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Designing Tablet Banking Apps for High-Net-Worth Individuals: *Specifying Customer Requirements with Prototyping*

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Abstract

Private banks with high-net-worth customers see a great potential in mobile information technology to provide more transparency in the advisory process. Previous literature has mainly focused on gathering requirements with regard to mobile banking applications targeted for retail customers or with regard to advisory services in physical proximity. This paper focuses on an mFAS which is designed for the private banking customer segment and facilitates location-independent customer relationships on a tablet. Furthermore, we specify previously established requirements with the Requirements Abstraction Model. In this study, we evaluated the requirements with a focus group involving seven domain experts. The results of this workshop suggest that most of the specified requirements meet the recommended practice for requirements specification. However, the experts only partly agreed that the presented requirements meet the completeness criterion, which guides future research endeavors.

Keywords: Requirements Engineering, Tablet Banking, Mobile App, Prototyping

1 Introduction

In Switzerland, 12.7% or 435,000 of households possess wealth exceeding CHF 1 million. During the recent financial crisis many such high-net-worth individuals (HNWI) lost faith in financial institutions and in their relationship managers (RM) (Gemes, Ammann, & Lenzhofer, 2010). Consequently, HNWIs are demanding more transparency and simplicity (Oehler & Kohlert, 2009). Financial institutions are taking various countermeasures in order to address these customers' concerns. Both practitioners (KPMG, 2013; PwC, 2013) and researchers (Inbar Noam, 2012; Nussbaumer, Matter, & Schwabe, 2012) believe that information technology (IT) is one of the measures that may facilitate more transparent financial advisory services. Consequently, introducing a mobile application (app) in financial advisory services might be a first step in this direction. However, in order to develop such mobile apps, recent articles have primarily focused on gathering the requirements of retail customers (Yousafzai, Pallister, & Foxall, 2003), or on advisory processes in physical proximity (Nussbaumer et al., 2012). This paper focuses on mobile apps in location-independent situations addressing the needs of the HNWI segment. In order to develop successful mobile apps, or software artifacts in general (Aurum & Wohlin, 2005), the literature acknowledges that the requirements engineering (RE) process, which involves the elicitation and management of requirements for designing software, is a prerequisite (Vijayasarathy & Turk, 2008). Accordingly, successful endeavors allocate a significantly higher amount (28 percent) of resources to RE (Hofmann & Lehner, 2001). The Requirements Abstraction Model (RAM) from (Gorschek & Wohlin, 2006) introduces an integrated approach for specifying customer requirements (CR) which should address these challenges in RE.

Thus, the goal of this paper is twofold and incorporates both theoretical as well as practical contributions. First, we specify CR for a mobile app targeted for private banking customer segments with the RAM. Second, by developing a prototype according to the specified requirements, we pursue an iterative evaluation and present the findings in three focus groups. The final focus group, involving seven experts, validates whether the requirements meet the IEEE recommended practice for requirements specification (IEEE, 1998). The following research question illustrates our goal: *What are specified customer requirements (CR) for a mobile app that meet the quality criteria of the recommended practice for requirements specification?*

We structure the remainder of this paper as follows: First, we elaborate how mobile apps facilitate financial advisory services in Section 2. Furthermore, we also discuss a theoretical foundation regarding RE and previously elicited requirements with regard to a mobile app for HNWI. Second, following the theoretical discussion in Sections 2, we introduce the research design, chosen design science research (DSR) approach, and the method in Section 3. Third, we present the results of our iterative evaluation with 3 focus groups in Section 4 and subsequently discuss the findings in Section 5. Finally, Section 6 provides limitations, conclusions and outlook for future studies.

2 Related Work

2.1 Mobile Financial Advisory Service (mFAS)

When speaking of mobile financial advisory services (mFAS), we refer to the interactions between relationship managers (RM) and high-net-worth individuals (HNWI) who possess investable assets exceeding \$1 million. According to the ISO standard (ISO, 2011) a financial advisory service consists of various process steps. In this study, we specifically focus on the monitoring and reviewing of the financial plan. Within these process steps, considering the recent technological advances, mobile applications (apps) provide viable alternatives to email or phone calls, e.g. access to RMs or personal financial information on the tablet from anywhere at any time. Despite the acknowledged relevance of such an mFAS for the HNWI segment (KPMG, 2013; PwC, 2013), the literature so far has only captured requirements for the retail banking customer segment (Yousafzai et al., 2003) or for advisory services in physical proximity (Nussbaumer, Matter, & Schwabe, 2012). Hence, this study aims at addressing this gap and specifies requirements for an mFAS for HNWI specifically.

2.2 Requirements Specification with the Requirements Abstraction Model (RAM) and with Prototyping

Requirements engineering (RE) captures complete and correct needs of various stakeholders and consequently to facilitate documentation of these needs (Byrd, Cossick, & Zmud, 1992). In order to develop mobile apps successfully, the RE poses a critical prerequisite. Hence, failing to apply a comprehensive RE may lead to project failures or costly change requests later throughout the project execution phase (Pohl, 2008). In order to manage successful RE, Gorschek and Wohlin (2006) introduced the Requirements Abstraction Model (RAM), an approach for specifying requirements. However, despite preliminary evaluations, they propose that researchers and practitioners should further instantiate and validate the usefulness of the proposed RAM (Gorschek et al., 2007). We aim at specifying customer requirements with the RAM on the Feature Level to the Function Level and consequently provide a theoretical contribution. This model contains 4 Abstraction Levels (Gorschek & Wohlin, 2006).

Goal Level. The Goal Level consists of general requirements which refer to the value creation process of an organization meeting the demand of customers. Due to the generic characteristic it is questionable whether the Goal Level actually composes actual requirements, but rather general guidelines.

Feature Level. The Feature Level consists of general characteristics. Such characteristics include technical functionality and behavior, tangible or intangible outcomes, design elements of the process and resources requirements of the service provider.

Function Level. Functions refer to specific characteristics. Compared to the Feature Level, such characteristics should be more specific and precise.

Component Level. This level relates to information how the developers should actually implement the requirements from the Function Level. In this study, we did not specify the requirements on this level, as we did not implement our artifact in a real-life context. The scope of this study is to specify requirements on the first four levels of the RAM.

2.3 Customer Requirements (CR) for Mobile Financial Advisory Service (mFAS)

A previous study (Ruf, Back, Bergmann, & Schlegel, 2014) elicited and prioritized customer requirements (CR) on the Feature Level for an mFAS. A multi-method approach was followed, including a literature review, expert interviews and focus groups. Overall, the stakeholders included in the study were the following: Project Sponsor, Senior Consultant, Social Media Manager, Investment Advisor, Relationship Manager, HNW customer, Independent Investment Advisor, and Director. Based on the feedback from the practitioners, as well as the desk research, the following requirements were identified.

(CR1) Access to experts. As a Feature Level requirement, customers should not only be able to contact personal RMs, but also financial experts and investment advisory teams. The mFAS, therefore, should provide such a network in the mobile app.

(CR2) Information quality. Regarding information quality, the previous findings suggest that customers are already well-informed and demand aggregated and personalized information. Furthermore, the information provided on the platform should be timely and available at the fingertips.

(CR3) Proactivity. As a next requirement, customers expect RMs to inform them proactively about new financial trends and topics, as well as events which are relevant for them. Hence, the mFAS should facilitate this information exchange between customers and RMs in a proactive way.

(CR4) Situational use and social presence. Furthermore, mFAS should enable a more effective and personalized communication for international customer relationships. The findings suggest that both practitioners and researchers believe that mFAS might be especially beneficial in such customer relationships. Furthermore, the findings also identified some challenges: Slow performance of the mobile network might lead to quality problems when using social presence features, such as desktop sharing and co-browsing, and might consequently lead to poor customer experience. Clearly, such challenges need to be addressed when developing mFAS.

(CR5) Transparency. With regard to transparency, researchers have previously elicited the requirement for documenting the information exchange between customers and RMs. According to this requirement, customers need to be able to access previous calls or product recommendations and assess whether these suggestions have actually improved the financial performance. Furthermore, if RMs initiate such recommendations, the way in which they meet

the pre-defined investment strategy needs to be transparent, and lie within the risk tolerance of customers.

(CR6) Privacy. Banks and RMs are both eager to gain more insights into customer behaviors by analyzing data such as recent transactions. However, previous studies have highlighted that customers need to be in control of the kind of data the banks and RMs collect and analyze. Hence, customers should be able to control and configure such data collection and analysis practices in the mobile app.

In the subsequent section, the way in which the requirements specification process of these six CR (CR1-6) was pursued is discussed in detail.

3 Research Design

In Section 3.1 the research endeavor is highlighted and the design science research (DSR) method from Peffers et al. (2007) is described. Section 3.2 provides details on the development and evaluation cycles of the prototype.

3.1 Design Science Research (DSR)

Activity 1: Identification of the problem and motivation (DONE). The motivation for the topic is provided in the introduction (Section 1) of this paper. Providing mFAS will become crucial in order to provide customers with a transparent advisory process and ultimately to meet customer expectations with regard to such a service.

Activity 2: Definition of objectives and requirements for the artifact (DONE). Previously published work (Ruf et al., 2014) has elicited CR following the RAM of Gorschek and Wohlin (2006). As a result, the researchers have derived various CR from a multi-method approach which included empirical findings involving domain experts and customers. The results of this activity were introduced in Section 2.3 above.

Activity 3: Design of an artifact (DONE). In this study, we designed a prototype with specified CR for mFAS. The following Section 3.2 highlights details on the research approach and chosen method. This research project involved experts from various banks in Switzerland and did not receive funding from a particular bank. Hence, we argue that the findings are more generalizable and unbiased than if the project had been funded by a single project partner.

Activity 4: Demonstration (OPEN). The artifact has been demonstrated with an experiment involving participants and potential customers; this ended in December 2014 (Ruf, Back, & Wittmann, 2015). We are currently in the process of analyzing the data.

Activity 5: Evaluation (ONGOING). Following the experimental demonstration, we plan to evaluate the artifact with customers in cooperation with a bank in Switzerland. However, this evaluation is still in the planning process and is dependent on the results of the experimental

demonstration. Furthermore, we believe that each activity should include a separate evaluation process. Hence, we present the evaluation of the specified CR in Section 4 of this study.

Activity 6: Communication (ONGOING). We plan to communicate our findings and results on a continuous basis and get valuable feedback from peer-reviewed conferences and journals.

As the scope of this study refers to Activity 3 and Activity 5 of the DSR, we provide further details on how we built our prototype and planned a first evaluation cycle.

3.2 Chosen Research Approach and Method

Regarding Activity 3, we designed an artifact based on specified CR. We conducted three design-and-evaluation iterations (Activity 5) which are described in further detail. Figure 1 depicts our procedure in developing and evaluating the CR.

Development Phase 1: Design of mock-ups and a first clickable prototype. For the design of the user interface, we chose Adobe Illustrator. We developed the advisory process, the navigation, and the look and feel of it. Subsequently, we used these interfaces to build a first clickable prototype with InVision software. This allowed us to simulate the advisory process by linking the interfaces and navigation sites. We evaluated this prototype in a first iteration.

Evaluation Phase 1: Focus group with researchers. With this first evaluation, we ensured that the prototype included the previously elicited System Requirements presented in Section 2.3. We incorporated small changes, such as switching the language from German to English, and adapting the look and feel of the menu. In total, three Research Associates and a Professor provided feedback regarding the completeness and consistency of implementing the CR in this prototype. The participants had previous knowledge in the domain of either interactive design or the financial industry.

Development Phase 2: Design interactive prototype v1. Based on the input and feedback from the first evaluation, we were able to further specify the CR and design an interactive prototype accordingly. Where possible, we used Axure RP in combination with HTML5 and JavaScript to develop this interactive prototype. Furthermore, we coded the social presence features, such as desktop sharing and the chat function with PHP and created a MySQL database.

Evaluation phase 2: Focus group with Research Associates and Master's Students. In the second evaluation and iteration, we presented the interactive prototype and the customer journeys to Research Associates and master's students who were either involved in user experience projects or the requirements elicitation process for such an mFAS. We were able to specify the CR and gain a more comprehensive understanding.

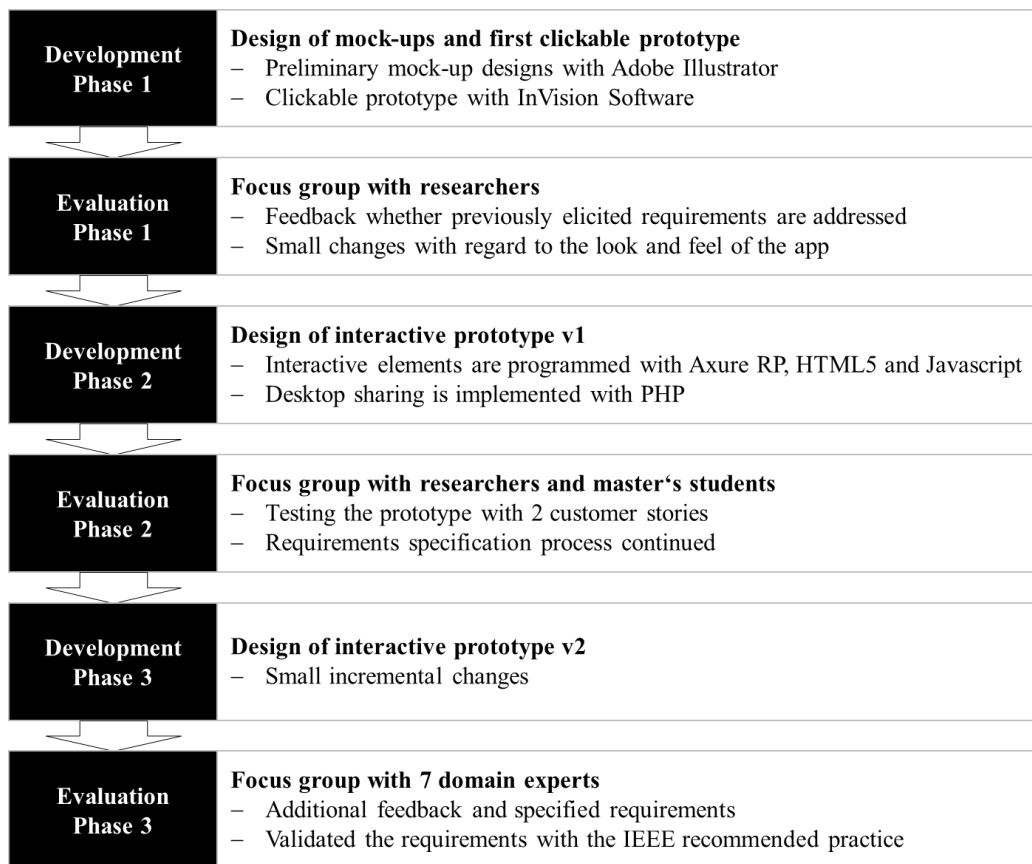


Figure 1: Design and evaluation phases

Development Phase 3: Design interactive prototype v2. This process involved an incremental improvement of the interactive prototype from the previous development phase.

Final Evaluation: Focus group with seven domain experts. For the final evaluation, we invited seven experts with extensive industry experience. We summarized the roles and experiences of these experts in Table 1. During the focus group, we presented the final prototype, gathered additional feedback in order to specify CR, and consequently evaluated its consistency and completeness. We organized the focus group for the final evaluation on June 26th 2014. The session lasted two hours. Three Research Associates were responsible for recording the minutes. Following the discussion, the participants were asked to fill out a questionnaire, for which the experts evaluated the CR with regard to the quality criteria of the recommended practice for requirements specification (IEEE, 1998). The experts were asked to agree or disagree whether the specified CR met the suggested quality criteria for requirements specification using a scale where 1="I completely disagree", 2="I disagree", 3="I partly agree", 4="I agree" and 5="I completely agree". Table 3 in Section 4 summarizes the survey questions and the findings from this final evaluation.

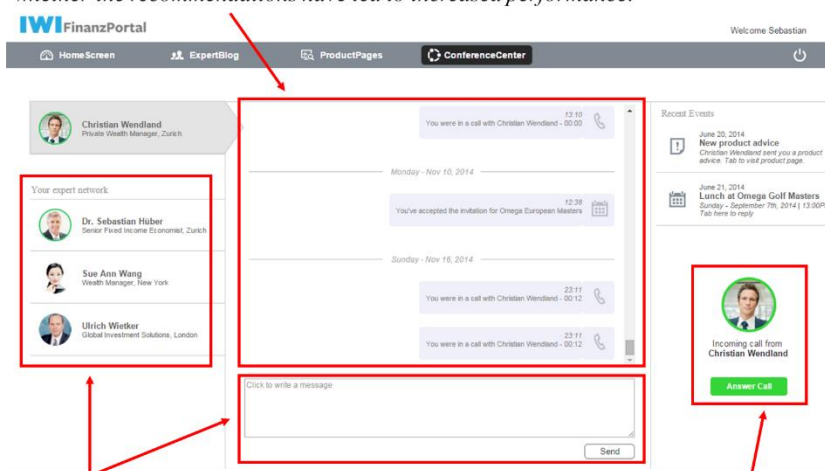
Position	Domain experience	Organization	# Employees
Head of Banking Consulting	More than 10 years	Consulting Firm	< 50
Senior Manager IT Architecture	More than 10 years	Private Bank	1,500
Head of Online Private Banking	8 years	Universal Bank	>10,000
Head of Private Banking	5 years	Universal Bank	1,000-1,500
Manager IT Architecture	5 years	Private Bank	1,500
Software Developer	5 years	Universal Bank	1,000-1,500
Assistant Manager Online Channels	2 years	Universal Bank	5,000-5,500

Table 1: Focus group with seven experts for the final evaluation

4 Results

During the first two DSR cycles, we specified the CR as summarized in Table 2. These specified CR and the prototype are presented in Figures 2 and 3.

(CR5) Transparency: Customers have access to the communication history and are able to evaluate whether the recommendations have led to increased performance.



(CR1) Access to experts and (CR4) social presence and situational use: Only RMs and experts are able to initiate desktop sharing and voice calls. Customers are able to send personal messages and use the chat feature. In this case, the mobile network appears to be appropriate. A green circle around the profile signifies that social presence features might be used. Moreover, depending on segmentation criteria, customers use the RM as a single point of contact or are also able to directly interact with the network of experts.

Figure 2: Prototype with the customer requirements (CR1,4,5) transparency, access to experts, social presence and situational use

With regard to (CR1) access to experts, the focus group with the domain experts suggested that depending on the importance of customers, they should be able to contact experts and investment advisory team members directly. Hence, whether RMs serve as a single point of contact really depends on how much wealth customers have or how important they are.

Accordingly, RMs should be able to customize this feature. Furthermore, the evaluation cycles revealed that customers should only be able to use chat. Thus, only RMs should be able to initiate video and desktop sharing features (Figure 2).

Feature Level*	Description*	Feature Level (continued)	Function Level
(CR1) Access to experts	RMs are the single point of contact.	The RM is a single point of contact, but is able to customize the accessibility of the advisory team.	Customers are able to request a meeting and chat or send messages. Video calls are initiated by the RM.
(CR2) Information quality	The information on the platform is timely, and aggregates news according to the individual customer's risk profile.	The platform includes both research information and information of the customer's current portfolio.	The platform visualizes the portfolio and the pre-defined investment strategy.
(CR3) Proactivity	The service supports the RM sending out product recommendations.	Such recommendations include rebalancing requests but also invitations to exclusive events.	Customers are able to accept or decline such invitations and request additional information.
(CR4) Situational use and social presence	Customers are able to access the personal RM from anywhere, at any time.	Such interactions include chat and desktop sharing. Video conferencing is not a priority.	If the mobile network is not fast enough for using such features, this should be graphically highlighted.
(CR5) Transparency	In order to address information and interest asymmetries, the mFAS provides a transparent advisory process.	Transparency relates both to the product recommendation and to the entire communication between RMs, customers and the financial advisory team.	The product site displays all relevant information in a comprehensive way for the customer. Furthermore, the communication center archives client touch points.
(CR6) Privacy	While privacy is critical for customers, RMs require insights about their clients. The mFAS should balance these two requirements.	Customers need to be aware of what kind of data the app collects and how it is analyzed.	On the first login, customers are able to configure the data collection and data analysis practices.

Table 2: Specified customer requirements (CR) for mFAS, *feature requirements in a previous study (Ruf et al., 2014).

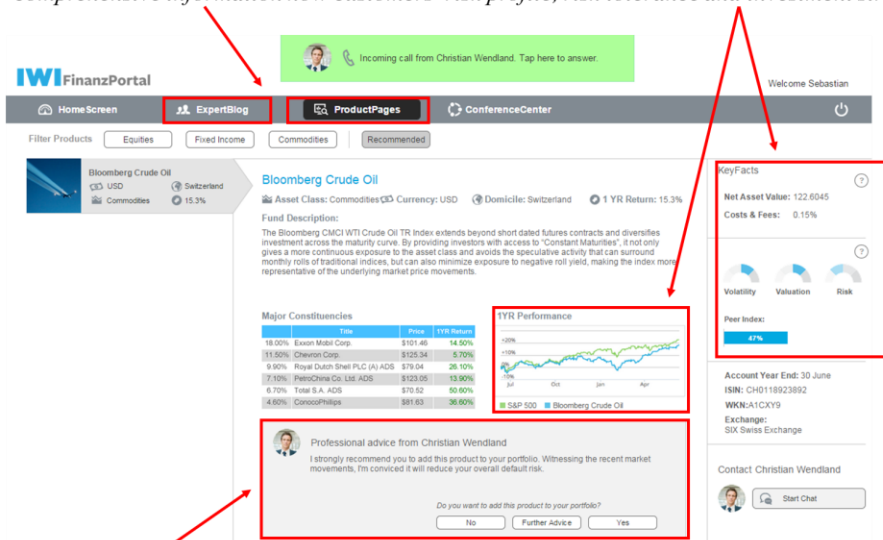
The Feature Level requirement (CR2) information quality refers to the aggregation of research information and investment advice. In our evaluation process, the conclusion was that such information relates not only to investment ideas and corresponding products, but also to the clients' current investment portfolio. Consequently, the mFAS should match the investment ideas and research information according to this portfolio information and provide a more customized and personalized service (Figure 3).

Regarding (CR3) proactive information, this should always include buy and sell orders combined. Practitioners also refer to such buy and sell orders as rebalancing. Furthermore, clients are interested in exclusive events to which RMs might also invite them. With regard to such proactive information, clients should be able to quickly accept or decline such recommendations. In our prototype, this CR was implemented with three simple buttons; customers could accept the recommendation, decline it (Figure 3), or request additional advice.

During the evaluation, we also specified the Feature Level requirement (CR4) situational use and social presence. Previous studies have emphasized the relevance of an mFAS for managing international client relationships. Our findings suggest that videoconferencing, or being able to see the other person, is not a main priority. Desktop sharing or co-browsing features are more relevant, in order to provide a better advisory service. Furthermore, the mFAS should notify customers if the performance of the mobile network is not sufficient for using such features. For example, if the customer does not have wireless or 3G network access, the desktop sharing and co-browsing features are disabled. In our prototype, the availability of chat and social presence features was highlighted with a green circle around the portrait picture (Figure 2).

Regarding (CR5) transparency, we designed a dedicated communication center which incorporated the entire communication streams between customers, RMs and the expert or investment advisory team members. Consequently, customers were able to verify whether the investment proposals and recommendations from previous interactions had actually resulted in increased financial performance. We also designed the product site according to transparency criteria. The product recommendations contained the transaction costs associated with a trade and information on how the product fit with the person's risk tolerance, risk profile and pre-defined investment strategy (Figures 2 and 3).

(CR2) Information quality and (CR5) transparency: The platform incorporates blogs and products and hence, presents information in an aggregated and personalized way. Furthermore, the recommendations provide comprehensive information how customers' risk profile, risk tolerance and investment strategy are met.



(CR3) Proactivity: Customers receive personalized recommendations for rebalancing their portfolio. Moreover, customers are able to decline, approve or request further advice with a simple push on a button.

Figure 3: Prototype with the customer requirements (CR2,3,5) information quality, transparency and proactivity

Finally, we also specified the last Feature Level requirement (CR6) privacy. We discussed the importance of privacy with regard to collecting and analyzing customer data. While financial institutions and RMs in particular try to collect and analyze data for a better understanding of customers, privacy issues remain one of the top concerns of customers. Hence, we implemented a notification at the beginning of the login process. With a simple click, customer could adjust their privacy settings and decide what kind of personal data they wanted to share with the financial institution.

Following the requirements specification process and the design of the prototype as depicted in Figures 2 and 3, we asked the participants to evaluate the CR according to the recommended practice for requirements specification (IEEE, 1998). We present the results of this final evaluation in Table 3.

The experts positively evaluated the specified CR as being (1) consistent and correct, (2,3) unambiguous, (4) modifiable, and (5) traceable as well as transparent. Regarding the quality criteria (6) ranked for importance and (7) measurable, the experts only partly agreed with our findings. Finally, compared to the other quality criteria, the experts were more skeptical with regard to the (8) completeness of our specified CR. Hence, some of experts disagreed or only partly agreed that our specified CR are complete. These findings give rise to discussion, which is addressed in the following section.

<i>The specified customer requirements (CR) ...</i>	<i>Feedback</i>
<i>(1)...are consistent and meet the customer and stakeholder needs.</i>	agree
<i>(2)...can only be interpreted one way.</i>	agree
<i>(3)...are unambiguous.</i>	agree
<i>(4)...are modifiable.</i>	agree
<i>(5)...are transparent and traceable.</i>	agree
<i>(6)...are ranked for importance.</i>	partly agree
<i>(7)...are easily transformed into measurable performance indicators.</i>	partly agree
<i>(8)...are complete.</i>	disagree/partly agree

Table 3: Results from the final evaluation and the focus group

5 Discussion

When looking at the results from Table 3 in Section 4, the conclusion that can be drawn is that by applying the RAM model we successfully specified CR that met most of the quality criteria. The experts agreed with our specified CR being correct, consistent, unambiguous, modifiable, transparent and traceable. Hence, we argue that the RAM model provided a useful framework in the RE process.

While the experts positively evaluated most of the quality criteria and, hence, agreed with how we specified CR and built our prototype, the results indicate that the presented CR might be only partially complete. Regarding the completeness criteria, some of the experts either disagreed or only slightly agreed. There might be several reasons for this critical assessment. First, our presented CR were still generic and abstract. The CR would need to be specified on the Component Level of the RAM in order to provide more complete and specific requirements in the business context of each practitioner, as suggested by Gorschek and Wohlin (2006). Secondly, the final evaluation also provided us with new requirements, which had not been considered thus far. One statement provided during the evaluation was the following: *“Depending on the customer needs, we should allow the customers to design their own app with the features and functions they need”*. For example, a trader might want to execute the transaction personally, while the RM should facilitate these transactions for other customers. Thirdly, we only elicited customer-related requirements (CR1-6). Accordingly, business processes, the existing information systems and other stakeholders within an organization also have requirements which were not addressed in this study. Such additional requirements might also originate from the political environment. One of the experts mentioned the following: *“New regulatory frameworks are a huge challenge for us. Which customers are we able to consult with the new financial intermediary and consulting regulation?”* To sum up, we believe that specifying requirements on the Component Level in a real-life context, as well as

capturing requirements from additional stakeholders, would have resulted in more positive feedback with regard to the completeness criterion.

Regarding the quality criterion (6) modifiable and transformable into key performance indicators, we want to highlight an item of feedback from the focus group: *“At the end of the day, we need to be able to make money with this service. How are we going to price such an app?”* Clearly, the CR presented in this study did not provide specific figures on increasing customer satisfaction, financial performance or profits. By addressing this limitation, we believe that the feedback from the experts with regard to this criterion would have been more positive.

Finally, the presented CR1-6 were not prioritized on a quantitative scale. Hence, only the relative importance of these CR in the focus group could be assessed. For example, in the opinion of the group and based on previous findings (Ruf et al., 2014), privacy is the top concern and a prerequisite which must be addressed when developing mFAS. While privacy issues are clearly of significant importance, proactivity is less of a priority. However, such a qualitative assessment did not completely meet the criterion “ranked for importance”.

6 Conclusions, Limitations and Future Research

In this study, we aimed at specifying customer requirements (CR) for a mobile financial advisory service (mFAS) with the instantiation of a prototype. In order to achieve this goal, we conducted 3 development and evaluation cycles. The final evaluation included a focus group with seven domain experts. Besides the specified CR (1) access to experts, (2) information quality, (3) proactivity, (4) situational use and social presence, (5) transparency, and (6) privacy, we also captured new ideas on how to improve our prototype. Furthermore, the evaluation also revealed how effectively the specified CR met the recommended practice for requirements specification (IEEE, 1998). Our findings suggest that our CR are consistent, correct, unambiguous, modifiable, traceable and transparent. However, the experts were more skeptical with regard to the completeness criterion. Consequently, we believe that future studies should also address different stakeholder requirements, such as the environment, business processes, and the existing information systems in an organization in order to improve the completeness of the presented CR. Apart from that, we believe that the provided CR provides insights on how practitioners design mFAS in their organizational context. It would be particularly interesting to evaluate how the proposed CR also applies to different segments, such as retail or affluent customers. In our study, we developed a mobile app that runs in the browser of tablets. Future studies might also evaluate how the specified CR are applicable to mobile apps on smartphones.

Furthermore, our results show an instantiation of the Requirements Abstraction Model (RAM) from Gorschek and Wohlin (2006), combined with a prototyping approach. By applying the proposed model for specifying CR, we instantiated the model and acknowledge its usefulness. Furthermore, we combined the specification process with a prototyping approach in three

iterations. Hence, we argue that the RAM is a useful method for capturing and specifying requirements.

Despite the presented results and contributions, we also want to discuss some limitations. The evaluation phases of our CR and prototype included Research Associates, a Professor, and Master's students, as well as seven experts with significant industry experience. While we made sure to include only experienced people in our evaluation process who had good knowledge and understanding of customer needs, the involvement of HNWI in the evaluation cycles would have provided us with additional valuable feedback. However, we only had limited access to HNWI and thus were not able to address this limitation in our study. Consequently, future research endeavors should incorporate additional feedback from this customer segment. Notably, we are currently in discussion with various banks in order to get access to HNWI clients for a future validation process.

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