UTISGAD
International Journal of Commerce, Industry and Entrepreneurship Studies
ISSN: 2791-6987
Volume (Cilt) : 2 Issue (Sayı) : 1 Year (Yıl) : 2022

Article ID:	UTISGAD-2022-2-1-113	pp. 89-100
Article Type:	Research Article	
Received:	22.06.2022	
Accepted:	02.07.2022	
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CORE REQUIREMENTS MODELLING FOR DIGITAL VENTURES. CENTRAL ASIAN ENTREPREUNERSHIP ECOSYSTEM CONTEXT

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ABSTRACT[2]

Digital ventures are created within Digital entrepreneurial ecosystems. Design of new digital products co-occurs with vast ambiguity regarding the technical feasibility of business requirements and guidelines. There is a lack of frameworks for product management in the Central Asian entrepreneurial context. The authors address the following research question: "How can digital ventures benefit from digital technologies to grow products in the Central Asian regional context?". Authors conduct an in-depth case study of developing and implementing a Learning Management System in the business context of a Central Asian startup accelerator for the period from 2019 to 2022. Our data collection comprises three methods: interviews, participant observations, and IT artifacts. For data analysis, we adopted grounded theory methods for coding and deriving theoretical concepts. Based on the data and existing literature, we propose an extension of the continuous post-launch product development framework by adding core requirements modeling mechanism. Authors' extensions allow mitigating the impact of unstable and abstract business requirements on software products' scope and budget.

Keywords: Digital Ventures, Product Management, Requirements Modelling

JEL Codes: M11, L10

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[2] *An abstract from this paper has been published at the 7th EMI congress (Entrepreneurship & Communication Social Sciences Congress) abstract book*

1. INTRODUCTION

Digital innovations stemming from digital products gain increased popularity amongst academics and practitioners as organizations such as Facebook, Google, Meta started as digital ventures from entrepreneurial ecosystems (Nambisan, 2017). Scholars identify digital entrepreneurial ecosystems as "knowledge clusters" depending on regional similarities (Autio et al., 2018).

As (Yoo et al., 2010) indicated, reprogrammable layered architecture of digital technology and separation of content layer allows digital ventures to be flexible. This provides an opportunity for rapid growth of digital ventures. Design of new digital products co-occur with vast ambiguity regarding technical feasibility of business requirements and lack of guidelines (The product experience, 2022). Even after initial launch growth is becoming difficult and startups are hit by the "death valley" (Tumbas et al., 2017).

(Lehmann & Recker, 2022) developed a framework to explain and guide digital product management. Yet little is developed for product management in Central Asian entrepreneurial context. There is lack of large digital organizations originating from Central Asian region. We therefore address the following research questions: "*How can digital ventures benefit from digital technologies to grow products in the Central Asian regional context*?"

In this research we conduct a case study of developing and implementing a Learning Management System for Central Asian startup accelerator for the period from 2019 till 2022. Based on the data and existing literature we propose extension of (Lehmann & Recker, 2022)'s framework by adding core requirements modelling mechanism. Authors extensions allows to mitigate impact of software requirements instability on product's scope and budget.

2. LITERATURE REVIEW

Digital products development is a topic of prominent debate in practitioner's world. Product development process is central for digital ventures – new organizations backed by venture capital aiming for rapid growth (Garg & Eisenhardt, 2016).

Product design and scaling in a small incremental iterations or large scale disruptive innovation with long term planning, focus on growth or on sales has been a key topic of debates (Thiel & Masters, 2014). As, to develop technical solutions a product manager must have product sensing capability. Product sensing is an ability of product manager to perceive users' needs and problems from behavioral patterns followed by construction of requirements for the product (Walter, 2022).

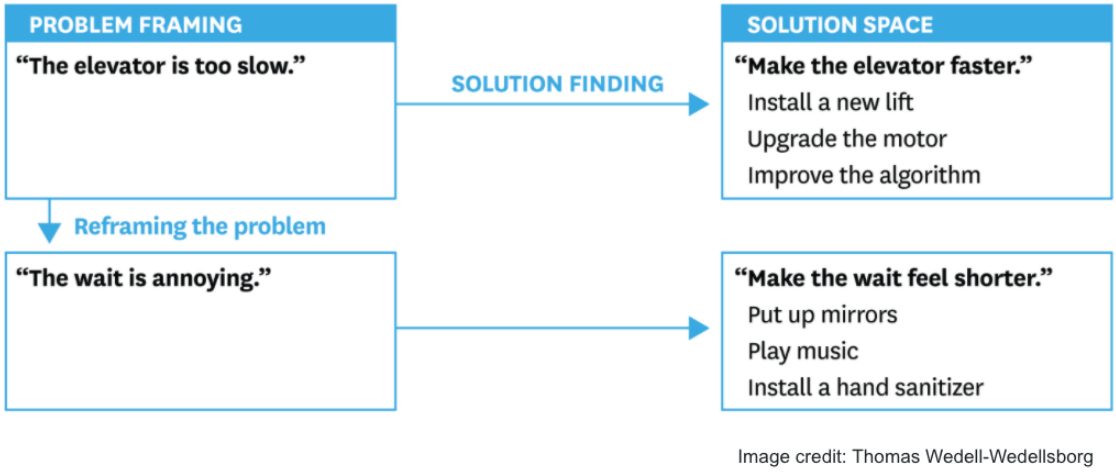


Figure 1. Example of translating users' problems into requirements for technical solutions

The context is substantial difference between development of B2C and B2B products. In the latter, product managers are focused on streamlining business processes, while in the former the focus is on the product's usability, look and feel for users (Walter, 2022).

(Huang et al., 2017) was one of the first scholars to recognize data driven operations as a foundational mechanism for digital products development and scaling. In addition, qualitative difference from new type of business value delivery model apart from Porter's classic value chain (Porter, 1985).

Lehmann & Recker's case studies of six digital startups uncovered three design mechanisms through which ventures manage product development: deploying complementary digital objects (e.g., UX interfaces, MS plugin to connect with non-digital customers), architectural amplification enabling modular architecture and source code refactoring and porting (e.g., APIs, reusing third party libraries) (2022).

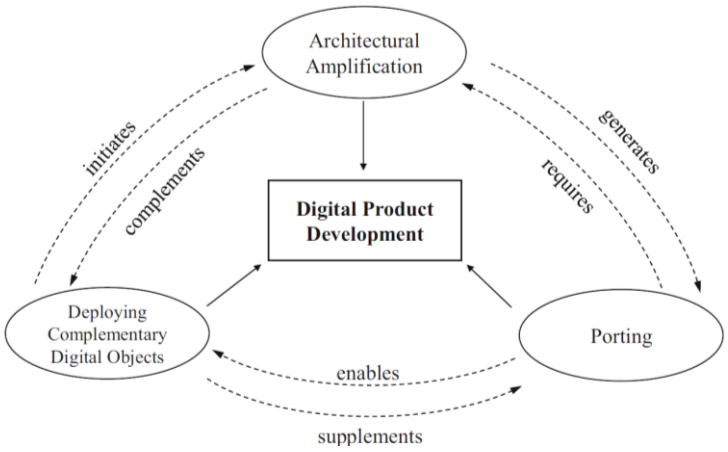


Figure 2. Model of continuous post-launch product development.
Source: Lehmann & Recker, 2022

3. METHODS

To explore the research questions we conducted an in-depth case study at Central Asian startup accelerator (AccelCo) operating in Kazakhstan, Uzbekistan and, Kyrgyzstan from 2019 till 2022. During our study AccelCo was developing a digital product to provide educational services for portfolio companies and external stakeholders. AccelCo undertook three major business requirements reconfigurations which led to change of product scope, budget and practically underlying technology stack.

AccelCo could be classified as an extreme case since it depicts paradigmatic phenomenon of business requirements evolution. According to (Gerring & Mcdermott, 2007) such extreme cases are useful go generating theory.

Our data collection comprises three methods: interviews, participant observations and IT artefacts. Particularly, we conducted 12 semi-structured interviews with AccelCo employees, it's software development subcontractor company and external project consultant from Europe. We interviewed stakeholders in the following occupations: CEO of IT company, accelerator's managing director, product manager, software architect, User experience (UX) team lead, online education domain expert, Learning Management System (LMS) domain expert, business analyst, software engineers and quality assurance engineer. We reviewed the following IT artefacts: data from Jira agile project management system, product backlog and technical specifications.

For data analysis we adopted grounded theory methods for coding and deriving theoretical concepts (Charmaz, 2006). Emerging concepts were reviewed against the relevant literature. Example coding scheme authors adopted is illustrated in table 1.

Table 1. Sample data structure with mappings of 1st order events to 3rd order concepts.

Illustrative 1st order empirical data	**2nd order theoretical category**	**3rd concept**
Business vision change led to software requirements reconfiguration	Requirements management	Core requirements modelling
API development is three months behind the schedule	System architecture	Porting
UX team had no empirical experience in online teaching business process and decided to adopt business process embedded to open source LMS	Fork	Deploying complementary digital objects

4. ANALYSIS FINDINGS

4.1 Business requirements for digital product emerge

AccelCo started to conduct an offline acceleration programs for SMBs in 2019 based at Almaty city office. Acceleration programs included educational courses with twelve mentors. After completing first cohort of the SMBs, AccelCo's managing director realized that offline format is a bottleneck limiting scaling of the program to Central Asian region. After engaging consultants from Europe, AccelCo decided to create digital platform, create video recordings of educational programs and distribute it to stakeholders.

4.2 Digital product concept

In June 2019 AccelCo's CEO developed a high level concept of LMS in a power point presentation. Company allocated a senior software architect to develop the system internally part-time, aside of architect's main duties. After six months, company's management recognized that system development was not started. As software architect pointed out,

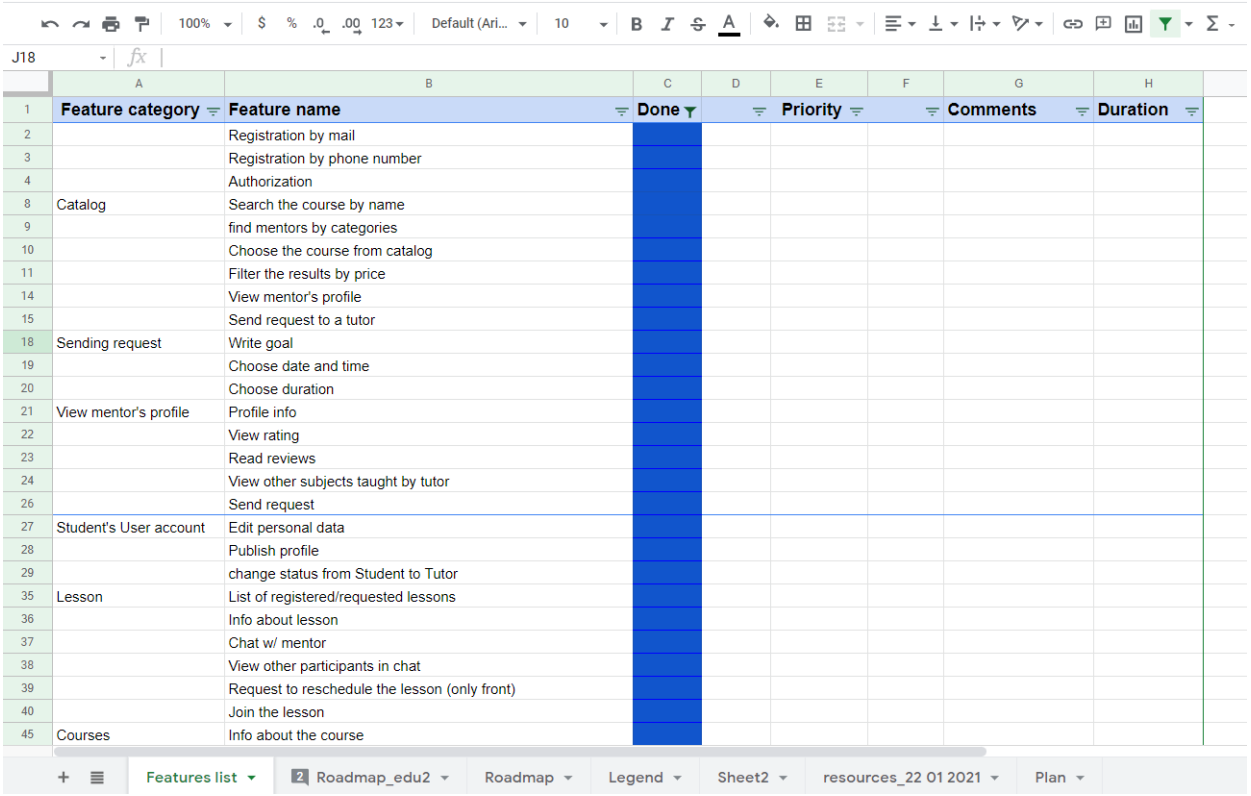
I did not receive business requirements. Can't start coding without formalized technical specification. The power point deck with rectangles and circles does not provide the necessary details to elicit functional requirements. It's too abstract.

4.3 Third party LMS consideration

AccelCo's management realized lack of "to-be" business process based on which business requirements could be developed. In February 2020 business development department invited a startup company with its proprietary Learning Management System (LMS). AccelCo assigned a dedicated team of business analyst and product manager to assess startup company's digital solution. As witnessed by AccelCo's product manager, proprietary LMS features were rigidly tied to startup company's existing business processes. Reconfiguration of features was not feasible.

4.4 Business requirements version one

In May 2020 an external consultant from Europe was invited to the project. A consultant reviewed competitors' digital products in Central Asia, Russia, Ukraine and USA. Based on the competitors review, a list of system features was developed. However, developers team indicated it is not possible to code all the features from the list within agreed time frame. Therefore, AccelCo's product manager and a business analyst decomposed each feature to user stories, assigned priorities to each user story. Then they modeled core business processes and validated the prioritized requirements with key mentors and consultant.



	A	B	C	D	E	F	G	H
1	Feature category	Feature name	Done		Priority		Comments	Duration
2		Registration by mail						
3		Registration by phone number						
4		Authorization						
8	Catalog	Search the course by name						
9		find mentors by categories						
10		Choose the course from catalog						
11		Filter the results by price						
14		View mentor's profile						
15		Send request to a tutor						
18	Sending request	Write goal						
19		Choose date and time						
20		Choose duration						
21	View mentor's profile	Profile info						
22		View rating						
23		Read reviews						
24		View other subjects taught by tutor						
26		Send request						
27	Student's User account	Edit personal data						
28		Publish profile						
29		change status from Student to Tutor						
35	Lesson	List of registered/requested lessons						
36		Info about lesson						
37		Chat w/ mentor						
38		View other participants in chat						
39		Request to reschedule the lesson (only front)						
40		Join the lesson						
45	Courses	Info about the course						

Features list | Roadmap_edu2 | Roadmap | Legend | Sheet2 | resources_22 01 2021 | Plan

Figure 3. Feature list by May 2020

4.5 Business requirements version two

Based on benchmark analysis and validation sessions with stakeholders AccelCo' product manager decided to narrow down the feature list in accordance with the modelled business processes. For instance, certain competitor's features were not relevant for Central Asian business context. LMS had two parts: student's part and mentor's part. For mentor's part there AccelCo's team could not come to agreement on User experience and user interfaces. As UX team lead noted,

We don't have practical experience in teaching online. Instead of guess working, for the mentor experience let's take what's there in the open source already available.

Thus, the team decided to search for external subcontractor with prior experience in LMS development.

4.6 IT outsourcing company involvement

Based on search IT freelance websites, product manager found an IT outsourcing company specialized in open source LMS Moodle development and implementation. The outsourcing company took two months to analyze the requirements and based on them developed more detailed technical requirements for developers. Certain requirements appeared to be not feasible to implement in a short period of time.

4.7 React JS and reconfiguring customer journey logic

Product strategy from AccelCo required non-typical customer journey for the educational product. Substantial change of backend logic and front end interfaces was required to accommodate the customer journey. Therefore, AccelCo team decided to change requirements priorities and postpone certain features development. To fit into the project schedule and budget Product manager decided to split development into two teams. Front end system implementation was assigned to internal AccelCo developers and customization of LMS Moodle's backend system was assigned to an outsourcing company.

4.8 API development

To allow information exchange between front end and back end systems a API layer development was initiated. API development was completed in three months. Testing period last two months.

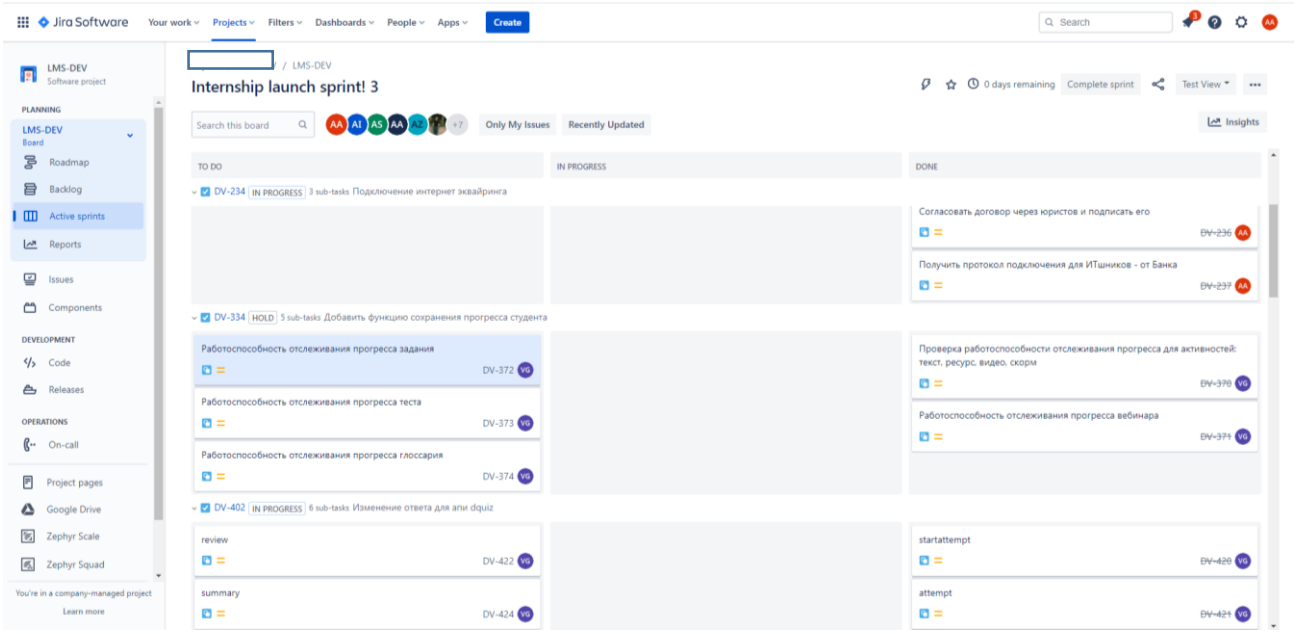


Figure 4. AccelCo's JIRA sprint example

4.9 Launch

Product manager enabled eight mentors to record their lectures and upload them to LMS system. Online acceleration program was launched based on 8 modules.

4.10 Embedding LMS to company's new portal and new CJM

Online acceleration was operating for 5 months from the AccelCo portal. In May 2021 company's CEO decided to change customer journey by onboarding users via third party web portal. Third party portal's web developers studied AccelCo's API documentation and enabled data exchange. Thus, new user requirements were accommodated without any reconfiguration

of the existing APIs and minor amendments to third party web portal. Key events are summarized in table 2.

Table 2. AccelCo LMS development timeline

Start date	End date	Description
01.06.2019	20.12.2019	Digital product concept
21.12.2019	28.02.2020	Third party LMS consideration
28.02.2020	30.05.2020	Business requirements version two
30.05.2020	01.11.2020	IT outsourcing company arrives, API development starts
01.11.2020	01.04.2021	Online course launch
01.05.2021	09.06.2021	Embedding LMS to company's main portal and new CJM

5. DISCUSSION AND CONCLUSION

5.1 Antecedent to digital core

Based on the case study analysis we propose a new mechanism - core requirements modelling. AccelCo's development team faced requirements instability which would result in dramatic stretch of project's scope and a budget. Firstly, abstract business requirements on the conceptual level were not sufficient for the IT architect to start development. Secondly, change of business strategy led to change of business requirements which nudged redesign of IT architecture. In this situation AccelCo's development team and IT outsourcing company were at risk of losing priorities. However, product manager was able to keep the key priorities and reduce instability by modelling crucial business requirements which he assumed will remain intact in any scenarios. The core business requirements emerged after modelling received the highest priority during the development process. Thus, core requirements modelling is a mechanism that depicts managers two actions. First, to prioritize business requirements. Then by applying long term planning and modelling convert prioritized requirements to prioritized product features. Thus, core requirements modelling emerges as an antecedent to digital core mechanisms revealed from prior research (Huang et al., 2021; Lehmann & Recker, 2022).

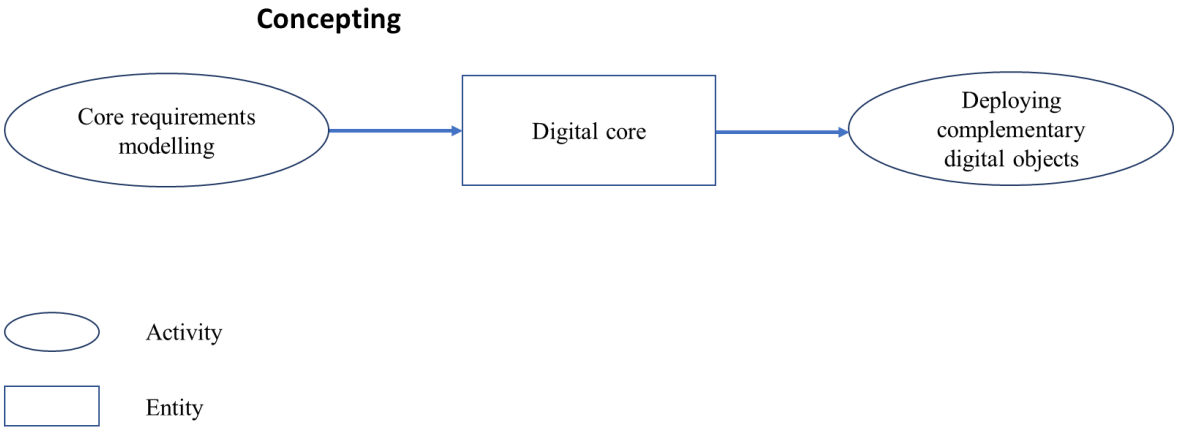


Figure 4. Emerging core requirements modelling mechanism

We reviewed literature in the requirements management. (Plotnikova et al., 2022) conducted six case studies of digital ventures in financial sector and identified gaps in the process of business requirements elicitation which results in a mismatch between business needs and digital system's features. Gaps hindering business value stems from iterative changes of requirements and results in change of project scope, budget and digital system's quality. This goes in line with (Nambisan, 2017)'s discovery that as product scope and features evolve continuously after deployment to the market, digital technology makes entrepreneurial processes less bounded. Prior research reveal that software engineering task is affected by requirements' complexity, level of abstraction and uncertainty (Jin & Levitt, 1993). Thus, our finding continues prior tradition of digital innovations research and relate to (Huang et al., 2021; Lehmann & Recker, 2022)'s digital core mechanism.

Past research has characterized software project management to control software development process via scope, quality, speed, and frugality (Marasco, 2005). Marasco states that growth of the number of product features leads to increase in scope, length and software quality. Thus, Marasco's model suggests decreasing amount of work to be done per time unit, e.g, completing 3 functions per months instead of six functions would positively affect project schedule. We expand this approach with a core requirement modelling mechanism.

Importantly, we posit that in the Central Asian regional context core requirements modelling is prerequisite for developing digitally enabled process of generating and using generic solutions. Our research extends Lehman & Recker's (2022) Model of continuous post-launch product development by proposing a mechanism to mitigate negative consequences of unstable and high-level abstract business requirements on budget scope and schedule. Moreover, our study also acknowledges drawback of short-term requirements management and planning.

5.2 Drawback of short-term requirements management and planning

While much research has been devoted to balancing agile teams' learning velocity and software delivery velocity, the context of unstable business requirements was not considered (Gothelf & Seiden, 2017; Marasco, 2005). A prominent lean startup tradition advocates for focus on learning, not outputs (Ries, 2011). However, although agile project management advocates for short planning sprints, our study shows that in the context of unstable requirements it is crucial to model core requirements across the whole product lifecycle. We have discussed this finding with author of The Software Development Edge: Essays on Managing Successful Projects,

"*RUP preceded Agile and was somewhat in between the two extremes of Waterfall and Agile. In my view, the swing of the pendulum away from Waterfall over to Agile was an overreaction. To this day I believe that there was way too much marketing hype and too much money paid to Agile consultants in order to get it to work. And it definitely had scaling problems*" (J. Marasco, personal communication, June 27, 2022). While our study complements

this stream of thought by putting emphasis on embedding "Waterfall style" long term requirements modelling into an agile practice.

5.3 Practical Implications

A core interest of product management practitioners is product growth and scaling (Huang et al., 2017; Oz, 2005). But few studies showed how product growth should be managed in Central Asian regional entrepreneurship context. We bridge this gap by describing how Central Asian product managers can build and grow digital products by applying digital technologies properties such as separation of front-end and back-end layers which provides more flexibility during product implementation. Prioritized requirements should be embedded to core requirements and modelled across whole development lifecycle.

Secondly, we reveal how managers, UX designers, software engineers and domain experts interact to deliver a product within unstable requirements context. We show how to increase digital project velocity by controlling number of product features in the backlog. This fact calls for managerial attention to focus on benchmark analysis and user story prioritization validated by key stakeholders during new product development.

5.4 Limitations & further research

There are several limitations to our study. Our main source of data were interviews which could be prone to interview bias. By using additional data sources (logs from IT system, Jira product backlog, features backlog) and covering almost all project participants we tried to mitigate the potential bias. Future research could expand data sources to include review of commits on code repositories, meeting protocols and others. Moreover, we didn't elaborate in detail the effects of collaborative software development on business requirements and feature backlog change. Finally, we studied a single case. As such, we couldn't assess the effectiveness of identified mechanism for ensuring digital ventures growth in a different domain. Further research may investigate whether product team's behaviors differ in other domains.

ACKNOWLEDGEMENT

I am grateful to Gulkamys Eshtaeva for her support and to Dr. Erdogan Ekiz from TEAM University for an inspiration to develop this research paper.

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