results of our study indicate a high popularity of hybrid development approaches in Germany. Independent of the size of the organization, many project teams combine individually selected development approaches. Most of the organisations aim at improving the productivity, the customer's perceived product quality, planning and estimation as well as the frequency of delivery to the customer. We plan to extend our data collection and analysis in future work.

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