

Enterprise Experience into the Integration of Human-Centered Design and Kanban

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Abstract: The integration of *Human-Centered Design (HCD)* and *Agile Software Development (ASD)* promises the development of competitive products comprising a good *User Experience (UX)*. This study has investigated the integration of HCD and Kanban with the aim to gain industrial experiences in a real world context. A case study showed that requirements flow into the development process in a structured manner by adding a design board. To this end, the transparency concerning recurring requirements increased. We contribute to the body of knowledge of software development by providing practical insights into *Human-Centered Agile Development (HCAD)*. On one hand, it is shown that the integration of HCD and Kanban leads to a product with a good UX and makes the development process more human-centered. On the other hand, we conclude that a cross-functional collaboration speeds up product development.

1 INTRODUCTION

Nowadays, companies face the challenge to develop competitive products, which fulfil user needs and lead to a positive *User Experience (UX)*. Therefore, the integration of *Agile Software Development (ASD)* and *Human-Centered Design (HCD)* is a popular research field. In literature, there are a lot of existing experiences and best practices investigating *Scrum* as one of the important methodologies for an agile human-centred process (Maguire, 2013; Winter et al., 2012; Holt et al., 2012). However, if we take a broader look on ASD, we can observe a change when it comes to the distribution of agile methodologies in general. In particular, the use of Kanban in IT projects has increased during the last years (Komus, 2012; Komus et al., 2014). Despite this trend, little is known about the integration of Kanban and HCD.

While Scrum specifies a process model including a set of meetings, roles and rules; Kanban can be implemented into an organization without changing the whole development process. In the beginning of

agile transformation using Kanban, there is no need to change the established, well-known development process. The application of Kanban starts with making a workflow visible and proceeds with continuous improvement of the existing process model. To this end, it is easier to change from non-agile development to Kanban, compared to the application of Scrum.

The evolution of Kanban for IT was mainly influenced by Anderson in between 2004-2010 (Anderson, 2004; Anderson, 2010). There are five core practices in Kanban (Anderson and Rook, 2011):

- Visualize the workflow (e.g. using a *Kanban board*)
- Limit *work in progress (WIP)*
- Manage continuous flow
- Make process policies explicit
- Improve collaboratively (using models and scientific methods)

The integration of human-centred development activities into the development process is necessary in order to improve human related factors (e.g.

usability and UX). ISO 9241-210 (ISO 9241-210: 2010) entails a process model for HCD related to interactive systems. In the beginning of a project the HCD process must be planned. The next step is to understand and specify the context of use. Therefore, user, tasks, hard- and software as well as physical and social surrounding have to be analyzed. Based on the data gathered the user requirements can be specified. After that, possible design solutions can be produced. Then designs are evaluated against user requirements and if necessary iterate single process steps until the solution meets the user requirements.

This article gives empirical insights into the integration of HCD activities in Kanban with the aim to develop a product with a good UX. To this end, a process model to integrate HCD activities in Kanban is evaluated through a case study. In particular, we achieve an agile conception process for the integration of HCD with the result: requirements are pulled along a structured workflow and are continuously managed through development. The contents are aimed both at agile practitioners who are interested in improving a cross-functional development process with Kanban as well as at academics, who are interested in gaining practical insights into the integration of HCD activities in Kanban.

The remainder of this paper is structured as followed: In section 2 we present related work by summarizing key aspects of *Human-Centered Agile Development* (HCAD) provided by literature reviews and the current situation of HCD and Kanban. Section 3 gives an overview of our research objectives and introduces the research design. Section 4 provides a discussion on the results and limitations of this study. Finally, Section 5 concludes this paper with an outlook on future work.

2 RELATED WORK AND BACKGROUND

2.1 Human-Centered Agile Development

Agile Methodologies are commonly used in our time. With the increasing application of ASD in practice, the research field of HCAD becomes also very popular. Accordingly, some literature reviews have been published during the last years (Sohaib and Khan, 2010, Silva et al., 2011, Barksdale and McCrickard, 2012, Salah et al., 2014, Brhel et al.,

2015). On one hand these literature reviews report challenges regarding the integration of HCD and ASD, on the other hand the authors identified best practices in order to address these challenges.

Sohaib and Khan (2010) investigated the tensions between usability engineering and agile methods. They provide an overview of existing approaches in order to integrate usability and agile methods.

Silva et al., (2011) dealt with similar questions and identified five key aspects to integrate HCD and agile (*Little Design Upfront, Prototyping, User Stories, User testing, Inspection evaluation, one sprint ahead*).

Compared to this, Barksdale et al., (2012) mapped their included papers into five integration types: practices, process, technology, people and social.

Salah et al., (2014) identified the following challenges and practices: *lack of time for upfront activities, difficulty of chunking, difficulty of prioritizing HCD activities, optimizing the work dynamics between developers and HCD practitioners, performing usability testing, HCD practitioner workload, lack of documentation*.

Brhel et al., (2015) determined also five principles for constituting a HCAD approach: *separate product discovery and product creation, iterative and incremental design and development, parallel interwoven creation tracks, continuous stakeholder involvement, and artifact-mediated communication*.

To sum it up, the key aspects for HCAD reported by literature are:

- *K1: Apply a first iteration for user research and little design upfront*
- *K2: Separate product discovery and product execution, mostly combined with one iteration ahead*
- *K3: Support continuous stakeholder and user involvement*
- *K4: Integrate prototyping and usability testing activities*
- *K5: Use artifacts in order to achieve a shared understanding*

Most of the included studies deal with development processes organized with Scrum or Extreme Programming (XP). However, little is known about the integration of HCD activities in Kanban. To the best of our knowledge this is the first case study concerning the integration of HCD and Kanban.

2.2 Integration of Human-Centered Design and Kanban

To reach a human-centered design process (ISO, 2010) it is important to take into account conceptual tasks like analyzing the context of use, specifying user requirements and producing prototypes. Another important aspect is the evaluation of these prototypes in order to prove whether design solutions meet the requirements. The aim of our approach is to make an agile development process organized with Kanban more human-centered. Therefore, we have to adapt the classical workflow.

Winter et al., (2013) recommend four important elements that optimize the development process:

- *Enhancement with design board*
- *Cross functional collaboration*
- *Release evaluation*
- *Usage of UX artifacts*

On one hand they propose adaption of workflows visualized in a Kanban board and on the other hand they implement UX artifacts.

Enhancement with Design Board. In many cases a Kanban board visualizes the workflow of the development team from a technical viewpoint. In these cases, there is often a lack of HCD activities. Conceptual tasks (e.g. user research, specify user requirements, usability testing) are missing. To this purpose, we enhance the Kanban process with a design board before the development board, without changing the development board (see Figure 1). Accordingly, conceptual tasks can be organized in the same structured way like development tasks. This constitutes the first core practices of Kanban by providing more transparency concerning the existing workflow.

Cross-functional Collaboration. One of the most important values in agile development is the interaction between individuals (Beck et al., 2001;

Schön et al., 2015). To avoid the building of functional silos (consisting of experts from one special domain, e.g. UX expert, QA) there must be a strong collaboration in a cross-functional team. Similarly to the daily scrum meeting (Schwaber, 2004), the team can organize a daily standup meeting. The objective is to synchronize the work between teammates (e.g. developers, UX experts, tester, project manager).

Release Evaluation. Another significant point in HCD is the regular evaluation of the UX. For this purpose, we can introduce a similar limitation according to the WIP limit for the last column (“done”, see Figure 1) of the Kanban board. Reaching the WIP limit implies starting the release evaluation. This has the advantage that complexity concerning planning will be reduced and the evaluation is carried out continuously. Significant findings can flow into the process as new tasks, prioritized on the design board.

Usage of UX Artifacts. To share a common vision among the project team, requirement artifacts are needed. These artifacts have to be understandable within the project team. In agile development the artifacts *Personas*, *Persona Stories* and *Prototypes* have become established (Winter et al., 2013).

Creating *Personas* is an effective way to understand the needs of users, prioritize features and functionality, and to direct the design of digital products and services (Cooper, 1999; Holt et al., 2011; Nielsen, 2013). Personas are deduced from concrete profiles of potential users in order to represent archetypal users. They help stakeholders to receive a common understanding of user needs.

User Stories are a widespread method for requirements engineering in ASD (Cohn, 2004). They are used for defining the scope. In respect to this, *Persona Stories* are a special type of user stories where the role is filled by a persona (Reichelt, 2010; Winter et al., 2012; Hudson, 2013).

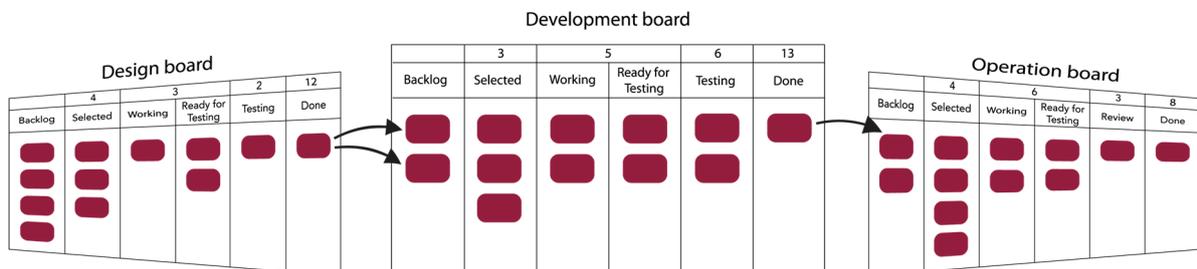


Figure 1: Multiple Kanban boards, representing the workflow from design through development and delivery of a product. One task from design board might be split to more than one task on development or operation board with the aim to obtain a continuous flow within the board and between the boards.

This entails the advantage that the benefits resulting from the usage of personas are more integrated into the development process.

Complex connections between requirements (e.g. interactions) can be visualized with *Prototypes* (Rudd et al., 1996). Project members can learn, discover, generate and refine ideas by means of them (Lim et al., 2008). Moreover, it can be tested if the conceptual model of the product fits the assumptions regarding the mental model of the user.

3 RESEARCH OBJECTIVES AND STUDY DESIGN

The aim of our study is to gain empirical insights in the integration of HCD and Kanban and to prove whether our approach (Winter et al. 2013) covers the key aspects of HCD (see K1-K5, 2.1) and the implications for practice. The study was carried out as a case study in a company. The phenomenon under investigation is the integration of HCD in Kanban in a real world context.

3.1 Research Questions

We defined the following research questions which can be mapped to K1-K5 as followed:

RQ1: Which advantages/disadvantages result from the integration of a design board?

K1: Starting the workflow by introducing a design board intends that conceptual tasks (e.g. user research, UX design) are carried out in the beginning of the development process. This approach is comparable to the implementation of a first iteration.

K2: The application of boards for design and development (see Figur) leads to a separation of product discovery and product execution. Design board tasks are related to product discovery, on the contrary, development board tasks are related to product execution.

RQ2: Which benefits result from a cross functional collaboration?

K3: Continuous stakeholder and user involvement implies a cross-functional collaboration because there are some roles that are more involved in the communication process and act as representatives (e.g. UX expert to users, product manager to stakeholder).

RQ3: How can a release evaluation be carried out?

K4: One important feature of HCD is evaluating

design solutions against user requirements. Prototypes are often used to be able to do usability testing. Performing a release evaluation includes the validation of assumptions represented by the requirements.

RQ4: How can UX artifacts be integrated in the development process?

K5: Artifacts play an important role for building a shared understanding. In HCD artifacts are used for collaboration and documentation of requirements, therefore it is necessary to find the right combination of artifacts that project members are willing to use.

3.2 Study Context and Research Setting

The case study was carried out in a medium-sized IT company, located in Germany and specialized in e-commerce, mobile apps and SAAS tools. They use JIRA from Atlassian to work with Kanban and have already gained experience with Scrum.

The case study is about a single team with twelve members (one team leader, one project manager, two visual designers, two UX experts and six developers) who had to do a relaunch of an internet newspaper portal within six months in 2013/2014. All team members have already been working with Kanban on different experience levels.

During the project the approach by Winter et al. (see section 2.2) was applied. To this end, a design board was introduced. This board was followed by the existing development board (see Figure 1) and visualizes the design process. Due to the size of the project team, necessary structures for the collaboration were created to prevent the formation of functional silos. There was no use of persona stories, because personas had not yet been established for the project. Instead classical user stories have been used. For complex tasks prototypes were created.

3.3 Data Collection and Analysis

In order to gain qualitative insights, we conducted semi-structured interviews with six project members. The telephone interviews were carried out 12 months after the completion of the project by a neutral interviewer (company extern). Important is, that the internet portal had been established at that time. An interview consisted of nine questions and typically took 20 to 25 minutes. The original interview questions (German language) can be found

in the Appendix. The participants were asked to describe their experiences with the development process and to discuss possible advantages or disadvantages. In the end they should point out their personal assessment through the usability and UX of the resulting internet portal. Before analyzing the data, we made a transcription of the recorded interviews.

In addition, we set up a retrospective with the UX experts in order to gather further insights.

4 RESULTS AND DISCUSSION

The results of the case study provide important information for researchers and practitioners. They are now discussed in relationship to our research questions. The statements from the individual interviews are anonymized (I1-I6).

4.1 Which Advantages/Disadvantages Result from the Integration of a Design Board (RQ1)?

The participants stated that before implementing the design board requirements were provided in a very unstructured way (I1). There were many stakeholders requesting tasks simultaneously. With applying the design board this situation has changed. The design board became the first contact point to place all requests (I1). UX experts started to bundle requirements. This led to a better communication among project members (I5). One participant (I6) reported that product managers and UX experts saved developers from chaos, which had existed before implementing the design board. In addition, the transparency concerning recurring requirements increased. Same requirements can be used for the same solution (I1).

We also observed some problems with the positioning of the design board. It was not placed beside the development board due to organizational conditions. Participants provided information that they had problems with the visibility of the design board and report that only the result of concept work was visible (I2), (I5).

4.2 Which Benefits Result from a Cross-Functional Collaboration (RQ2)?

The close collaboration between developers and UX experts resulted in a high release rate. One

participant (I3) stated that the project would have taken 4-5 months longer if they had worked as separate teams. Another participant reported that the co-located work brought benefits. The previously spatial separation resulted in more questions (I3). Another benefit of the cross-functional collaboration is that the developers got a better feeling for the requirements (I2). Although there was a close collaboration between developer and UX experts one participant state that conceptual work was not visible during the project, only the result (I5).

With a view to the daily standup it was a challenge to find the balance between superficial and detailed discussion (I3). Positive and negative perceptions of the participants concerning daily standups:

Daily standup positive:

- Increased transparency regarding the work of others (I1), (I2), (I5)
- Work was better coordinated (I1)
- Good overall view : Everyone got a feeling on progress of the project (I1)
- Promoted communication and overview (I4)
- Personal stress level was low because the communication has been improved (I4)
- Short distances to UX experts (I4)
- Group discussions during critical periods or new functions (I5)
- Previous experience of other developers regarding complex tasks were shared in team (I2)
- For developers interesting to see where things are headed (from a UX expert point of view) (I2)

Daily standup negative

- It was annoying to be torn from one's work (I4)
- Time and regularity were a switch (I1)
- Standups took often more than 15 min. because of team size (I1), (I6)

4.3 How Can a Release Evaluation Be Carried out (RQ3)?

For the last column of the design board a WIP limit was set up (see column "done" in Figure 1). Once the limit has been reached, a release evaluation could be done. After a few weeks the last column of the development board was full, so that a first release evaluation was executed. An UX expert reviewed the recognized UX problems. Quickly feasible adjustments (< 30 minutes) were fixed immediately. Other tasks were interrupted for it to

ensure release dates. For serious UX problems a new task was created in the design board.

All participants stated that they were happy with the resulting product and the overall usability (I1 - I6). We can observe a growth of unique users and usage of the portal (I6).

4.4 How Can UX Artifacts Be Integrated in the Development Process (RQ4)?

User stories were provided by the UX team, not the stakeholders (I5). One team member observed that the high number of concepts led to good results (I3). Moreover, a toolbox of UI elements had been created. Included UI elements were evaluated concerning their UX. This toolbox of UI elements took the heat off the UX experts and increased consistency among interaction design. The elements were used for minor changes directly by the developers. This resulted in three benefits: a) developers used the right UI elements on their own, even if they were in a hurry. b) UX team was relieved. c) developers received a better understanding of the HCD process and stayed in touch with the UX experts.

4.5 Additional Findings

The implementation of the process model resulted in high efficiency (I1) for which structure and discipline are required (I4). To sum up, participants felt comfortable with the process because on one hand the number of tasks were well structured (I5) and on the other hand they liked the fact that there was a complete process, which had covered the development from conception to deployment (I1) (see Figure 1). To this end, it was easy to focus on their work (I1).

Besides, one participant emphasised that *planning poker* (Grenning, 2002; Moløkken-Østvold et al., 2008) was funny and the results of the average value were good (I2). The same participant experienced the project as very organized compared to other projects without agile process (I2). With regard to Kanban they stated that it is more performant than Scrum (I3) and experienced the application as very positive because of the transparent process flow (I4).

Overall, there was a better understanding of HCD due to cross-functional collaboration between UX experts and developers. In addition, the importance of having a small UX team became more obvious to the stakeholders. As a result of the direct

cooperation, functional silos have been avoided. Moreover, the cross-functional cooperation raised awareness of usability for the current and following versions. “*Good usability*” is more often a common topic of conversation among developers, now. They also ask UX experts and visual designers to find a common solution without being forced.

The number of user issues (“*How can I find ...*” or “*How does ... works?*”) has declined, which results in less user support. Till today, the internet newsletter portal has still a high UX and usability. This is often confirmed by users and editors of the newsletter portal.

4.6 Limitations

The results have to be interpreted with regard to the different experience levels of the participants. Some of the participants had worked in many Kanban projects before, whereas some other participants had poor experience with Kanban. The participants who had poor experience with Kanban might not have been able to see all benefits of the integrated HCD activities (e.g design board, release evaluation, UX artifacts). Furthermore, the results might be different due to the usage of classical user stories instead of persona stories.

A possible weakness of our approach might be the time on which the interviews had been carried out. The relaunch of the internet portal was finished more than one year ago. This may have led to the issue that not every interviewee remembered all details or might reflect the facts in a more positive way.

Although we interviewed different project members (developer, UX expert, project manager) we might miss some findings from special perspectives. For example there were two visual designers working on the project, but we were not able to interview one of them, because of limitation in their time.

5 CONCLUSIONS AND FUTURE WORK

This paper presents the results of a case study concerning the integration of HCD in ASD. We contribute to the body of knowledge of software development by providing:

- i. Practical insights into *Human-Centered Agile Development (HCAD)* with the integration of HCD and Kanban.

- ii. Empirical research with regard to the key aspects of HCD (see K1-K5, 2.1) in an economic environment.
- iii. A proof, that our approach covers the HCD key aspects.

In our process model, conceptual tasks are organized by a design board, which visualizes the workflow and increases transparency concerning user research, UX design and usability evaluation activities. Requirements are continuously prioritized and flow into the development process in a structured manner.

We can conclude that the integration of HCD activities in Kanban leads to a product with a good UX and makes the development process more human-centric. The users of the developed internet portal are satisfied and their needs are fulfilled. In addition, project members felt comfortable with the development process and the organization of their work. Besides, we can conclude that cross-functional collaboration is necessary to speed up product development.

Future research may specifically investigate a scaled approach of our process model. Moreover, it might be interesting to prove whether the integration of HCD and Kanban can face the challenges UX experts have in ASD (e.g. feel exhausted in short iterations, natural workflow is more orientated to a continuous “flow”).

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- Welche Nachteile hatte dieser Prozess für dich?
 << Antwort >>
- Du hast aktiv am Projekt mitgearbeitet, daher interessiert mich deine persönliche Einschätzung. Wie findest du das Ergebnis des Projekts bezüglich der Usability und Erleben der Nutzung?
 << Antwort >>
- Wie ist deine Einschätzung, ob das Ergebnis des Projekts mit dem sonst üblichen Prozess auch gelungen wäre?
 << Antwort >>
- Wie hast du dich in diesem Prozess im Vergleich zum sonst üblichen Prozess gefühlt?
 << Antwort >>
- Gibt es vielleicht noch etwas, dass du anmerken willst? Irgendetwas das dir besonders wichtig oder bemerkenswert erscheint?
 << Antwort >>

APPENDIX

Interview questions:

- Dann bitte ich dich als erstes mir deinen Namen und deine Aufgaben in dem Kanban-Projekt zu nennen und kurz zu schildern.
 << Antwort >>
- An jedem Mittag habt ihr euch zu einem Daily Standup getroffen. Was habt ihr ungefähr gemacht und wie empfandst du diese Daily Standups?
 << Antwort >>
- Wenn ich es richtig verstanden habe, war dieser Prozess dieses Mal etwas anders als sonst. Welche Änderungen oder Besonderheiten sind dir in Erinnerung geblieben?
 << Antwort >>
- Welche Vorteile hatte dieser Prozess für dich?
 << Antwort >>