HELENA Stage 2—Danish Overview

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Abstract. Since the early days of software engineering, a number of methods, processes, and practices to design and develop software systems have been proposed and applied in industry, e.g., the Rational Unified Process, Agile Software Development, etc. However, since no silver bullet exists, organizations use rich combinations of agile and/or traditional methods and practices, rather than following a single process by the book. To investigate this reality, an international exploratory multistage research project named HELENA (Hybrid DEveLopmENt Approaches in software systems development) was initiated. Currently, the HELENA survey is conducted globally (second stage of HELENA project). This short paper presents and discusses the results of the survey in Danmark compared to the global results based on the data from August 15, 2017.

Keywords: Hybrid development approaches, HELENA

1 Introduction to the HELENA Project

HELENA is an international exploratory multistage survey-based study on the use of "**H**ybrid d**E**ve**L**opm**EN**t **A**pproaches in software systems development". The project aims at: *a)* researching the practical application of methods, processes, and practices in software engineering, and *b)* development and deployment of new systematic processes to enable more efficient and effective software development. To achieve these goals the project is designed to collect data through a survey[4], which has been refined over several iterations. After being successfully tested within Europe in project stage one [2], the HELENA project is currently in stage two, in which the survey is conducted globally in more than 25 countries. A third and final stage will conclude the project. In stage three, focus groups will perform in depth research on community-defined topics of interest, based on the results of stage two.

With this paper, we aim (i) to identify potentially interesting similarities and differences of the current Danish results compared to the overall global ones; (ii) to assess whether results from stage one can be confirmed focusing on the Danish

[4] HELENA survey accessible from www.soscisurvey.de/HELENA/

population; and (iii) to establish a base for more in-depth research at the end of the survey, at the end of Sept. 2017.

In particular, Section 2 presents and discusses an overview of the results of the survey in Danmark compared to the global results (including the Danish ones) based on the data from August 15, 2017. Furthermore, focusing only on the Danish data set, in Section 3 we replicate the analysis performed on the data set from project stage one [3], and we assess whether the main results of stage one are in line with the ones collected from Denmark in stage two. Finally, Section 4 wraps up the main finding and briefly suggests future directions that the Danish team will consider.

1.1 The Danish Participation

The Danish HELENA research team consists of 4 members (see Table 1 for contacts and affiliations). Since the beginning of project stage two, the team invited 132 individuals via personal email (127) or mailing lists and physical meetings (5) to answer the survey. Of these, 22 fully completed the survey, i.e., response rate of ca. 16.6%. Finally, at least 13 (ca. 9.8%) individuals started the survey but did not complete it.

Table 1. Danish team—Contacts.

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2 Demographics

Except of two, all respondents have at least three years of working experience and the majority (13 out of 32) are senior with more than ten years of experience, see Figure 1. This distribution is similar to the world-wide demographics, see orange line in Figure 1.

The Danish respondents are mostly product managers/owners, developers, and architects, see Figure 2. That is interesting, as it is firstly, different from the world-wide population, see orange bars in Figure 2, and secondly, it suggests a more agile development environment in those companies as fewer project/team managers participated and no participant selected positions like analyst/requirement engineer, quality manager, tester, and trainer. Of course, these Danish results may be heavily biased by the selection of survey participants (in essence we activated every practitioner we know) and may be not representative of the entire Danish software industry.

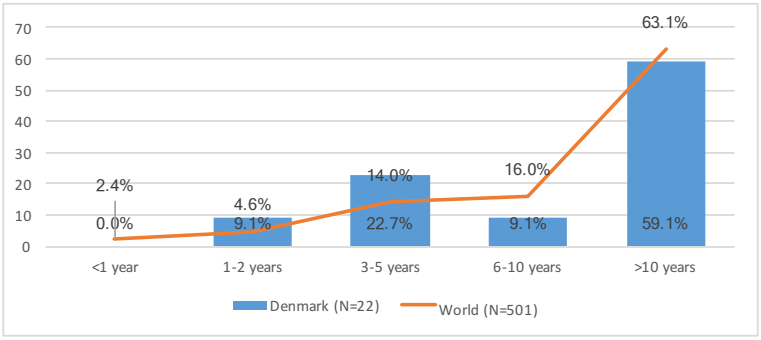

Fig. 1. Overview of the experience level as stated by the participants.

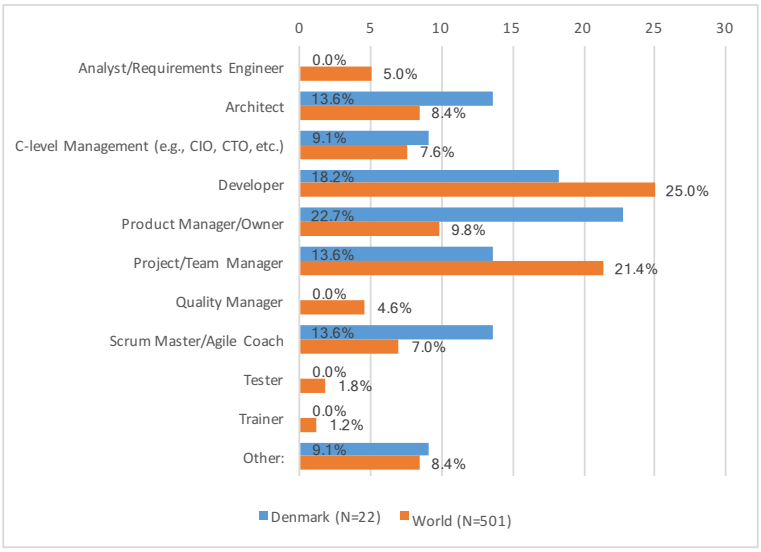

Fig. 2. Overview of the roles as stated by the participants.

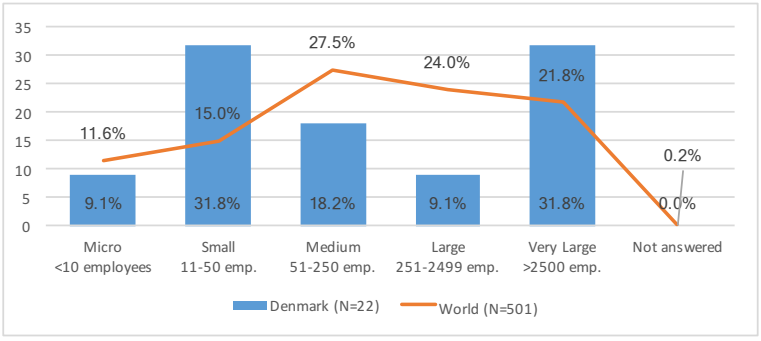

Fig. 3. Overview of the size of the companies as stated by the participants.

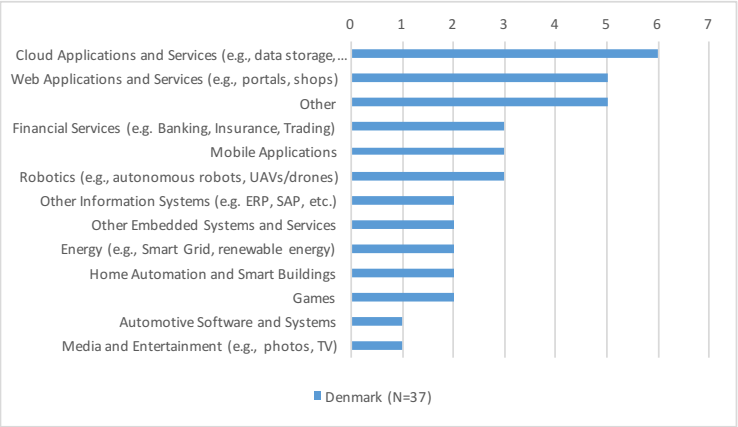

Fig. 4. Overview of the application domain of the companies as stated by the participants. Note: multiple selection was enabled.

Nonetheless, Figure 3 illustrates, that not only small and medium-sized enterprises are represented—which might favor a more agile development environment—but that approx. a third of the respondents works in large companies.

The application domain of the companies is very diverse. Most respondents work in the areas of cloud-, web-applications and services, see Figure 4. However, also robotics, home automation, and automotive software is represented, which is interesting for a country without car manufacturing. Even though existent in Danmark, there are no responses from the healthcare domain. This particular domain has been discussed within the 'safety' focus point identified during the first HELENA workshop[5] [4].

3 Applied Methods and Practices in Danmark

Currently, our hypothesis is that the Danish software industry is more inclined to apply agile software development. To investigate this, we focused on the data set generated by Danish respondents, and we analyzed the list of methods and practices selected. This section presents the breakdown of the methods and practices based on the company size and the industry sectors (see see Figure 2).

This analysis was first done on the HELENA data set for stage one [3]. However, this analysis differs in a few ways. First, since stage one, the list of methods and practices alphabetically listed in the survey has changed to improve the instrument, and the HELENA team has yet to discuss and agree on a categorization of both the methods and the practices before the end of project stage two. Therefore, this analysis relies on a categorization based on prior experience and previously used classifications (e.g., [1]). Appendix A provides the

[5] The first international HELENA workshop was held co-located with the 2017 International Conference on Software and Systems Process (ICSSP).

Table 2. Overview of the relative use of the different approaches based on (a) company size and (b) industry sector. For each item, the quantity is computed by counting the number of companies of, e.g., a particular size that have marked, e.g., a traditional method with at least a 5 (i.e., "we sometimes use it"). Note: while participants had to select exactly one company size, they could select multiple industry sectors in which their company is engaged.

		Method				Practice			
	QTY	Traditional	Agile	Both	Approaches Selected	Traditional	Agile	Both	Approaches Selected
Micro (<10)	2	0.0%	60.0%	40.0%	5	10.5%	36.8%	52.6%	19
Small (11-50)	7	0.0%	79.4%	20.6%	34	8.3%	56.5%	35.2%	108
Medium (51-250)	4	21.1%	57.9%	21.1%	19	12.9%	55.7%	31.4%	70
Large (>250)	2	21.1%	63.2%	15.8%	19	12.1%	53.4%	34.5%	58
Very Large (>2500)	7	24.4%	58.5%	17.1%	41	15.4%	52.3%	32.2%	149
Average		**13.3%**	**63.8%**	**22.9%**		**11.8%**	**51.0%**	**37.2%**	
Deviation		**10.6%**	**6.2%**	**6.8%**		**1.9%**	**5.6%**	**6.2%**	
Cloud Applications and Services (e.g., data storage, SaaS)	6	0.0%	75.0%	25.0%	32	9.0%	54.1%	36.9%	111
Web Applications and Services (e.g., portals, shops)	5	0.0%	70.8%	29.2%	24	10.9%	51.1%	38.0%	92
Other	5	26.7%	60.0%	13.3%	30	16.3%	52.0%	31.6%	98
Financial Services (e.g. Banking, Insurance, Trading)	3	13.3%	80.0%	6.7%	15	8.0%	60.0%	32.0%	50
Mobile Applications	3	0.0%	75.0%	25.0%	12	7.8%	52.9%	39.2%	51
Robotics (e.g., autonomous robots, UAVs/drones)	3	20.0%	55.0%	25.0%	20	16.1%	46.4%	37.5%	56
Other Information Systems (e.g. ERP, SAP, etc.)	2	30.0%	50.0%	20.0%	10	13.0%	50.0%	37.0%	46
Other Embedded Systems and Services	2	0.0%	66.7%	33.3%	3	19.0%	47.6%	33.3%	21
Energy (e.g., Smart Grid, renewable energy)	2	23.8%	61.9%	14.3%	21	12.7%	52.7%	34.5%	55
Home Automation and Smart Buildings	2	42.9%	50.0%	7.1%	14	19.5%	51.2%	29.3%	41
Games	2	11.1%	66.7%	22.2%	9	6.9%	58.6%	34.5%	29
Autonotive Software and Systems	1	50.0%	25.0%	25.0%	4	12.5%	50.0%	37.5%	16
Media and Entertainment (e.g., photos, TV)	1	0.0%	83.3%	16.7%	6	5.3%	57.9%	36.8%	19
Average		**16.8%**	**63.0%**	**20.2%**		**12.1%**	**52.7%**	**35.3%**	
Deviation		**14.3%**	**11.7%**	**6.6%**		**3.8%**	**3.1%**	**2.5%**	

full categorization for reference. Second, the scale used for these variables in the survey changed from being binary to a 7-point Likert scale[6]. Third, differently from the analysis performed in stage one, the data aggregation herein performed have been executed by keeping the methods and the practices separated.

Table 2, shows clearly that the majority of Danish software producers apply agile methods—on average $\geq 63.0\%$—independent of company size and sector, see Figure 5. A notable exception are companies producing automotive software, which tend more to apply traditional methods.

On average, more than half of the Danish companies—disregarding size and sectors—apply agile practices, even those developing automotive software. However, companies with less than ten employees appear to be less agile in practice, likely due to the lack of 'teams' as such.

Furthermore, the analysis in Table 2 supports one of the main results of project stage one [3], namely, that hybrid approaches emerge regardless of company size and industry sector ($\geq 20.2\%$).

Notably, and differently from earlier results [3], it seems that companies with less than 50 employees in Denmark do not use 'traditional' methods and only some 'traditional' practices. Similarly, it seems that 'younger' sectors, such as *media and entertainment*, *games*, and *mobile applications* are least 'traditional'

[6] The survey variables `PU09` and `PU10` changed scale from project stage one to two. Earlier they were binary, now they are on a 7-point Likert scale: **1**: 'Do not know the framework'; **2**: 'Do not know if we use it'; **3**: 'We never use it'; **4**: 'We rarely use it'; **5**: 'We sometimes use it'; **6**: 'We often use it'; **7**: 'We always use the framework'.

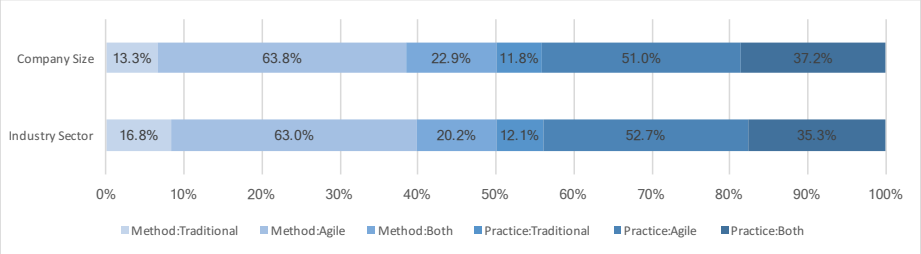

Fig. 5. Overview of the breakdown provided in Table 2 generated based on the averages.

in their practices. Interestingly, *financial services* report similar low application of 'traditional' practices, all below 10%.

We are aware that this analysis is premature and potentially misleading as only 22 respondents from Danmark are registered so far. To strengthen our analysis and to confirm the tendencies we encourage more participants from the Danish software industry to take the survey.

4 Conclusion and Final Remarks

In this short paper, we have presented and analyzed the current results of the Danish HELENA stage two survey, based on the data from August 15, 2017.

The trends seem to be in line with the entire data set as well as the results identified during the first stage of the project: traditional and agile methods and practices are combined with each other regardless of company size and industry sector. Nevertheless, some interesting differences are present in both the population and the data, which seem to indicate that Danish enterprises might favor a more agile development environment. The grounds for these differences and the extend to which methods and practices are combined will be further investigated once the survey will be closed. To this end, the Danish team will certainly attempt to promote and advertise more the HELENA survey, as attracting additional participation will be crucial to reach deeper and statistically sound insights.

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A Categorization of Methods and Practices

Variable	Categorization[7]	Description
		Methods
PU09_01	Traditional	Classic Waterfall Process
PU09_15	Traditional	Phase / Stagegate model
PU09_16	Traditional	PRINCE2
PU09_17	Traditional	Rational Unified Process
PU09_21	*Traditional**	Spiral Model
PU09_22	Traditional	Structured Systems Analysis and Design Method (SSADM)
PU09_24	Traditional	Vshaped Process (VModel)
PU09_03	Agile	DevOps
PU09_05	Agile	Dynamic Systems Development Method (DSDM)
PU09_06	Agile	eXtreme Programming (XP)
PU09_07	Agile	Feature Driven Development (FDD)
PU09_09	Agile	Kanban
PU09_10	Agile	LargeScale Scrum (LESS)
PU09_11	Agile	Lean Software Development
PU09_13	Agile	Nexus
PU09_18	Agile	Scaled Agile Framework (SAFe)
PU09_19	Agile	Scrum
PU09_20	Agile	ScrumBan
PU09_02	Both	Crystal Family
PU09_04	Both	DomainDriven Design
PU09_08	Both	Iterative Development
PU09_12	Both	ModelDriven Architecture (MDA)
PU09_14	Both	Personal Software Process
PU09_23	Both	Team Software Process
		Practices
PU10_01	Traditional	Architecture Specifications
PU10_03	Traditional	Automated Theorem Proving
PU10_16	Traditional	Detailed Designs/Design Specifications
PU10_19	Traditional	Expert/Team based estimation (e.g. Planning Poker)
PU10_20	*Traditional**	Formal estimation (e.g. COCOMO, FP)
PU10_21	Traditional	Formal Specification
PU10_24	Traditional	Model Checking
PU10_36	Traditional	Use Case Modeling (as Requirements Engineering Practice)
PU10_05	Agile	Backlog Management
PU10_06	Agile	BurnDown Charts (as Progress Monitoring Practice)
PU10_09	Agile	Collective code ownership
PU10_10	Agile	Continuous deployment
PU10_11	Agile	Continuous integration
PU10_12	Agile	Daily Standup
PU10_13	Agile	Definition of done / ready
PU10_15	*Agile**	Destructive Testing
PU10_23	Agile	Iteration/Sprint Reviews
PU10_17	Agile	Limit WorkinProgress (e.g., using Kanban board)
PU10_25	Agile	OnSite Customer
PU10_28	*Agile**	Refactoring
PU10_29	Agile	Release planning
PU10_30	Agile	Retrospectives
PU10_31	Agile	ScrumofScrums
PU10_34	Agile	User Stories (as Requirements Engineering Practice)
PU10_35	Agile	Velocitybased planning
PU10_02	Both	Automated Code Generation
PU10_04	Both	Automated Unit Testing
PU10_07	Both	Code review
PU10_08	Both	Coding standards
PU10_14	Both	Design Reviews
PU10_18	Both	EndtoEnd (System) Testing
PU10_22	Both	Iteration Planning
PU10_26	Both	Pair Programming
PU10_27	Both	Prototyping
PU10_32	Both	Security Testing
PU10_33	Both	Testdriven Development (TDD)

[7] Note that the items which categorization is marked in *italic with a * symbol* are considered particularly debatable.