Agile Software Process Improvement by Learning from Financial and Fintech Companies: LHV Bank Case Study

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Abstract. A large shift towards the use of agile software development in different industrial sectors is evident nowadays. Financial institutions are not unfamiliar with this tendency since they have the need to respond faster to the changes in their business environments. This is partly due to the new generation of financial technology (fintech) companies that have shown a significant difference in time to market and in speeding up software development. To compete with fintech companies, financial institutions are looking for improving their software development processes focusing on applying agile practices in a better way. This article presents a set of proposals to improve software development in the LHV Bank. The set of proposals has been determined through a literature review and interviews conducted in two leading financial institutions and two fintech companies. The analysis done allowed us to understand the best practices that are currently being applied, how they are implemented, and which ones are suitable to apply in LHV Bank.

Keywords: Agile Software Development · Financial institutions · Fintech companies · Software Process Improvement

1 Introduction

Large financial institutions have historically relied on waterfall-inspired methods for software development, which have delivered great value for a long time. However, these methods are no longer able to satisfy the current needs in a changing business environment. A shift from waterfall towards agile software development has taken place in the last years due to changes in the competition [3]. Estonia is not unfamiliar with this tendency [16], in particular in the context of financial technology and institutions.

The problem of many financial institutions is the need to respond faster to the changes in business environments and to have quicker product and software development processes. Financial institutions are increasingly investigating software process improvement with agile methods in order to compete with a new generation of companies, also known as financial technology (fintech) companies,

that are relying purely on agile development [14]. In particular, the main question is what financial institutions can learn from fintech companies in order to get their current process more into agile development.

Large financial institutions and fintech companies have fundamentally different ways of working. There is a significant difference in time to market and in the speed of software development. Financial institutions with longer history often have a large number of products that are based on legacy infrastructure whereas fintech companies are focusing only on a small number of niche products using up to date infrastructure. Fintech companies are competing with existing financial institutions by offering exactly the same products but using their competitive edge in reacting to customer needs and delivering new solutions faster. Compared to banks, fintech companies are focusing only on one product and they are free to develop the whole software from scratch.

In order to compete with fintech companies, financial institutions are looking for improving their software development processes by making them more agile. Like other banks, the LHV bank has already adopted some agile principles and processes. Our study aimed at making proposals for improvement that can make LHV's software development processes even more effective and efficient by fine-tuning the adoption of agile principles and practices.

To get a list of proposals for software process improvement (SPI) in the LHV bank, we carried out a review of the literature and we made interviews with two leading financial institutions and two fintech companies. The interviews with the financial institutions allowed us to understand the best practices they currently apply and how they implement them in their processes. As a result, we describe eight proposals for software process improvement in the LHV Bank.

This article is organized as follows. Section 2 shows the current software process at LHV Bank. In section 3 we describe the research design. Section 4 shows the analysis and findings obtained. Section 6 discusses the threats to validity and section 7 the conclusions and future work.

2 Context of LHV Bank

LHV[3] is an Estonian bank with 360 employees and more than 133000 clients. LHV bank recognizes itself as an innovative bank with strong investment and entrepreneurship experience. The organizational structure consist of several divisions, where the Retail Banking is the one in charge of product development. It has 5 product units, which are in charge of 24 different software products related to transactions, investments, and credits, among others. Every product has its Product Owner (PO), yet some POs have more than one product to manage.

There are 7 development teams and one R&D initiative team. Each development team is led by a Software Development Unit Manager (SDUM), who usually leads two teams. Development teams consist of 8-12 people: one Analyst, one Lead Software Engineer, 3 to 6 Software Engineers and 1 to 3 Quality

[3] LHV Bank web site - https://www.lhv.ee/en/

Assurance Engineers. In total, over 70 people are employed in the Information Technology division. The teams in share the responsibility for the development of some products. In case of products with supportive functions, they are divided among several teams.

The product development starts from the product vision created by the PO and approved by the Management Board. The PO is responsible for planning the annual product Roadmap in co-operation with SDUM, where the functionality is included in the Roadmap in terms of Epics. Since the development teams are in charge of more than one product, the POs have to agree on the priorities of Epics in the Roadmap on mutual understanding and agreement.

Every Epic in the Roadmap gets a rough size estimation for resource planning and prioritization. During the development, the time used for different tasks is precisely monitored and reported. On Monthly Planning Meetings, the ways to improve the processes are evaluated. The teams have daily meetings, in which the PO has always the possibility to participate. The Epics are divided into smaller tasks by the SDUM and the Analyst, and the teams have Weekly Backlogs for smaller tasks and bug fixes.

Overall, the setup of the teams and work processes at LHV follows the Scrum [15] method to a large extent. In addition, it has borrowed the elements from XP and Lean Software Development methods well [12]. The bank has a relatively strong visualization culture, where all teams are keeping track of the tasks using the visualization principles typically applied in Kanban [12,6].

3 Research design

We used a multi-method approach including a literature review and interviews with two leading financial institutions and two fintech companies to derive a list of proposals for software improvement in LHV Bank.

3.1 Participants

The companies for the interviews were chosen from Estonia with the aim to assemble a set of companies with different characteristics. The main criteria for choosing the companies were the following: (a) the company is large enough and well-known; (b) the company has its own in-house software development organization; (c) the decisions taken in different stages of the development processes must be done by the company itself; (d) the company is or has been lately in the fast growth stage; (e) the company has entered other markets in the Baltics, UK, Europe or World in general.

The interviews were done with the following companies: *Swedbank*[4], *Bigbank*[5], *TransferWise*[6], and *Monese*[7].

[4] Swedbank web site - https://www.swedbank.com
[5] Bigbank web site - https://www.bigbank.eu/
[6] Transferwise web site - https://transferwise.com/
[7] Monese web site - https://monese.com/

Table 1 summarizes the profile of the companies interviewed. It is worth noting that the companies that have started in the last five years, use agile practices since the beginning. On the other hand, the companies with longer history, have started to take agile practices into use more systemically just in the last 3-5 years.

Employees playing different roles and with different level of expertise were selected for the interviews. In particular, the employees who agreed to be interviewed were the CTOs, VPs of Engineering and Engineering Leads, who have worked in the companies since the beginning or at least over 10 years.

Table 1. Profile of the companies interviewed.

Company	Main Markets	Years in activity	Employees	IT Employees
Swedbank	Baltics	27	2300	500
Bigbank	Baltics, Europe	12	450	100
TransferWise	UK, Worldwide	7	1200	240
Monese	UK, Europe	3	100	30

4 Results

4.1 Findings from the literature

LF1: Agile is about the mind-set of the whole organization. This finding relates directly to the Agile Manifesto [1]. The first step in moving from waterfall to agile is to bring the customer close to the rest of the parties involved. As a consequence, the interaction between the parties is increased, and the focus shifts from checking the tasks of the developers to serving the customer and getting the right things done [9]. The second principle states that people interactions are more important than processes. Since people with different skills are working together to deliver product features, it is crucial to guarantee the collaboration as well as their enjoyment on what the team is doing [8]. The third principle is welcoming change. It is very important to react to the changes and even failures when something went wrong. The team has to learn from each iteration and integrate that learning into the next one.

In 2015, a research carried out among the financial institutions in Kosovo concluded that the success of implementing agile approaches depends on the structure of the organization and culture. The agile method is about the mind-sets of all people in the whole organization. Financial institutions that promote collaboration and a culture of cooperation are in a better standing and accept more easily the transformation from waterfall to agile. In addition, two other attributes from culture, i.e., control and competence, are needed for a successful transformation [4].

LF2: Different agile methods and practices should be combined. Early thinking in agile software development focused on detailed activities, complemented by small and self-contained teams. Over time, it has become clear that the large proportion of software development problems are caused by the poor process management in general. Agile software development is not anymore only about the work division inside a small team, but rather about managing the whole development process. The full benefits of being agile can be achieved only with engaging management and business people [7].

Scrum has helped agile software development teams to organize and become more efficient. In addition, Lean methods like Kanban are extending these benefits. It has been argued that many implementations of Scrum suffer from the same problems that traditional project management methods, and even that it is difficult to manage Scrum without Kanban. Adopting Kanban is an appropriate way to enhance Scrum [12]. In fact, the term Scrumban appears in the literature more often in the recent years, referring to the application of Kanban within a Scrum context [12]. In 2016, the Scrumban concept was efficiently implemented in a large bank in the USA. Although the bank was in agile transformation already for years, it still struggled on slow and unreliable delivery of work. The reason for that was that the bank focused on improving the individual components of the delivery process, but not the entire system [12].

LF3: Agile training enables organizations to a better implementation of the practices. The training on agile is one of the success factors for implementing agile software development [9]. Organizations that provide training to the teams are having more successful implementation of the practices than organizations that do not provide that. The training enables organizations to develop know-how and prepare better for the implementation of the methodology. As in any other project, the support and involvement of the management level improves the success of every business project. However, the larger it is, the more complex it becomes to manage the agile software development [9].

In 2014, the Scandinavian bank Nordea decided to renew their digital banking platform and use agile development methodology to achieve that. As the organization and project were large enough, Nordea decided to use SAFe framework for that purpose. In total, 80 people were trained and the Agile Release Train formed of them consisting of five Agile Teams of development. The bank itself has concluded that proper training was vitally important to start with the project in the right way. The bank stated that the delivery system improved significantly [11].

LF4: Following agile principles in full brings the success in SPI. During 2004-2007, a financial institution KeyCorp made the transition from waterfall to agile software development. One of the main changes was that project managers were turning into Scrum Masters, where development team started to see he/she as another team member [17]. In 2009, the Australian financial institution Suncorp implemented a major system replacement using agile iterative method. One of the main lessons learned was that although unstable and

changing requirements are one of the key benefits of agile, it cannot be seen as a way to increase the scope of the project without impacting on time, quality and budget. [2]. In 2010, a Danish bank Jyske Bank experienced a problem the planning. The developers felt that preparing planning was like falling back into waterfall approach and they were tagged as old-fashioned [18].

Agile methods do not pay enough attention to agile testing. But the reality is that testing is a crucial part in the whole software development process. It is important to start testing as early as possible and the testing should be run very frequently, even before every source code integration and definitely before every release. Automated tests with relevant tools make more sense as these use less resources and time that is critical in the agile development. To avoid the problems that weak communication between developers and testers may rise, they both should work in the same open space area. Full integration of developers and testers is a productive choice. In agile development, the test plan cannot be fixed. It is important to modify the test plan adequately to the changes in requirements and problems appearing in development [5].

4.2 Findings from the interviews

IF1. A modular system architecture and microservices are prerequisites for applying agile practices. The system architecture was pointed out by each company as the main success factor for applying agile practices. If the system architecture is monolitic and a large part of the system is built as a single system, applying agile practices is a difficult task. Therefore, the companies pay special attention to a system architecture where the system is composed of smaller modules, where microservices are used as the main software development technique. Although all of the companies said that their new systems are built up using microservices, three of them admitted that they are still having also a monolitic legacy platform. Two of them are in the process of completely changing or splitting up the legacy code into smaller parts.

IF2. Common objectives of team members are important for managing the team. The interviews showed that common objectives of team members are of utmost important. The teams should be fully responsible for their product, both from the business and development perspectives. In a typical setup of a fintech company, the products or features are divided into teams that share common customer support and operations divisions. Such setup allows the teams to set their own business objectives, including not only the development of the product but also the sales targets.

As for setting the objectives and measuring the outcomes, one company uses the Objectives and Key Results (OKR) management tool[8]. The OKR framework [10] allows companies to define targets at different levels such as company, team and personal levels with the aim to increase the visibility of goals inside the organization. The use of a management tool to set the objectives of the teams

[8] OKR product site - https://weekdone.com/resources/objectives-key-results

also serves to measure the team results. However, the focus should not be longer whether the individual developer's productivity is sufficient but instead whether the team is producing the right product and achieves its business goals. In fintech companies, all team members are measured by reaching the same business objectives. That is a crucial factor to amalgam individual team members into a single team that is working under the banner of the same objective.

IF3. Cross-functional can cover the full development cycle of a product. All companies said that they are using the Scrum framework with modifications according to their individual needs. Teams consist of a Product Owner, 4-8 Developers/Quality Analysts and 1-3 other positions that are necessary for the development of specific products. This way, companies establish cross-functional teams, i.e., teams that have all skills to develop a product.

The larger and more mature companies have also a Scrum Master position, sometimes named Project Manager or Product Engineering Manager. Smaller companies do not have a separate Scrum Master position and instead transfer that role's tasks to the Product Owner or Lead Developer. The practices used for software development are tailored according to the level of experience of the team. Mature teams follow the practices proposed by Scrum whereas less experienced teams are allowed to use just Kanban. However, most of the companies admitted that they are also using elements from Kanban on company level or in Scrum teams. This is done in order to track and visualize the current tasks in process and to manage the work in progress.

IF4: A 'Responsiveness to changes' culture is a key element. All the companies repeatedly pointed out that the agile development process should take into account the changes happening in the process of developing a product. For this reason, they use the concept of minimum viable product (MVP). A MVP is a product that has only the most important features that solves the problem for the customer. A MVP gives early feedback about the product directly from the customer and is a valuable input to developing the product further. If the MVP satisfies the customer, it can be developed further; otherwise, the product can be changed quickly [13]. From most of the interviews, it came out that as financial services are regulated more than any other service. For this reason, the MVP is organized in stages. In the first stage (Alpha), the MVP is usually given into use internally to a limited or the whole staff of the company. Just after that, the MVP in the second stage (Beta) is given into use to the limited or whole final customers. If the MVP survives the Beta stage, it can be launched as a new product for customers.

It is important to build up a culture of 'Responsiveness to change'. All companies interviewed brought out that the key factor here is the constant exchange of information. The companies often have quarterly or monthly meetings, where the management is giving the business overview and directions and the teams are giving the overview of their activities or products features under development. The culture of closing the products or cleaning the product backlogs is strongly supported in the companies.

IF5: Automated testing accelerates the agile development process. The companies put much attention on how to reduce the time and resources spent on quality assurance of the code. In fintech companies, the developer and quality assurance positions are merged and the companies rely on the tests that have been done by the developers. On the other hand, the larger financial institutions have a separate quality assurance position to fulfill the regulatory requirement of reviewing the code based on the four-eyes principle.

In any case, all the companies stressed the importance of having automated testing process in place. Regression testing was mentioned as the most common software testing technique used. In one company, also Test Driven Development (TDD) as a practice from XP is used.

IF6: Autonomous release processes give independence to teams. All of the companies raised the issue of having an autonomous release process. This process gives independence to teams since they can launch the new products or features when they decide. The previous release process became the bottle neck for teams and the companies have just recently taken into use independent release processes to fasten the launch of the development done. For that, the companies have built their own solutions or bought ready-made orchestration software from the market.

Autonomous release processes give teams the full authority to develop and launch new products or features. As a consequence, the whole process becomes faster because the team does not depend on other resources. In case of bug fixing, the team can fix the reported bugs independently. The teams can decide whether the new feature is made available to all or part of the customers.

5 Proposals

After analyzing the literature and the key findings from the interviews, we generated a list of proposals that might help improve the current software processes at LHV Bank. The following proposals have been prioritized according to their potential of being implemented immediately and not having to wait for a long-term, comprehensive initiative.

P1: Introduce agile management culture organization-wide. Based on LF1 and interviews in general, it can be concluded that being agile is not just about software development but about the mind-set of the whole organization. In small companies, it really covers everyone from the management to the customer support. In larger financial institutions, it is about the management, product management and IT. It can be even said that agile methods are becoming the new management style and culture of the new generation financial institutions.

What originally started from technology-driven companies can also be applied to other types of companies, including financial institutions. Also in financial institutions software technology is playing a larger and larger role every year. All signs indicate that it is time to change the management principles in financial

institutions. Instead of rigid silos of business and IT, an organization-wide agile culture that is joining teams should be considered.

In LHV Bank, agile methods and management culture should be introduced to the management on a broader scale. It might be a larger cultural change, but it is worthwhile to try a more decentralized and less controlling management style in general. Since financial institutions usually develop in-house software and not outsourced, they are becoming more like technology companies with high focus on product and software development. Therefore, it is important that financial institutions at all management levels have a good understanding about the agile methods and practices.

P2: Organize relevant trainings. Based on LF3, it is important to have a proper training methodology for the whole organization to increase the knowledge of how to implement more and better agile practices in financial institution. In LHV Bank, when introducing the agile principles, the relevant trainings should be organized and building up the knowledge base should be taken seriously. Learning from other practitioners from the financial sector would add extra value in the learning cycle. The training should take into account the differences of financial institutions as much as possible.

P3: Assemble concrete teams for products. Based on IF3, the agile organization in the financial institutions has to be structured along cross-functional teams. The teams, as smaller units, are responsible for their own product and process from the very beginning until the very end. This is the key to increase development speed.

In LHV Bank, there whole organization structure should be revised with the aim of building more cross-functional consisting of POs and developers with various skills. To avoid conflicts abouts which product gets the highest priority in development teams in charge of 3 to 4 products, the number of products should be reduced by consolidation, as well as the number of business divisions.

P4: Set common business objectives for team members. Based on IF2, it is critical to have a set of common objectives for team members. In the LHV Bank, common objectives can be set for each team. In financial institutions, it is even easier to do this as the whole organization is already having a high level of financial literacy. Usually, financial institutions are project oriented in developing their business. Such culture helps to set and follow the objectives of the teams more easily.

The objectives have to be both quantifiable and qualitative. At least basic business objectives should be set for each team member. For example, if the bank is planning to release a new credit product, the team should set the objective of launching it by the given deadline as well as selling a given number if credits with the help from Marketing and Customer Support. Such objectives will make the whole team more interested in the actual viability of the new product and react quickly to changes, if something needs to be improved for the customer.

P5: Give more autonomy to the teams. Based on IF4, being responsive to changes is a key element in the agile development of financial institutions. In addition to having objectives, the teams should also have the power and autonomy to work towards achieving these objectives.

In LHV Bank, more autonomy should be given to teams by increasing their decision power over their products. Although the financial budget of the team is limited as the number of team members is fixed, the power should be given over the decisions. For example, by letting the team decide what kind of product features to develop, in which order, and at what time the features have to be developed. Giving more autonomy to the teams will ensure that the whole development is moving to the direction of continuous delivery. The autonomy should be given not only to the PO but also to the SDUM. The people playing these roles have to feel that they are working for achieving the common objectives and they have the power and resources to do that. This way, these roles will encourage people to start a new product as a MVP and test it on the real customers, rather than developing anything new.

P6: Review the elements of the agile development method used. Based on LF2 and LF4, each financial institution should find its own way to agile development. Following a specific method might not suit a specific organization. Combining elements of different agile methods will give the best result for a financial institution. However, to support the changes in the process, the organization has to be open minded. Based on IF5, it is important to have as much automated testing as possible to reduce the time spent on manual testing for each change on the software.

In LHV Bank, practices from Scrum, XP, Lean Software Development and Kanban are currently used. However, the whole development process should be reviewed by learning from not only the latest best practices of other financial institutions but also the organizational experience. Including practices such as refactoring and regression testing is essential to decrease the time on testing and to increase the reliability of the systems. At the same time, financial institutions have to guarantee that the code is reviewed based on the four-eye principle. This issue can be solved by applying peer review practices.

P7: Automate the release process. Based on IF6, autonomous release process gives the independence to the teams in financial institutions. It is one the factors of speeding up the development by making the releasing phase shorter since the team is able to react to the bugs faster. In LHV Bank, the releasing process needs to be improved. The current process requires much manual work and involves people from different departments. The whole release process should be redesigned and a suitable information systems taken into use for that. Although the priority of automating the release process is not high in this list, it can actually be done as one of the first things in parallel with the previous proposals.

P8: Use more modular system architecture and microservices. Based on the IF5, the agile practices can be applied in the best way if the financial institution have a modular system architecture. The trend to address modular architectures is using microservices. In LHV Bank, the first core system of the bank accounts was developed already 20 years ago and it has remained the basis for most of the main banking services. Although the new modules of the system have already been built separately, these are still relatively large and do not enable different teams to work on the same component at the same time. Therefore, it is important that in the future, the banks infrastructure will move towards smaller components and microservices. That will increase the speed in the development of the components.

6 Threats to validity

There are several threats to validity in this study that we aimed to mitigate. *Construct Validity.* Our proposals are based on both a literature review and interviews. The questions discussed in the interviews might have been understood differently by the interviewees. To mitigate this threat, we let a person not involved in the study review the questions.

Internal Validity. The study might give a subjective overview of the product development, IT development and delivery processes of the LHV Bank. This is partly due to the fact that the LHV Bank is a highly regulated institution and for security reasons does not allow to disclose descriptions of all their information systems in a very detailed level.

External Validity. The findings from the interviews were based only on four companies. Although the companies interviewed have different sizes and different levels of maturity, all of them have Estonian roots and their main development is done in Estonia. It might be possible that the companies in other countries or regions worldwide implement different agile practices.

7 Conclusions and Future Work

We present a set of proposals for software process improvement using agile methods for the LHV Bank case. We sketched the currently used software processes at the LHV Bank and pointed out the main improvement areas through a set of proposals. The proposals were based on a literature review and interviews conducted.

Although agile methods and practices have already been used in the software development of the LHV Bank for several years, the proposals listed might allow the organization to implement agile practices in a more powerful way and also across the whole organization. Being agile is relevant not only for managing the software development but also for managing the whole organization.

Once we have established a list of proposed changes, future work will be to implement the proposed changes at the LHV Bank. The implementation plan of proposed changes will be drawn, the resources committed and the execution

done. Following the implementation, we plan to evaluate the effects in order to determine whether the improvements were indeed successful.

Acknowledgements. This research was supported by the institutional research grant IUT20-55 of the Estonian Research Council.

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