

Hybrid Software and Systems Development in Practice: Perspectives from Sweden and Uganda

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Abstract. Many organizations are adapting the use of hybrid software development approaches by combining traditional methods with flexible agile practices. This paper presents the initial results from the survey on the use of hybrid software and systems approaches. The results are from twenty one respondents from Sweden and Uganda. Our results show that the iterative model is the most widely used process model in both Sweden and Uganda. However, the traditional process models are also used in combination with the more agile models like Scrum. From the results, we also show that the large sized companies face the biggest problems during implementation of agility since they have to adhere to standards and control measures.

Keywords: Software process · Hybrid development approaches · HELENA survey

1 Introduction

Software development methodologies cover a range of techniques that are useful for planning, executing and monitoring the process of developing software systems. These methodologies are diverse and organizations are quickly adopting to new technologies [4]. This paper analyzes initial results from a survey carried out with an overall goal of investigating the current state of practice in software and systems development. The aim of the HELENA¹ survey was to collect data from software developers and practitioners to help determine the main software development approaches used in practice and how these approaches are combined in project development [3]. This paper presents preliminary results of the data collected as part of the second phase of HELENA. The results discussed here are from Sweden and Uganda. As part of the second phase of HELENA, Uganda is the only country from Africa that is participating in the survey and

¹ Hybrid dEveLopmENt Approaches in software systems development.

therefore we decided to compare results from a developing country to those from a Nordic country like Sweden. The first reason is that we were interested in establishing any differences and similarities between these two countries in terms of the type of software industry. The second reason is that Uganda and Sweden share a program to educate PhD students, which gives us the unique possibility to have young researchers visiting both sites for future studies in phase three of HELENA.

The survey was sent out to several practitioners in industry and based on their responses, Sweden received 13 data points while Uganda received 8 data points. The data collection was mainly done through personal contacts, via email, mailing lists and telephone contacts. In Uganda, the link to the survey was sent out to 15 companies and was filled out by eight of those resulting in a response rate of 53%. In Sweden the survey was mainly distributed through direct emails to existing contacts, complemented by posting the survey in social media such as Twitter. All 13 responses received in Sweden are accounted for through direct mailing, leading to a response rate of 37%.

The remainder of the paper is organized as follows: Sect. 2 provides an overview of the initial results from Sweden and Uganda. Section 3 provides a discussion of the results. Finally, we conclude the paper in Sect. 4.

2 Initial Results

In this section we present results from the HELENA survey [3]. The survey consists of five categories of questions belonging to: Metadata, Process Use, Process Use and Standards, Process use in the lifecycle and Experience. The results presented in this section were selected from three of the five sections in the survey, i.e., Metadata, Process Use (PU) and Process Use and Standards (PS). As indicated in the previous section, we received a total of 21 data points from both Sweden and Uganda; the analysis in this section is based on these data points.

2.1 Demographics

In this section, we cover the responses from the Metadata section of the survey. We analyzed responses on the company sizes and the roles that the respondents have in the projects they are part of. Table 1 provides an overview of the comparison of the company sizes and the roles from Sweden and Uganda.

The result set provided answers from all categories, i.e., micro-sized organizations to the very large organizations. As seen from the results, five of the organizations were micro-sized organizations and they all belonged to respondents from Uganda while five of the organizations were very large companies and these were only observed in Sweden. All the Uganda respondents had defined roles that they performed on the projects while from the Sweden respondents, there was the “other” category with two respondents. The respondents also highlighted the roles that they were frequently assigned to. From the results, it is

Table 1. Overview of the comparison of the number of participants from Sweden (SW) and Uganda (UG) under different company sizes and the roles of the participants (n = 21).

	Micro		Small		Medium		Large		Very large		Sum
	UG	SW	UG	SW	SW	UG	SW	UG	SW		
C-level Manager	-	-	1	-	-	-	-	-	-	-	1
Product Manager	-	1	-	-	-	-	1	1	-	-	3
Project/Team Manager	1	-	-	-	-	2	-	2	-	-	5
Analyst/Req. Engineer	1	-	-	-	-	-	-	-	-	-	1
Architect	1	-	-	1	2	-	1	-	-	-	5
Developer	2	-	1	-	1	-	-	-	-	-	4
<i>Other</i>	-	-	-	-	1	-	1	-	-	-	2
Σ	5	1	2	1	6	1	5	-	-	-	21

seen that the architect and project/team managers were the most frequently stated roles in Sweden while in Uganda the developers were the most frequently stated roles.

2.2 Process Use

Under process use, we were interested in determining the patterns in software development, as there is move towards agile software development process [3]. We aimed to establish the least used/unknown process models and the always/often used process models. Figure 1 provides an overview of these results from the Sweden and Ugandan respondents.

We picked the top five software development models based on the results from the survey. All processes that tied for the fifth position were included. From the results in the Fig. 1, Crystal Family and Nexus are the either not known or never used in most software companies for both Uganda and Sweden. It is also interesting to note that whereas the Dynamic Systems Development Method (DSDM) is unknown in Sweden, it is one of the most commonly used models in Uganda. We find the opposite result for Kanban, for which is known by most of the Swedish companies, but never used for five of the Ugandan companies.

2.3 Process Use and Standards

The authors in [2,3] argue that external standards, norms and regulations are major initiators brought about by the increasing complexity of software-intensive systems. In this subsection, we investigate if external standards facilitate the creation of hybrid development approaches. From the survey results, it was

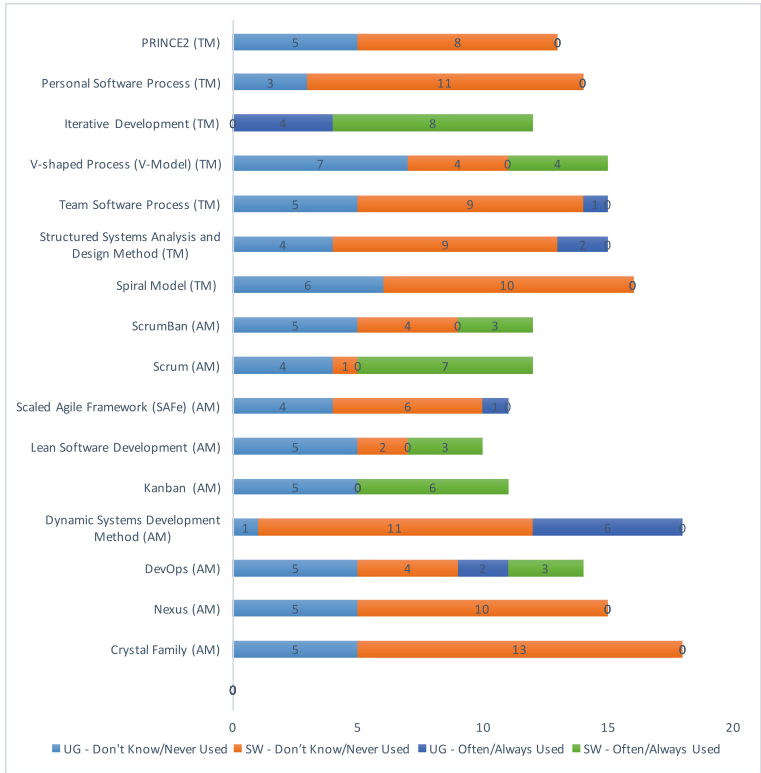


Fig. 1. Overview of the comparison of the least used/unknown development approaches versus the often/always used development approaches in Sweden (SW) and Uganda (UG) (TM: Traditional Method; AM: Agile Method).

established that 61.5% of the Swedish companies implemented external standards in comparison to the 37.5% of Uganda companies. For both countries, more than 50% of the participants indicated that they implemented the standards due to the requirements of the company/project businesses. Table 2 shows whether using standards, norms and regulations challenge companies in the implementation of agility. However, we note that the responses received for this questions were quite few (n = 11) in comparison to the responses from the previous questions. Therefore, we did not carry out a comparison of Sweden and Uganda but rather we considered an aggregated view of the responses from both countries. From the results, it is evident that the large companies face the biggest problems during implementation of agility.

Table 2. Results of the number of respondents that identified whether standards, norms and regulations challenge the implementation of agility in their organizations ($n = 11$).

Company size	Challenged by agility?	
	Yes	No
Micro	1	1
Medium	1	-
Large	2	1
Very large	3	1

3 Discussion

In this section, we discuss the results presented in the previous section. We highlight any commonalities and differences between the respondents from Sweden and Uganda. As shown in Table 1, the role distributions are reflective of the company sizes. For example, we observe that larger companies from Sweden had more roles compared to the small sized companies which is also consistent with the results presented in [3]. In Uganda, the greater number of the respondents were software developers since there is a growth in software development industry as compared to the architects and project managers from the Sweden results.

From the results shown in Fig. 1, the iterative method of software development is the most commonly used model in Uganda and Sweden. This is possibly due to fact that it is one of oldest development processes. Furthermore, from the results we observe that there is a widespread use of V-shaped traditional model in Sweden while it is one of the least used development methods in Uganda. The wide spread use of the model could be attributed to the model being an extension of one of the oldest process models and also this is in line the with large size of companies as established in Sect. 2. More companies in Sweden indicated consistent use of agile software related approaches as opposed to Uganda, e.g., the use of Scrum, Kanban and DevOps. From these initial results, it is evident that organizations tend towards using hybrid approaches for software development.

The results shown in Table 2 are consistent with the initial survey results as reported in [3], that large companies face the biggest problems during the implementation of agility. From the results, there were no significant differences between the responses from Sweden and Uganda. Many of the respondents gave justification as to why implementation of agility was a problem. Some of the views received from the individual respondents were that:

“There is a perceived level of control; deviations identified can lead to deadlocks and schedule conflicts with other projects; increased need for speed is slowed down by safety regulations, e.g. traceability, documentation levels, formal reviews; ISO26262 assumed process is pure waterfall and cause problems to run in an agile setup; conforming to standards from different domains, sometimes

standards are not easily changed or flexible even when the business environment points to the need for change.”

Many of these problems highlighted here are consistent with findings from previous studies on the challenges of agile implementation [1].

Based on these observations, we raise some questions for future research. We observe that agile methods are less known by Ugandan companies, while they use iterative development. Similarly DSDM is largely unknown by Swedish companies. By taking more data in future, we hope to understand questions that relate to any correlations between the used processes and the contextual environment of the companies including education, maturity of software industry and nature of projects carried. Other questions relate to re-occurring combinations of approaches and effect of the observed differences on internationalization and outsourcing.

4 Conclusion

In this paper, we have provided an overview of the results from the HELENA survey based on responses from Sweden and Uganda. Particularly, we have focused on the questions relating to demographics, process use, and processes and standards. Based on the results received from respondents in Uganda and Sweden, we carried out a comparative review of the main software development approaches used in industry. We categorized the company sizes from Uganda and Sweden while highlighting the roles that the respondents play in these organizations. We also analyzed the main process models that are used in both countries and found out that companies do not adhere to one development method but rather employ hybrid approaches in practice.

The main limitation of this study is the number of data points that were received from Sweden and Uganda were small and the results presented here may not provide a generalization of the software development approaches in Sweden and Uganda. For future work, we aim to get more data points before the close of the survey period and also survey other research questions and areas as discussed in the previous section. Furthermore, we also hope to compare our results with results from other regions.

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