Qualitative Analysis of Mobile Application Development in the Financial Industry: Status Quo and Future Development

Masterarbeit

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CONTENT

1. Introduction

"You`ve got to start with the customer experience and work back toward the technology – not the other way around." [1] *– Steve Jobs, CEO von Apple*

Back in 1997, Steve Jobs, Chief Executive Officer[2] of Apple, stated aptly that in the era of digitalisation the potentials of existing technologies should be used to meet customers' needs and expectations. This approach should be based on examining customers' needs first and then aligning the technology accordingly (cf. Petry, 2019, p. 76f.). This can be confirmed by the worldwide success story of personal digital assistants (PDA) (cf. Vollmer, 2017, p. 274). In 2007, with the introduction of the iPhone, the popularity of mobile applications (app) gained rapidly in society (cf. Jabangwe et al., 2018, p. 99). With the increase in mobile devices, the range of mobile apps available in the App Stores has also multiplied significantly over time. By 2020, the number of available apps in the top App Stores such as Google Play Store has led to almost 2.56 million apps and in Apple App Store to almost 1.85 million apps worldwide (cf. Statista, 2020b). However, among the most popular app categories in America in 2020, mobile financial apps just rank 11th with almost 107 thousand available apps in the App Store compared to business apps with 444 thousand available apps (cf. Statista, 2020a). Also, the increase in smartphones is estimated to be around 69 million users in Germany by 2023 (cf. Statista, 2020c). This indicates a high growth potential for banks offering mobile financial apps on mobile devices. Furthermore, a Bitkom study shows that compared to the past an increasing number of bank accounts are opened online rather than in a bank branch. Additionally, the population's understanding of online payment procedures increases and a trend towards mobile banking can be observed. Whereas in 2015 only 34% of the population carried out mobile banking via smartphone, by 2019 this number has already increased up to 52% (cf. Bitkom, 2019a, p. 9ff.). Also, two thirds of the German population (65%) state that they use an app for mobile banking and 12% of the younger banking app users even use a payable app (cf. Bitkom, 2019b). It can be recognised that the development of mobile financial apps in the software sector has grown into an extremely exciting and new topic.

The widespread use of the smartphone makes it possible to generate new business models and offer mobile services (cf. Vollmer, 2017, p. 3, 273f.; Zeidler et al., 2008, p. 345). But besides new opportunities offered by the digital age for financial institutions, e.g. a completely new access to target groups, more and more FinTechs have entered the market with a strong *digital only* strategy (cf. Bitkom, 2019a). As a result, users get used to the convenient solutions and force companies to offer mobile apps (cf. Forbes, 2020). Consequently, within in a truly short time, new apps have to be brought to market and new releases have to be completed trying to gain a competitive advantage and keep customers loyalty (cf. Jabangwe et al., 2018, p. 88). Users also expect a high-quality user interface (UI) and user experience (UX) since mobile apps are well established in the market. Furthermore, the strong fragmentation of both hardware components by various mobile devices and software components such as various operating systems (OS) leads to constantly changing challenges (cf. Vollmer, 2017, p. 273f.). Therefore, financial institutes are called upon to focus on offering mobile financial apps. As these small apps can only offer few functionalities, they have to be more customer centric as users particularly focus on service benefits (cf. Krah, 2017; Leichsenring, 2016). Since more and more companies want to integrate mobile apps into their business cycle, it leads to an increased need for a specialised software development process (cf. Nosseir et al., 2012, p. 281). Accordingly, a new mobile app engineering approach seems to be an appropriate solution as the development of software apps for desktop computer

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[1] Petry, 2019, p. 76.
[2] Gender: In order to simplify the readability of the text, the language form of the generic masculine is used in this paper. At this point it is expressly mentioned that this form of the word is to be understood independently of gender.

differs significantly from mobile app (cf. Schekelmann, 2016, p. 107; Vollmer, 2017, p. 273f.). Nevertheless, mobile apps are an object-oriented software development whereby object-oriented paradigms such as the software development process model for classical, object-oriented desktop apps can be applied to provide a suitable framework for structuring and implementing development processes (cf. Schekelmann, 2016, p. 96f.; Vollmer, 2017, p. 2ff.). But since mobile apps are a special field of software engineering, different aspects regarding the software life cycle (SLC) and other characteristic features need to be considered (cf. El-Kassas et al., 2017, p. 166). Here it is important that the processes of software engineering for Personal Computer (PC) based apps are tailored to the processes for the development of mobile apps (cf. Jabangwe et al., 2018, p. 88). Especially in information technology (IT) projects, process models are used for planning, implementation and control as they offer different tools and systematically predefined phases for implementation (cf. Wieczorrek & Mertens, 2011, p. 66). There are different approaches to develop software that aim to smoothly implement the project requirements during software development (cf. Kirmani, 2017, p. 587). Both plan-driven and agile methods of proceeding are adapted frequently in practice by developers and scientists as they support the development process through their long existence and best practice approaches (cf. Werth et al., 2019, p. 3). According to a PWC study, the trend in agile development will also continue in the coming years (cf. Pwc, 2019, p. 20ff.). Therefore, banks are called upon to implement their software development process using an agile method. It is evident that this subject has recently gained much attention.

In the literature there are many papers about the software development process and various process models, but a literature survey shows that there is a lack of a mobile financial app development process. Jabangwe et al. (2018) also note a small number of science-based publications on mobile app development processes. Either they assume that general software development processes today barely differ from mobile app development processes or that there is a general lack of interest in this field of research (cf. Jabangwe et al., 2018, p. 98ff.). As mobile app development is still a relatively young field of research, and knowledge as well as experience values do not appear to be mature enough to draw universally valid conclusions (cf. Vollmer, 2017, p. xf.), there seems to be a need to generate a process model based on high quality, practical findings for the financial sector. The previous argumentation leads to the following two general research question (RQ) of this thesis:

RQ 1: "Which process models are used in practice for the development of mobile applications in the financial sector?"

RQ 2: "How can the development of mobile apps be further improved?"

To answer these questions, this work is aimed to contribute a substantial part to close this research gap by gathering practical experience and knowledge of experts on this topic and trying to generate a design sketch of a prospective process model for mobile app development in the financial sector. Hence, it is essential to gain a deeper understanding of process models in mobile app development. In this context, this work will also consider the following aspects: Economic aspects of developing mobile apps in the financial sector as well as challenges that can arise during an agile transformation of a financial company. Therefore, it is essential to observe two different fields of research. On the one hand, this paper uses a theoretical view while screening the existing literature for developing mobile apps. On the other hand, a qualitative approach is conducted while using the Grounded Theory Methodology (GTM) to observe expert expertise to discuss classical and agile development process models with current literature.

In order to provide a general structure to this work, it is organised as follows: This work is divided into seven chapters. After the motivation has been given and the problem has been introduced in chapter one,

chapter two establishes the theoretical basis. The foundation part is divided into three sections. In the first part central terms are defined which represent the basics of mobile apps and mobile devices. In the second part the concepts of software engineering and the software development process are introduced. Based on this section, the third part classifies different process models. Since a distinction is made between agile and classical methods in software development, different process models are distinguished on the basis of different process flows (sequential, iterative, parallel). After the theoretical foundation has been given, chapter three introduces the research methodology which includes planning, implementation and evaluation of the expert interviews to gain new insights. The selection of the method is based on a qualitative analysis according to the GTM. In the qualitative analysis in chapter four, the data is evaluated and then discussed in chapter five. The results of the qualitative analysis will be compared with the theoretical findings, as they have an influence on the qualitative analysis and the development of a design sketch for a suitable process model in mobile financial app development. Subsequently, limits and future research are defined in chapter six. A conclusion and outlook in chapter seven finish this work. The following chapter examined the conceptual framework of this work.

2. Theoretical Foundations

The theoretical framework of this work is mainly based on literature dealing with mobile apps and software development process in software engineering. While attempting to create a specific process model for the development of mobile apps in the financial sector, it is important to consider particularities and restrictions in the area of mobile apps. In this chapter, these specifics are examined, and specific characteristics of mobile apps defined. Moreover, this chapter covers domains of software engineering, as this can be transferred to mobile app development. Therefore, different agile and classical process models in different sequential, iterative and parallel process flows are explained and illustrated to give an overview of potential kinds of process models. The primary papers of this work include software development models that recommend, evaluate and validate a series of software development steps. To achieve a uniform understanding of mobile app development, the following section defines foundations of mobile devices and characteristics of mobile apps.

2.1 Foundations of Mobile Devices and Mobile Applications

According to the literature, different approaches can be distinguished within the software app domains (cf. Pressmann & Maxim, 2015, p. 6f.). This paper especially deals with network-centric mobile app development which is common to mobile devices. But how to exactly describe a mobile device? Various characteristics distinguish the special features of a mobile device. The characteristics of mobile apps are subdivided into the dimensions of portability, simplicity, quickness and ubiquitous usability. This means a mobile device can be taken everywhere and is easy to use. Mobile devices are also referred to a "personal accessory" (Aichele & Schönberger, 2014, p. 97) of a user. It reflects the personality of the user as all settings and apps on the mobile device are adapted to the user's personal needs. Furthermore, a mobile device has a network connection so that a connection to the internet can be achieved if desired (cf. Firtman, 2010, p. 4f). It thrives through the diversity of innovation and is characterised by a wide range of products on the current market (cf. Aichele & Schönberger, 2014, p. 93). The author Siebler-Guth (2019) emphasises three essential attributes in his work that distinguish a mobile device: "Localizability, accessibility and independence of location" (Siebler-Guth, 2019, p. 17). This work is limited to the definition of Maske (2012) in which mobile devices are defined as follows:

> "Mobile devices generally include mobile phones, smartphones and PDAs. [...] Notebooks and sub-
> notebooks and similar devices are becoming more compact and can therefore be easily transported from one

interviews if there is an opportunity to acquire experts. Unfortunately, no expert from these banks was available for an interview in this research work. Also, the topic of scalability could only be treated marginally here. According to the literature and expert statements more research is needed. Future research could be interesting to explore in other process combinations as RUP and Scrum or FDD and Scrum. It should also be examined whether parallel testing of both sides (customer and contractor) occurs more frequently in practice. Furthermore, the quality of the experts' statements and the suggested process model should be further evaluated by applying it in practice under controlled conditions. In the following conclusion, the findings of the analysis are used to answer the research question posed in the introduction.

7. Conclusion and Outlook

The aim of this thesis was to identify which process models are used in practice for the development of mobile apps in the financial sector and how the development of mobile apps can be further improved. For this purpose, the GTM was used to gain insights into a computer science topic using methods of social research. The expert interviews provided a deep insight into the development of mobile apps and future trends, especially in the financial sector. As expected from the previous literature research, phase-oriented (sequential) process models are used in the implementation of regulatory requirements. Especially in the financial sector these are very distinctive as regulators, as the BaFin has high documentation requirements.

The interviews showed that eleven out of twelve experts demonstrated that agile (iterative) process models are used in the technical development of mobile financial apps. Among these, Scrum in particular is one of the best known and most frequently used process models of the recent past. The interviews clarified that in practice, theoretically no process model is used in its pure form. On the one hand, the roles in Scrum are adapted so that additional roles are added, e.g. a Lead PO. On the other hand, the strict documentation requirements of WM are softened in order to be able to combine both process models. The role of the Lead PO is to support the Scrum team and to solve the communication problem between the model interfaces. The Lead PO acts as professional and/or technical project manager. This role is used to coordinate and improve communication between the customer and Scrum team when several development teams work together on a mobile app development. If necessary, he also has the authority to escalate. If the two boundaries of the models become blurred, a transition guide could be used to help anchor mutual requirements. Most important is an intensive communication about what the iterative approach of Scrum offers compared to the management approach of WM. Communication is therefore the main goal of a successful cooperation. At the same time, it is also the greatest challenge when combining both models since both approaches (MVP approach vs. management approach) pursue different goals. Furthermore, the understanding of agility in mobile app development is quite different at both management and IT level. According to this, a uniform way of thinking is necessary throughout the entire organisation which is associated with an intensive learning process for each individual. Especially the retrospective in Scrum is an essential part of the development process, the experts emphasise. This enables employees to reflect on themselves and to further develop their skills and abilities. The result is a continuous improvement process that leads to increased results and efficiency improvements in the entire development process. Nevertheless, a model only works as well as the people who work with it. This approach also shows its strengths here: The development of hybrid mobile apps can be implemented into existing processes in small steps. Therefore, it is recommended to choose the best process model which fits for your team and the project.

Conclusion and Outlook

Based on this knowledge and practical experience of mobile app developers as well as on well-founded scientific methodological results, this thesis presents a new development process of mobile financial apps. The results of the analysis show that the process model level is not influenced in mobile app development, but that individual phases such as testing of mobile financial apps are intensified compared to PC-based app development. Therefore, the development of mobile financial apps increasingly involves multiple and explorative tests such as A/B testing, crowd testing, family & friend phases, and a mobile device cloud to meet the diversity of mobile devices, network operators and OS specific requirements of iOS and Android. In addition to the technical obstacles, the constantly changing customer requirements pose a major challenge in the development of these apps. Hence, the customers are regularly involved in the conception phase in advance. In addition, user feedback from the tests is actively integrated into the development process to offer a user-centric app to the market and to achieve a positive UX. Since the desire for simplicity is diametrically opposed to extensive regulatory, security and economic requirements in the financial sector, it should be clear to all of those involved in the development process that compromises must be made with regard to the customer optimum. Thus, the selection of a suitable development paradigm plays a secondary role, as it is the business objectives that determine which goals are pursued with a mobile financial app. The goal should be to balance the trade-off between the business case and customer needs. According to experts, a future trend in this area will be PWA, as they combine the advantages of web app development with those of native app development in terms of the look and feel by integrating hardware resources. Another advantage is that PWA works offline, although they are developed browser based. There will also be a strong trend towards Augmented Reality and Virtuality Reality supported by speech systems like Alexa or Siri. From a technological point of view this is already possible, but the required approvals and user acceptance are still missing. A long-term goal in the development of mobile financial apps should be the creation of an app ecosystem. Traditional banks should enter into cooperation with FinTechs or young start-ups and integrate for instance video consulting or other innovative solutions from FinTechs into their own financial apps. Furthermore, omni-channel solutions can assist well-established banks not to be replaced by fast growing and innovative competitors. Banks can integrate their basic banking apps into fast growing platforms from BigTechs such as Amazon, Google, Facebook, etc. to grow with these platforms.

Consequently, this work expands knowledge in previous theoretical research into a new research area. In this respect, this work follows a future research direction based on the findings of Werth et al. (2019) and Jabangwe et al. (2018). This paper is subject to certain limitations as outlined in chapter six. Future research should be conducted to support the results of the qualitative analysis from the expert interviews. For this purpose, it is recommended that further interviews with different roles in different app- and software development companies be conducted. This work could not elaborate the interface problem of the model combinations in more detail. Therefore, the research gap should be examined regarding the interface problems between model combinations and the focus on the role problem should be increased in future research. Additionally, quantitative analyses and cross-national studies are also recommended. The process model proposed in this thesis should be applied and improved in practice in the financial sector.

In summary, it can be concluded that process models are better adapted to the needs of a business context and that the problem does not lie in applying a process model, but in finding the problem first. It is not helpful to use a process model that does not meet the needs of the companies and does not solve the actual problem. Consequently, the challenges arise from the constantly changing situation caused by the agile environment. Old systems, such as the core banking system of a bank, cannot simply be restructured so that an agile model can be applied. Nor should the creativity of agile methods be lost by forcing an agile approach into a rigid, plan-oriented model. Therefore, the potential for improvement in the modification of agile methods should be to adapt evolutionary organisational approaches by

incorporating a proactive agile mindset that encompasses values, principles and practices, and role definitions. Therefore, the management level in particular is requested to transfer decision-making powers to a Scrum team in order to react more agile to changes. Also, agile values such as *inspect and adapt* should be applied increasingly in the development process to avoid waste. Against the background of the insights gained in the interviews, it seems reasonable to use a combination of WM and Scrum in the financial sector as a so-called hybrid process model. This combination of a plan-driven, responsible and accountable WM and agile model like Scrum with its adaptable and fast criteria are perfect process models to ensure high flexibility as well as high security standards. At the end of the analysis, the values of the manifesto for agile software development are reflected in the findings of the expert interviews: "Responding to change over following a plan" (Beck et al., 2001, p. 1).