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User-Centred Design Methods, Time to Market and Minimum Viable Product in Startup Development Practices

Master's Thesis

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Aalto University School of Science Master's Programme in ICT Innovation		ABSTRACT OF THE MASTER'S THESIS
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<p>Abstract:</p> <p>This study aimed to answer the question whether time to market and competition pressure are important issues for new companies with a software products and whether they affect the development process and decision-making regarding releasing or the product. The study is based on the literature data and interviews with six technology startup companies. It investigated how the concept of minimum viable product is used by the companies for testing the product-market fit and how they apply principles of user-centred design for providing a good user experience of their products. I found that innovative products helped the companies escape direct competition. The development cycle was mostly defined by the industry standards and concrete customer needs rather than the competition pressure. User-centred design practices are widely implemented by the startups, but they are not always complete. In today's software market, the experience that the customers are provided with new products seems to be more important for the startups than formalisation of the development process and the product's time to market.</p>		
Keywords: startup companies, user-centred design, time to market, minimum viable product, new product development		

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1. Introduction

1.1 Background and motivation

Many countries are experiencing a dramatic change of the economy structure: new small companies are often becoming the main source of new jobs nowadays (Denning 2014). The startup culture is fostered by governments, at the municipal and national levels. In Finland, decline of the technology giant Nokia caused creation of many new small tech companies (startups) that are often born by the former Nokia engineers (Bosworth 2012). Together with the popularity of the Lean Startup concept, it created a boom of the entrepreneurial culture.

However, despite of various success stories heard from the mass media, most startups fail (e.g. Crowne 2002). While there are indicators about the positive trend in the survival rate of new companies, at least in the USA (Fairlie et al. 2016), currently only about half of new American businesses survive their 5th year (U.S. Bureau of Labor Statistics 2016).

There are various factors affecting startup survival rates (e.g. Marmer et al. 2012, Hyytinen et al. 2015). One of them is the market demand that is considered to be the key for the startup longevity. In a recent survey about reasons for startup failure, “no market need” is called the main reason for fiasco (CB Insights 2017). There are, however, also other important factors, and experience of the users of the product is one of them. “User un-friendly product” was called the reason for failure in 17% of the cases (CB Insights 2017). And while the market needs are usually external reality, providing a good user experience is under developer's control.

The importance of user experience (UX) for product market success has been widely recognized only during the recent years (e.g. Klein 2013, Gothelf & Seiden 2016). The evolution of user experience of various digital products, e.g. web sites, for the better is

obvious to any observer who has been using the Internet for more than a decade. Obscure and less-than-usable user interfaces of many kinds were much more common in the past. However, despite of the common understanding of the importance of paying attention at user experience and having various famous positive examples, startups are often unsure about how to apply UX design methods for their precise needs (Olsen 2015).

Cooper (2004) suggested the following explanation for the phenomenon of the widespread poorly designed interfaces: the usability was often sacrificed to the speed of the development in order to be on the market on time. Besides, the product requirements were often seen as an assembly of features defined mostly by marketers. The whole experience of prospective users of the product and their overall goals were not considered during the development process. Cooper argued that the positive user experience of the product could be a more important success factor than the speed of delivering of the product to the market. Moreover, good user experience creates customer loyalty that can save a company during hard times.

While Cooper's arguments and examples look compelling, I was interested in finding more examples that would confirm them. At the same time, prior to starting the work on this thesis, my initial impression was that the time to market is still considered to be an important driver for new companies with a novice product. This impression was based on mass media, various web publications, blogs and public discussion. For example, being late to market is often feared because of the presumed revenue loss (Johnson 2013). A survey by CGT/Sopheon indicates that "79% of new products miss the launch date" (ibid.).

However, in the above mentioned and other examples, it is not always clear what the launch dates are based on. Naturally, startups fear competitors and feel the pressure to pass the lowest part of the "finance pit" (the time when the cash flow is negative) as fast as possible. They are struggling to deliver the minimum viable product (MVP) as soon as possible in order to prove their concept on the market and receive investments (Blank & Dorf 2012).

Here we come to another term which usage may be confusing. While the original idea of MVP was meant to be the tool for testing the product idea and the designers'

assumption about the market and the users (Ries 2011), this term seems to be often used with different meaning. MVP is commonly considered to be a prototype with a limited functionality. On the other end of the scale, MVP is understood to be a complex delivery for testing all the market assumptions at once (e.g. Higham 2016).

1.2 Purpose

The aim of this thesis was to clarify the use of all these three terms — user experience, time to market and minimum viable product — in the modern startup world and to find out how young companies balance them all while creating new products. I was interested in learning how startups — young small technology companies with limited resources — manage to provide a good user experience of their products and still not to be late for the market, and whether this problem exists in reality.

1.3 Research question

The general research question of this study is:

— What are the factors of primary concern of new high-tech companies in the process of design and development of innovative products?

1.4 Structure of the thesis

This thesis project work consisted of a theoretical and an empirical part. In the theoretical part of this report, I present a literature review related to the subjects of startup companies, minimum viable product, product development, user-centred design methods and time to market. In the empirical part, results of the interviews conducted with six startup companies are presented. The interviews were aimed at investigating whether time to market is a matter of concern for young companies operating in the Information and Communications Technology (ICT) field, how they perceive the concept

of MVP and what their MVP is in reality and whether their development practices correspond to the principles of the user-centred design. The results present the essence of the interviews related to product development, users and customers, time to market, competition and decision-making. In the Discussion the theoretical and empirical parts are confronted.

2. Review of the concepts

2.1 A Startup Company

The term “startup company” can be met in various different contexts. It is mostly used for technology companies at the beginning of their life — during the first years and, for example, until the moment of acquisition by a larger company or until the Initial public offering (IPO). Such companies usually have a potentially high scalability and their product (often a single one) is aimed at the international market. Because the Internet makes distribution of electronic products much easier as compared to logistics of physical goods, the most common product of startups is a digital product, for example, a mobile app. Recently the term “startup” has received more solid definitions, e.g. by Ries (2011) and Blank & Dorf (2012), that can be summarised as a temporal stage of a company that is searching a sustainable and repeatable business model while operating in conditions of extreme uncertainty. This definition means that startups often do not have a clear idea about who their users are, who would pay for their product and how to scale up.

In reality, the term "startup" is mostly used in the ICT field where any young non-service company with a software product may call itself a startup. Such companies are often aggregated in incubators and accelerators that help young companies with office facilities, business advice, networking and funding. However, it is not unusual to hear about the startup concept even from large companies that foster innovation spirit (Hendricks 2014).

2.2 Lean Startup

The Lean Startup concept has its roots in the automotive industry and Agile software development practices (Womack et al. 2007). It was developed as an approach opposite

to the common practices of when a product is developed based on assumptions and fixed requirements collected by market researchers and then released on the market with the hope that it will be accepted by customers. The product may undergo lab usability tests, but prototypes are not usually revealed outside of the firm and only the “finished” version is presented to the market. The Lean Startup approach is fundamentally different: the product is developed in small iterations and tested with real people — potential customers — as early as possible. Each version of the product is used for receiving market’s feedback that is immediately taken into account in the process of further development (Ries 2011).

This approach eliminates the guesswork about “what customers want” and enables substantial saving of resources. The product can be modified at an early stage of the development when it is much cheaper to make changes, the whole concept of the company’s product or business model can be changed (pivoted), or the company can be shut down — all of these without spending millions of investors’ money and years of founders’ life. While the aim of design in general can be seen as a way to prevent foreseeable future failures (Baber & Stanton 1996), the Lean approach suggests that the future cannot be forecasted accurately, only approached through the Lean methods (Tonkinwise 2016).

2.3 Minimum Viable Product

The minimum viable product (MVP) is the cornerstone concept of the Lean Startup approach and is a widely used term. However, despite of the common use of this notion, MVP does not refer to a simple version of the final product that can be delivered to the customers. MVP is not a product as it is often understood in the common meaning of the word. MVP may come in various instances, often as a simple prototype, but sometimes even as a description, a procedure or a slide deck that can be presented to potential customers or investors and that is “good enough” for them to understand the product’s concept. For example, MVP can be implemented as a concierge service that fulfils the customer needs, or in a “Wizard of Oz” technique when human operators execute requests behind the scene instead of a computer (Rice 2011, Gothelf & Seiden 2016).

Essentially MVP is a tool for receiving market feedback as early as possible, and in only some cases it can have a form of a product prototype (Gothelf & Seiden 2016). But first of all, by creating MVP developers are aiming to test the product-market fit, i.e. to get an answer whether the planned product will cause an interest or really deliver a value to the customers (Ries 2011). Finally, MVP is a learning tool that is widely considered to be the key for the startup success (Marmer et al. 2012).

2.4 User-Centred Design

The idea that the product development should be more focused on the user is not new. It emerged as a response to growing frustration of users towards various electronic systems and as a mean for tackling usability problems (Norman 2013). The formal user-centred design (UCD) practices, under various names (e.g. customer-centred, human-centred), were first developed in the 1950s (Gothelf & Seiden 2016) and started to be developed more actively in 1980s (e.g. Holtzblatt & Beyer 1993). The general principles of the user-centred design were later defined in the International Organization for Standardization (ISO) standards; the most recent one is 9241-210 (ISO 2010). The standard defines the human-centred design as an “approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques” (ISO 2010). The standard lists the following general principles of the human-centred design:

- the design is based upon an explicit understanding of users, tasks and environments;
- users are involved throughout design and development;
- the design is driven and refined by user-centred evaluation;
- the process is iterative;
- the design addresses the whole user experience;
- the design team includes multidisciplinary skills and perspectives.

Unlike “traditional”, or generic, development practice where the consumer is usually presented with the final version of the product, the user-centred process, by its definition, puts the prospective user in the centre of the whole development process, giving him an important role in defining what the final product will be from the early stage. In order to enable such user involvement, the user background, working environment and, most importantly, user goals and requirements should be studied and defined unambiguously (ISO 2010).

The methods for user-centred design can be roughly divided into the following groups:

- User research, or ethnographic methods: e.g. contextual inquiry, interviews, observations, questionnaires (Holtzblatt & Beyer 1993, Gaver et al. 1999, Kuniavsky 2003, Rubin & Chisnell 2008, Millen 2000).
- Data analysis methods: e.g. affinity diagrams, cognitive mapping, causal models, creation of personas (Holtzblatt & Beyer 1993, Cooper 2004, Millen 2000, Massanari 2010).
- Design methods: rapid prototyping with paper, wireframes; interactive mock-ups, functioning interactive prototypes (Holtzblatt & Beyer 1993, Cooper et al. 2007).
- Testing methods: cognitive walkthrough, heuristic evaluation, user testing (Nielsen 1994, Lewis & Wharton 1997, Rubin & Chisnell 2008).

The overall aim of the user-centred design methods is creation of a product that would fit the user’s goals. UCD development methods develop products in fast and short iterations in order to obtain users’ feedback as fast as possible and for the earliest possible version of the product when making corrections is relatively cheap.

It is easy to notice that UCD methods have a lot of common with the Lean Startup concept that is based on Agile product development style: shorter, less formal and more customer-oriented development cycles (Highsmith & Cockburn 2001, Manifesto for Agile Software Development 2001, Varma 2015). As a “marriage” of these concepts, the methods and, eventually, the term Lean User Experience emerged (Klein 2013, Gothelf & Seiden 2016).

The Lean user experience methods are built on the idea of customer's goal-oriented, or user-centred, design, Agile development methods and the Lean concept (Gothelf & Seiden 2016). In the core of the Lean UX is a multi-disciplinary team that tests their hypothesis about customer's goals and need and does experiments with a minimum viable product.

2.5 A Brief History of Time to Market

Time to market, or new product development cycle time, can be defined as the time elapsed from the ideation phase to the product launch date when the product becomes commercially available (Griffin 1993, Ali et al. 1995, LaBahn 1996). Traditionally these terms have been associated mostly with tangible products that require substantial time and financial investments for starting-up (Griffin 1993). Therefore, most of the literature data relates to the manufacturing industries.

2.5.1 The length

The length of the product development process is affected by two major factors: the complexity of the product and the difference between its versions: a completely new product takes much longer to develop as compared to a new version of an existing product that is slightly different from the previous one (Griffin 1993). Naturally, a highly innovative and technically complex product takes longer to develop. In the study by Ali et al. (1995), the mean development time of various technical products by small firms was 18 months, or five person-years.

2.5.2 Reasons to hurry

There may be various reasons for the rush to the market. Below there are several tentative groups of such reasons. However, they cannot always be separated from each

other because, for example, losing in a competition always means losing money in the end. Thus these categories are rather conditional.

- Direct competition

The most obvious reason to hurry to the market is to catch up with a competitor who has already a similar product in the market or close to releasing one (Bayus 1997). For example, IBM hurried up to enter the personal computer market in 1980s when that was already dominated by Apple and Tandy; Ford had to speed up development of a new model in order to compete with Chrysler (ibid.).

- Product life-cycle

The struggle for speeding up the product development time has been a common point for many companies given the shortening of life-cycle of many products (Griffin 1993). The harsh competition pressure requires releasing new versions as often as possible.

Examples of shortening life-cycle caused by a harsh competition can be observed frequently in the ICT industry. For example, the major mobile phone manufacturers compete with each other and release new models of gadgets quite frequently.

- Financial

There is evidence that delays in releasing new products can cause significant profit losses. For example, in the car industry the loss can make up to 1 million USD per day (Clark 1989). Even getting over of the development budget may be less detrimental for the profit than shipping significantly late (see Ali et al. 1995 for review).

What means a profit lost for large firms could be a matter of life and death for small companies. Especially for startups with limited funding, receiving revenue from the customers may be critically important for survival. Such revenue would not only bring the break-even point closer, thus justifying the efforts to speed up (Ali et al. 1995), but also considered to be a good indicator for potential investors.

- Catching an opportunity

In certain industries, the window of opportunity for a new product may be relatively short, and being the first in the market provides significant competitive advantages (Bayus 1997). This is especially the case of patentable technologies. For example, when a patent on a drug expires, competing pharmaceutical companies are rushing to develop own solutions and thus shortening the time to market of their product is a critical success factor (Prašnikar & Škerlj 2006). In the case of consumer electronics, the seasonal factor, e. g. Christmas sales, or a major event such as a trade show, may play an important role in the market acquisition (Smith 2004).

In general, pioneering advantage may provide a larger market share, pricing freedom, opportunity for establishing industry standards and create a company's image as an innovation leader (see Feng et al. 2013 for review). However, the long-term market share may not be affected by the early entry that much (see Ali et al. 1995 for review).

2.5.3 Another angle: "take your time".

On the other hand, there may be reasons for not hurrying at full speed because the ensuing costs may not be worth the results. The product development may turn out to be a marathon, not a sprint, and the development speed may not be the most important factor for winning. Crawford (1992) summarized several groups of "hidden costs" of accelerated product development. The most obvious one is quality: forcing developers to deliver the product faster may result in defects that surface later and incur unpredictable costs. An inferior product released early would fail in the market or may even have to be recalled. This happens sometimes, for example, in car industry (Bayus 1997; see other examples in Cooper 2004).

Furthermore, there is evidence that it is the quality of the product, not the timing, that is the key market success factor (see Cohen et al. 1996 for a review). It has been shown that if a new product has a better quality than already existing one, the delayed release of the new product would not affect much its market performance (Lilien & Yoon 1990).

The quality is often defined by the product's "performance" and the amount of new features included in the product release, and they naturally make the product more complicated and longer to develop (Cohen et al. 1996). While many of such features may create additional value for the customers, the amassment of features by itself may be a poor indicator of success, especially without a proper study of the user's goals (Cooper 2004).

While the exact meaning of quality or performance is not always explained in the literature, user experience can certainly be included in these categories. Premature product may provide a poor user experience, leading to the users' disloyalty in case another option with a better user experience appears in the market (Cooper 2004).

2.5.4 Costs of time to market

Depending on the current company's situation (product development practices and timing), reduction of development time may decrease or increase costs (Bayus 1997). Hurry to the market can also disable quality testing and correcting found problems, thus increasing amount of unsolved defects (Carmel 1995, Chien & Li 2012). Therefore, the quality assurance may trade off against the development time. The acceleration of time to market is meaningful only when the window of opportunity is relatively narrow, i.e. the risk of losing it outweighs the costs (Bayus 1997). In short, speeding up can be considered as a viable option in case the costs will be covered by higher returns, which, in turn, depend on the dynamics of sales, market window, product lifetime and costs of accelerated development (ibid.).

2.5.5 How to fight against time (to market)

The product development cycle time is affected by development costs, innovativeness of the product and its technical components that include knowledge and materials (LaBahn 1996). Therefore, the way for reducing the time to market depends on how new and how complicated the product is.

There are various approaches to reducing the development cycle time. One approach that is aimed at saving time without playing down the quality is modifying the project management. Based on the control theory, LaBahn et al. (1996) described two types of project management that are aimed at reducing the time to market: the output control that is based on the project milestones and deadlines and focused on costs, performance and launch date, and behavioural control that focused on defining development steps and procedures.

Formalization of the product development process was shown to positively affect its time (Griffin 1993). The management improvements should aim at keeping strict schedule, improving agility, avoiding mistakes and rework (Smith 2004). Keeping track for benchmarking, i.e. thorough evaluation of the changes, is important for making decisions regarding the acceleration of the product development process (Griffin 1993, Nijssen et al. 1995).

Among other approaches, concurrent engineering can be noted (Handfield 1994). It is a practice when development processes are organized in parallel instead of consequence. Concurrent engineering can reduce overlaps and significantly improve time to market, for example, in Make-to-order products (Handfield 1994).

In the software industry, the management practices for reducing development cycle time evolved from the sequential waterfall type, or stage-gate process (Cooper & Edgett 2012), to iterative (agile, lean) (e.g. Karlsson & Åhlström 1996, Gothelf & Seiden 2016). Simplified structure of the developing organization, reduction of team size and introduction of cross-functional teams by bringing together members with different functional skills and backgrounds, also compile a management approach for cycle-time reduction (Carmel 1995, Nijssen et al. 1995, Cohen et al. 1996).

Development cycle can be affected by outsourcing of certain production parts; however, the effect may be positive or negative (see LaBahn (1996) for examples from the automotive and computer manufacturing, and Prašnikar & Škerlj (2006) for the pharmaceutical industry). On the other hand, a closer involvements of suppliers right from the beginning of the development process is one of the principles of lean manufacturing (Karlsson & Ahlström 1996) and was demonstrated to reduce the development time (Dröge et al. 2000, Feng et al. 2013). Component reuse can

substantially reduce the cycle time of both physical and software products (Carmel 1995), but this approach should be applied with care because it may result in poor user experience of the product.

Customer involvement was also shown to decrease time to market of new products (Feng et al. 2013). This finding aligns with the user-centred design practices and empirically confirms that such approach do not necessary trade-off between the user satisfaction and the product development duration.

Trading-off against quality can be used for cutting the time to market in certain cases, for example, in products with short life cycle like semiconductors (Chien & Li 2012). Such trade-off, however, should only be allowed with consent of the customers and the condition of following a clear protocol and statistical control of the manufacturing process (ibid.).

3. Methods and Data

3.1 The companies and their products

The empirical part of this study is based on interviews conducted with six startup companies operating in the ICT area (Table 1). All companies except of one were of similar age — about one year. One company was established more than three years ago. The companies were mostly also at the close phases of development: their products were already initially validated on the market, the companies were getting revenue from customers and were seeking to expand their business. The reason for selecting these companies was the assumption that at these stages of their evolvement startups should already have established working practices but at the same time still have fresh memory for reflecting on their development process.

The official age of startup companies, however, does not always reflect the time spent on the product development because in many cases the initial research was done during a few years before the official registration as an academic research or when one of the founders was engaged with another company. The size of the companies ranged from 2 to 15 people involved, including founders and employees. All except one of the interviewed companies were associated with Helsinki EIT Digital incubator; one company was located in Stockholm.

Company 1 provides an online service in the field of event planning. At the moment of the interview it was a small two-person company consisting of two original founders, one is being CTO and one is a business manager. Its product is an online event planning tool.

Company 2 provides a software solution for educating and training in the field of cyber security. Their users are employees of large corporations. The solution is typically ordered by chief information security officers who are thus the company's customers.

Company 3 works in the education industry where it provides a cloud service for managing devices and application content. The product is used by the IT departments of cities and schools, elementary school teachers and students. The purchasing decision is done by the city or school administrations who are the company's customers.

Company 4 operates in the construction industry. It provides a platform for visual information management. Its customers are real estate owners and the users are facility managers.

Company 5 is the oldest and the largest among the interviewed: it has been operating for more than three years and had somewhat established manufacturing and selling practices. It builds hardware and software digital solutions for information system access management. The company is mostly targeting large corporations as customers, while the users of its products are the customers' employees.

Company 6 defines its line of business as "sharing economy of skills", meaning that it provides a learning platform for a wide spectrum of aims. Their customers are various professional communities, organisations and education institutions; the users are the people who need to acquire new skills.

Table 1. General characteristics of the companies, as of April 2017.

	Official age, years	No of people involved	Development phase ¹	Area of business
Company 1	1.5	2	Scaling	Event planning
Company 2	1	6	Scaling	IT security
Company 3	1	5	Scaling	Device remote management
Company 4	1	5	Validating	Construction industry
Company 5	3.5	15	Establishing	Data security
Company 6	1	7	Validating	Education

¹ According to Startup Commons (2015).

3.2 The interviews

Interviews were chosen as the primary method of this study because they enable much more flexibility than, for example, questionnaires. Various related subjects could be explored during an interview. Interviews enable building a rapport between the researcher and interviewee and, thus, may facilitate uncovering "hidden" issues.

The interviews were semi-structured, i.e. there was only a general frame with certain "obligatory" questions. They were conducted in accord with the guidelines for qualitative studies (DiCicco-Bloom & Crabtree 2006). I assumed that using previously validated interview questions makes the results more credible and comparable to other studies, like in the case of surveys (Boynton & Greenhalgh 2004). Therefore, as the basis for my interviews, I used the interview frame developed by Simell (2016) for a study about how user-centred design methods affected startups' success. The frame corresponded the general aims of this study and covered a wide range of issues related to startup's development process. Additional questions related to this study were included in the interviews and certain questions from the original frame were omitted.

In all cases except of Company 6, the interviewees were co-founders of the startups. The interviewees' titles were CEO, CTO, product manager, main developer and designer. The formal title, however, does not always reflect precise duties since founders often have to play many various roles in their startups. The most important factor was that all of the interviewees played essential role in founding and developing of the products.

As the general data, the information about the company's field of business, size, age, the structure of the team and the interviewee's role, tasks and the years with the company was collected. The core parts of the interviews were focused on the product, its users and customers, the design and development process. The conversations concerned the descriptions of the product and typical use cases, the users and the customers, their involvement in the development process and product testing, channels for obtaining user feedback and its use by the team, other elements of user-centred design practices.

The questions also included the ones related to the initial delivery, methods for estimation of the product-market fit and acquiring first customers and investments, the interviewee's interpretation of the minimum viable product. Certain parts of the

interviews were devoted to the competition, market opportunity window, time to market, decision-making about product release and strategy pivots. In order to avoid the stereotyped definitions that could also affect the answers, the terms like "time to market", "minimum viable product" and "user-centred design" were, when possible, deliberately avoided in the conversations until the later stages. The general content of all six interviews is reflected in the word cloud in Figure 1.

Four interviews were conducted live and two were conducted over the Internet with the video chat service Skype. All interviews were audio recorded with permissions of the interviewees. The most essential and relevant information was also taken as short notes during the interviews as a precaution measure.



Figure 1. Adjusted (limited) word cloud based on all 6 interviews.¹

The interviews were transcribed manually with the online service Transcribe². This tool enables playing the sound file and typing the text in the same browser window and controlling the playback with keyboard shortcuts, which substantially saves time while

¹ The word cloud was generated with ATLAS.ti software and adjusted by removing prepositions, various general words and infrequent terms.

² Transcribe — online transcription and dictation software by Wreally Studios. Available at <https://transcribe.wreally.com>

doing the transcription work. The transcripts were then coded and analyzed with the software for qualitative research Atlas.ti³, version 8.

Initially I was planning to exert only what seemed to be the most important and relevant information. However, while making the transcripts, I realized that important details fade from the memory quite quickly. Having the nearly-full transcriptions of the interviews was not only very useful for further analysis, but also provided inspirational reading and discoveries of things others than those directly related to the subject of this study.

The durations of the interviews varied from 21 to 72 minutes, but these numbers, however, do not reflect the information that was derived from the interviews; see Appendix 1 for more details. Because also other issues related to startups were touched during the interviews, small portions of some of the discussions that were not relevant to the subject of this study were not transcribed. The companies were later contacted again in order to verify the respective parts of the Data and Results section; three companies replied to the request; one interviewee suggested minor corrections.

The interviews were coded in several iterations. Totally 24 codes were used (Appendix 2). In many cases the coded citations were overlapping or one citation could have been marked with several codes (Figure 2). The total word cloud for the coded citations is presented in Appendix 3.

³ ATLAS.ti — the qualitative data analysis & research software by ATLAS.ti GmbH.

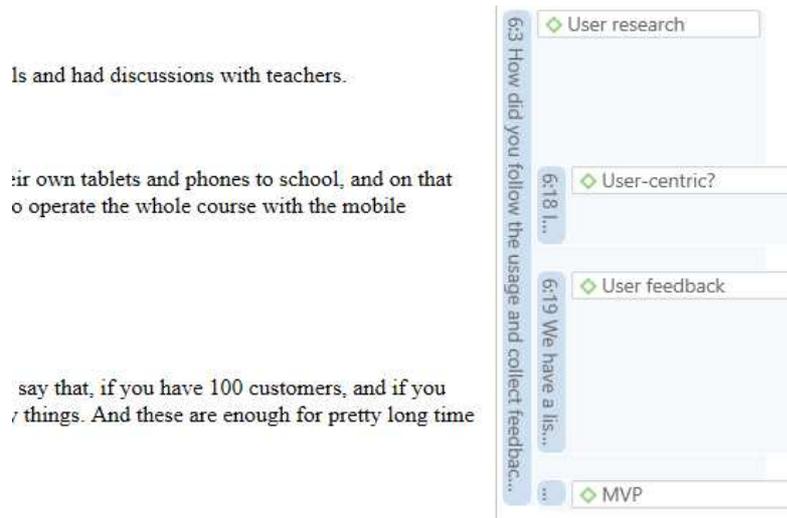


Figure 2. Coded fragment of an interview displayed in Atlas.ti 8. The whole fragment is marked with the code "User research", with smaller citations are enclosed and marked with other codes.

3.3 Usability Maturity Model as a benchmark

As a benchmark for evaluating development practices among the studied companies, I used the Usability Maturity Model (hereafter UMM) developed by Earthy (1999). This model belongs to a series of benchmark models aimed to facilitate user-centred design practices among companies (Jokela 2010). Such models can be used by companies for developing and adjusting their own procedures in order to achieve certain goals, as well as by external auditors. The usability maturity models are, in turn, a subset of capability maturity models used for evaluating and facilitating certain development practices in the industry, for example, in quality management, product design and development (Fraser et al. 2002).

The Usability Maturity Model (UMM) describes seven human-centred design processes that a company should follow in order to ensure that product development is done in accord to established human-computer interaction standards (Earthy 1999):

HCD 1. Strategy development that involves all stakeholders and supported by relevant marketing and user study.

HCD 2. Planning and management of the human-centred design processes that ensures appropriate resource allocation, interactive development procedures and collection and use of feedback.

HCD 3. Specifying the stakeholder and organisational requirements, including analysis of stakeholders, documentation of system goals and its use.

HCD 4. Detailed specification of the context of use, including definitions of users, their tasks and environment.

HCD 5. Creation of various design solutions as proposals and prototypes that are based on results of the above-described processes and include plans for user training and support.

HCD 6. Evaluation of designs against requirements.

HCD 7. Implementation of the selected solution and its further operation, including determination of the impact on the stakeholders and organisation, further customisation, user support and training.

These processes are summarised in Table 2.

Table 2. Human-centred design processes and their base practices.

HCD 1	HCD 2	HCD 3	HCD 4	HCD 5	HCD 6	HCD 7
Ensure HCD content in systems strategy	Plan and manage the HCD process	Specify stakeholder and organisational requirements	Understand and specify the context of use	Produce design solutions	Evaluate designs against requirements	Introduce and operate the system
<ul style="list-style-type: none"> - represent stakeholders - collect market intelligence - define and plan system strategy - collect market feedback - analyse user trends 	<ul style="list-style-type: none"> - consult stakeholders - plan user involvement - select human centred methods - ensure a human centred approach - plan HCD activities - manage HC activities - champion HC approach - support HCD 	<ul style="list-style-type: none"> - clarify system goals - analyse stakeholders - assess H&S risk - define system - generate requirements - set quality in use objectives 	<ul style="list-style-type: none"> - identify user's tasks - identify user attributes - identify organisational environment - identify technical environment - identify physical environment 	<ul style="list-style-type: none"> - allocate functions - produce task model - explore system design - develop design solutions - specify system and use - develop prototypes - develop user training - develop user support 	<ul style="list-style-type: none"> - specify context of evaluation - evaluate for requirements - evaluate to improve design - evaluate against system requirements - evaluate against required practice - evaluate in use 	<ul style="list-style-type: none"> - manage change - determine impact - customisation and local design - deliver user training - support users - conformance to ergonomic legislation

Note. Reprinted from Usability Maturity Model: Processes, by Jonathan Earthy, retrieved from <http://www.idemployee.id.tue.nl/g.w.m.rauterberg/lecturenotes/Usability-Maturity-Model%5B2%5D.PDF> Copyright 1999 by Lloyd's Register of Shipping.

The companies' processes were assessed in according to the capability scale consisting of 6 levels (Earthy 1999):

0. Incomplete process: the organisation is not able to carry out the process.
1. Performed process: the defined purpose is achieved.
2. Managed process: acceptable quality of the product is achieved within defined time scale and allocated resources.
3. Established process: the organisation is able carry and replicate the process on a regular basis.
4. Predictable process: the process is performed consistently by the company and is under clear control.

5. Optimising process: the organisation is able to adapt the process for specific business goals

This model was chosen for the benchmarking because, unlike the ISO standard 9241–210 (ISO 2010), it has concrete description of the processes. This study is not, however, attempted to perform a full assessment of the interviewed companies according to UMM but rather compare the information obtained with the interviews with the descriptions in the model. The format and time frame of the interviews would not allow for covering all components of all seven processes; some components of processes were explored better than others. For example, HCD 1 — Strategy development — was not discussed explicitly during the interviews; in only some cases its activities could be assumed to be performed. Therefore, the evaluation was thus made based on the overall image of the companies that could be derived from the interviews. At the same time, the conclusions were not derived from the declarations like "usability is our top priority" without finding support for this in the actual practices described by the interviewees.

3.4 Ethical issues

No personal information was collected during the study. The interviewees were free to decline the request for the interview; the requests were clearly originated from the researcher and not from the administration of the EIT Digital node. Certain details that could be considered as commercially sensitive or uncovering internal procedures were omitted from this report or generalized. The companies are anonymised in this report and referred as Company 1, Company 2 etc.

4. Results

4.1 The product development, competition and time to market

Company 1

The Company 1 product (online event planning tool) is a specific service that is not aimed at mass market. Its user base has been growing slowly and gradually. According to the interviewee, the company did not feel any competition pressure. Given the company's bootstrapped operation mode — only two co-founders working part-time — the company has not been concerned much with the speed of the time to market process. It perceived the window of opportunity to be wide enough for "being late", with only seasonal variations in the demand of the product. The interviewee, however, admitted that there could be "latent competitors" that might surface later and outrun them at some point. Nevertheless, he believed that

"There is always place for good products and there is always place for making things a bit different".

Given the fact that the product initially had only a free version, apparently the company was not aiming at receiving revenue fast. Providing a good user experience of the product was a higher priority for them over the fast delivery. However, it also brought certain challenges to the team. The ultimate decision about releasing the product was based on the readiness of the core functionality while the visual design could still remain unpolished.

Company 2

There are large competitors at the market of cyber security where Startup 2 operates, but their approach to the problem is different from the other players. The company is therefore hoping to convince the potential customers to "convert" to their product based on its uniqueness and good user experience.

The releases of new versions of the product are made in small iterations. The team tries to identify

"the smallest piece of the software that is creating value, that we can sell".

The first version of the product was operated manually, later it was automated.

Time to market (developing time) was defined by the funding conditions (funding was provided by a state fund). Certain compromises concerning the product features had to be done. However, the company was still relatively free with the release decision and used the "gut feeling" for defining when the product was ready enough:

"something that we were happy about".

Company 3

Since the company's product is a tool used in primary education, a certain pressure on the development process was imposed by the seasonal factor — beginning of the school year and the preliminary agreements with potential customers about starting a pilot project:

"We promised the date but unfortunately we were late. So we discussed the situation with customers and agreed on a new roadmap."

The delay in the product delivery was mitigated with good customer relations that still allowed postponing the pilot project. The pilot version of the product was released based on the readiness of the minimal amount of the core features that were promised to the customers.

In general, the company considered the competition to be intense, but it is mostly happening in the market of enterprise solutions and not so much in the education field where the company is positioning its product. Because the company has started in the Finnish market, being 'the local' provided certain competitive advantage in such sensitive and heavily regulated field as the early education, where the customers are mostly public authorities.

Despite of the existing solutions in the market, the interviewee believes that

"there is always room for a good product"

because those solutions do not fully satisfy those customers at which the startup is focusing. The company believes that if it provides a better solution by focusing at user goals, i.e. building only the needed functionality, the customers may still switch to their product.

Company 4

The product is a unique and novel solution that competes with various old products used in the construction industry and property management. Although there were no direct competitors for the product, there are traditional solutions that are de-facto industry standards. The company needs to "jump over the threshold" in order to reach the majority of the industry customers. Therefore, although the company considers the competition to be strong, they perceive their main challenge to be in overcoming the industry traditionalism and resistance to change:

"Creating something new also increasing the competition, because the <...> industry is a bit resisting to change. They are already using some traditional application, <...> something new for them is totally scary, they don't want to give up existing things and start a new approach. <...> In terms of uniqueness, there is no competition. But in the terms of what people get used to, there is a huge competition. That's our biggest limitation at the moment."

While there are no objective reasons for speeding up to the market like direct competitors, the development process is under a pressure because of the preliminary agreements made with potential customers: if those would be waiting too long, it will be more difficult to convince them to try the new solution. Furthermore, some of the customers are big software companies that are incorporating the product into their own solutions, thus there can be strict delivery terms.

Company 5

Like the previously described startup, the company's products compete with traditional solutions, but the provided technology is innovative and unique. It therefore does not have direct competitors in the data security field in the technical terms:

"We have much less competitors if we define the market."

The release of the product had a self-imposed hard deadline defined by a trade show that company considered to be important to participate. Besides that, there were no other pressure that would urge to shorten the time to market and the product would be released

"when we did enough internal testing and decided that it's stable enough."

The development cycle of the hardware product is relatively long and takes about a year. It is dependent on the technology advance and developments by the partner companies who provide the components (semiconductors). The software products are renewed much more frequently. The new releases are defined by the functionality requests from the customers; the development is done by the company's own research and development team. Because of the subscription-based business model, the advances in the product functionality are more important for acquiring new customers than satisfying the existing ones.

Company 6

The established and popular learning platforms can be considered as the company's competitors, but like in the previously described companies, the startup's product is diverting from the mainstream approach and thus competes with "traditions" rather than with other products on the technical level. The company is therefore not concerned much with those competitors:

"I try to focus on our own game. Looking at other's design is deceiving because you only see what they made public before half a year or one year ago. You are looking at their trail, not where they are going."

The release decisions are defined by the industry and the company's own implementation standards, but not by immediate competition pressure. According to the interviewed person, the company is using "the expectation management" in order to ease the pressure from the existing customers towards the development process. The time-to-market cannot be defined for the company's products precisely:

"The good and bad thing about software is that it is never really finished".

Resume

- New companies operating in the ICT field — mostly software startups — are not concerned much about the time to market in the classical meaning of this term. They are not afraid of 'being late'. They do, however, feel the limitations imposed by the window of opportunity, but such window can be quite large. Such companies often create a new market or avoid direct competition by creating a substantially new product with a serious attention to the user experience of the selected target group.
- The competition does not define the design process and, in general, seems to take surprisingly small part among the startups' concerns where the quality and user experience of the product had much higher priority.

- The product launch date is often defined arbitrary based on the company's inner "gut feeling" and standards rather than the market situation.
- The time to market of startup companies is largely defined by their "promise" to potential customers.

4.2 Minimum viable product: interpretation and implementation

Company 1

Company 1 used an early version of its product for collecting feedback from potential customers. The market feedback was also collected with a website with promotional materials like text description and screenshots of the product, as well as a signup form. The interviewee confirmed that their MVP was the actual product with reduced functionality ("20% of the current version"). The startup also had a demo video at an early stage of the product development, but the video was used for applying to various incubators, not for collecting user feedback.

Company 2

Company 2 used a slide deck that described the proposed functionality of the product before any version of the actual product was created. The results of the presentations were letters of intent from several customers, which were used for obtaining state funding for creating the product:

"We just tried to give the best ideas and show that we are passionate about this problem, the things that we are creating".

The interviewee, however, did not call the slide deck MVP. According to his opinion, "a real MVP" would be a concierge service imitating the use of their product (for example, sending emails manually instead of the software on the server). He understood MVP as an iterative process of testing newly added features one by one by releasing new versions of the actual product:

"Still our product is kind of MVP in a way. I don't know when we will get to the phase when we can say that "ok, our product steps out of MVP phase."

Company 3

The first version of the product with which Company 3 went to potential customers was also the actual product, with only one basic function implemented. It was not, however, designed for the users to test independently. Its demonstration was aimed to explain the product concept and simplicity of its use to various stakeholders and to obtain an agreement of the customers to conduct a pilot testing project. The interviewee did not consider this version as MVP. According to his opinion, MVP was a more complete version that was delivered to the customers for the pilot project that they could already use independently. Moreover, they believe that the current version

"is still MVP, we still change it a lot."

Company 4

At the moment of the interview, the company's product was still at the stage where the customer' data had to be processed manually by the developers. Similarly to the case of Company 3, the early prototype of the product was used for presenting their solution, receiving requests from the potential customers and making agreements about pilot projects. For the direct question whether that demo version could be called MVP, the interviewee replied:

"In terms of convincing people — yes, but in terms of technical development — no."

Company 5

For seeking seed funding from investors, Company 5 used a set of slides that demonstrated the concept of the product. Thereafter a prototype of the hardware product was built and demonstrated at a trade show. The company, however, found that demonstration of video that showed both the hardware and the software products was

enough for drawing attention to the products and explaining its functionality. The initial slide deck is clearly perceived by the interviewee as the company's MVP.

Company 6

The company's initial delivery to potential customers was an interactive demo version of the product. The interviewee, however, told:

"I wouldn't call it MVP because it hardly covered maybe a fraction of functionality, it was more maybe a proof of concept".

It was used for collecting feedback from external test users, as a pitching aid, as well as the company's internal communication tool. What the interviewee considered as MVP was a functioning web prototype, "quite rough and raw". He believed that it still will be "in the unpolished state for quite a while." The user tests of that version of the product were used for design changes, "some sort of reality check".

Resume

- The interviewed companies had various versions of MVP, and their understanding of what MVP is also differed substantially.
- MVP was used for initial user testing, acquiring potential customers, making preliminary agreements, getting customer feedback and obtaining seed funding.
- In several cases the startups would formally consider their product to be MVP only if it was a version of the real product, while simple prototypes or presentations were designed solely for demonstration purpose and were not considered to be MVP.
- Two startups had "Eternal MVP" - current product is perceived as an experimentation tool.

4.3 User-centred design practices in the startups

The development practices of the interviewed companies were confronted with the components of seven processes described in the Usability Maturity Model (Earthy 1999). The processes that are referred as HCD 1, HCD 2 etc. correspond the ones in Table 2 in Methods and Data. The findings are summarised in Table 3 in the end of this section.

Company 1

A clear knowledge in the domain (HCD 4) provided the company with the initial ideas about the stakeholders and the market (HCD 1, 3). While it seems that no specific market intelligence was collected in advance, the more advanced understanding of the customers and the market moved the focus of the product (HCD 1). The system was developed through various prototypes that were, however, not tested with relevant users but with people available for such tests ("friends and family testing"). Nevertheless it seems that most of HCD 2, 3 and 5 were implemented. Although no formal prototype evaluation (HCD 6) seems to be done, customisation (HCD 7) is done quite extensively:

"Ninety percent of the things we do come directly from the user requests".

Given the slow growth of the user base, the adequate user support still can be provided through personal contacts with the customers (HCD 7).

The company's position on the capability scale can be identified at Level 1 — "performed process" (Table 3). The company is yet to develop a management practice in order to sustain the user-centred activities when the user base will grow out of the capacity of the two-person team. It will not be possible to continue obtaining user feedback, its processing and providing adequate support with the current practices.

Company 2

The founders have personal industry experience in the area of the product's focus and thus can represent stakeholders (HCD 1). Collection of the market intelligence (HCD 1) and identification of organisational, technical and physical environments (HCD 4) was done through meetings with potential customers. User feedback (HCD 6) is collected through personal contacts like chat, via the sales personnel, as well as with the Net Promoter Scores. The analysis of the feedback is a regular practice that involves the whole team (HCD 2), but the real users were not interviewed before the first version of the product was released. The user feedback is actively used for development (HCD 6, 7). User support is implemented through an integrated chat system (HCD 5, 7).

The startup can be evaluated at the Level 2 — "managed process". The company's user-centred designed practices are well established and performed with confidence. Given the young age of the company, the process is still "under construction" and may need further modification when the product becomes more mature.

Company 3

The market intelligence was collected through market research and interviews where the stakeholders were contacted; the system requirements were also clarified through these contacts (HCD 1, 2, 3, 4). Based on these data as well as close cooperation with the users (school teachers), the system goals, user tasks and environment were defined. The feedback is regularly collected and utilized in development process (HCD 6). Customer support is also done through personal contacts (HCD 7). The prototyping is done occasionally but does not seem to be a regular practice. While the users were presented with some initial demo version, there were no iterations with the users until there was already a functioning product. The implementation was based on users' feedbacks, but the final decisions regarding the interaction design were done mostly by the product manager:

"When you talk about user interface, everyone has their own opinion. I know that you just need to make a decision."

The profound evaluation of prototypes (HCD 6) is therefore seems to be missing.

The company's capability can be evaluated as close to the Level 1 — "performed". There was no evidence that it is planned to be further improved and reaching the Level 2 looks problematic in the near future.

Company 4

The founder's personal experience provided the knowledge about stakeholders and environment (HCD 1, 4). Minimum viable product in the form of a prototype presentation was used for collecting initial customers' feedback; the latter was the basis for the product modifications (HCD 6). Only one potential customer was closely involved in the product development (HCD 2). Customers are, however, intensively involved in the customization of the product (HCD 7). Customer support (HCD 7) is done through a concierge service since the current version of the product requires manual customer's data processing by the developers.

The company is performing selected components of several processes, but it has not established routine user-centred practices yet. Therefore it is still at the Level 0 — "incomplete" — at the capability scale.

Company 5

The stakeholders' representation (HCD 1) is based on the founders' background in the industry. The potential customers were involved since the concept development (MVP) (HCD 2, 3, 4). The prototype was tested with the potential users (HCD 5, 6) but there was little actual user involvement in the building process. There is no established routine for collecting user feedback at the moment:

"it is the plan for the future".

A dedicated user experience specialist is mostly involved in the development of interaction design and prototypes, while the product manager is sporadically collecting user feedback. The initial user interface design was based on

"the expert opinion by the founders".

The market demand affects the functionality of new versions (HCD 7).

The company is at the Level 0 — "incomplete" — on the capability scale. It has a clear understanding and urge to move further, which is indicated, in particular, by the recent hire of a dedicated user experience specialist.

Company 6

The stakeholders' representation is done through the domain knowledge of the development team (HCD 1): the company was founded based on

"the domain expertise of the founding members that they acquired based on working in education scene".

The users are exposed to the design at all stages, starting from early prototypes (HCD 2, 3, 4, 5, 6). The observations and user feedback serve as the basis for design decisions (HCD 6) but do not affect them directly. The whole team is involved in the user feedback analysis. A high level of assistance is currently provided to the early users (HCD 7).

The startup is clearly at the Level 1 — the user-centred activities are performed well. The company is still developing their procedures along with the product itself. The practices thus do not look matured yet (established).

Table 3. Implementation of the human-centred design (HCD) processes by the interviewed companies and overall evaluation of their capability. The processes and capability levels are according to Earthy (1999) (see Table 2).

	HCD 1	HCD 2	HCD 3	HCD 4	HCD 5	HCD 6	HCD 7	Level
Company 1	*		*	*	*		*	1
Company 2	*	*		*	*	*	*	2
Company 3	*	*	*	*		*	*	1
Company 4	*	*		*		*	*	0
Company 5	*	*	*	*	*	*	*	0
Company 6	*	*	*	*	*	*	*	1

Resume

- All the interviewed companies performed most of the UCD processes at least at some level.
- Formal correspondence of the performed activities to the described processes does not guarantee that the startup is actually capable even at the minimal Level 1.
- Most of the startup companies do not have established UCD practices or formalised UCD processes yet.

5. Discussion

The product development cycles, competition and time to market

Intensified competition and acceleration of product obsolescence cause shortening of life-cycle of products and, subsequently, the production cycle (Cordero 1991). Companies are releasing new products to the market more often than before. This demanded shortening of the product development cycle, or time to market (Griffin 1993). These observations were done on mostly physical products that replace each other and which versions are usually quite different. Development of new versions of such products takes months or years (Griffin 1993).

A similar situation is occurring presently on the software market — however, on a different time scale. While incremental development was recognized as a significant factor for reduction of the development cycle long time ago (Smith & Reinertsen 1995), only currently it has become ubiquitous. For example, in this study, Company 2 defines new versions by "the smallest piece of the software that is creating value".

The process of new software products development is much shorter as compared to tangible products and measures in months. New versions of mobile applications may be pushed to an app store on a weekly basis (compare to 1–2 year periods between the major versions of software in 1990s — see Carmel 1995). Furthermore, the sequential versions of new software products may be very close to each other. Our interviews indicated that sometimes the release of a new version may be caused by a "bug" needed to be fixed in the previous one (and then the companies would not even call such releases a new version) and sometimes by a customer's demand. At least one company (6) underlined their attempts to have an improved user experience in new versions: "I also try to push for small UX wins each release."

Given the low cost of distribution through the Internet, new versions can replace the previous ones very often. For example, the mean time between deployments of new versions of software by Amazon is 11.6 seconds (Jenkins 2011). The difference between the time to market of physical (hardware) and software products is also illustrated in this study by the example of Company 5: it had products of both types and the development cycle lasted, on average, 1 year and 3 months, respectively.

There are different consequences for early or late market entry depending on the novelty and the type of the product (Lilien & Yoon 1990). In the case of tangible products, while the market and technology are getting more mature, it is more difficult and more expensive for newcomers to enter the market because the market leaders have already accumulated significant experience and their products are getting more polished (Pérez 2001). At the same time, the long-term market share may not be affected by the early entry that much (see Ali et al. 1995 for review).

For innovative (or even revolutionary) products, the window of opportunity may be quite wide. Innovative products often create a new market where there can be enough space for many players. For example, by launching the first iPhone and the App Store market place, Apple created a new market for smartphones. Apple, however, does not permanently dominate the market it created: its closest competitor Samsung often sells more devices (Strategy Analytics 2015). This is an example how new technology created opportunities for many more players. An interviewee in this study told that "There is always a pressure you feel that the window is closing, but there is always room for a good product."

Interestingly, none of the interviewed startups seemed to be concerned much about competition or being late on the market. According to the interviewees, "certain competition is good" and "there is always place for good products". By innovating, the companies avoided direct competition with existing solutions on the technical level and may even create a monopoly. The founder from one of the startups addressed this with the following expression: "We have much less competitors if we define the market".

In at least two cases, the studied companies had to compete not with other players but rather with "traditions". For example, the construction industry where Company 4 operates is considered by the interviewer as very conservative. It is therefore difficult to

convince the business customers to implement the new solution. This situation resembles the "chasm" between the early adopters and the mainstream customers described by Moore (2014).

Being involved in the innovation business may also be risky, especially for startup companies. In certain cases "too much of innovation" may be associated with a lower survival rate as compared to less innovative startups (Hyytinen et al. 2015). This issue, however, was not discussed in the interviews.

It was noted before that innovative products create new market because they satisfy specific user needs that were not addressed before, but their development time is increasing (Ali et al. 1995). Naturally, the more technically complex the product is, the longer development time it requires (ibid.). While this study was not concerned much with the technical content of the products, they were clearly of different level of complexity. The hardware product of Company 5 required about a year of development cycle (that was also dependent on the components' manufacturers).

The time to market does not seem to be a matter of the companies' concern either. The startups release their products when they think that they are ready using the "gut feeling": "We actually decided that it is good enough". The readiness was often defined by the core functionality of the product that was promised to the prospective customers. The startups, for example, first approached the potential customers, demonstrated them the possible solution and concluded a preliminary agreements about pilot project. Then they are in a hurry not to delay too much and also fulfil the customer's expectations.

Unlike in the case of, for example, consumer electronics where the seasonal factor often plays an important role in the market acquisition (Smith 2004), the software market seems to be mostly free from such dependency. Only two of the interviewed startups had seasonal factor as one of the reasons for release decision, which was based on the nature of their markets (education and academia). As it was correctly predicted earlier, the development of the delivery channels (the Internet) removed the dependence of software companies from the "market rhythms" (Carmel 1995).

Managing the product development

All of those said above do not mean, however, that the startups are not in a hurry. They have certain obligations towards existing or prospective customers. Even in the absence of direct competition, too long development process still may cost them a market share as prospective customers may not be willing to wait too long. Therefore, in certain cases the startups still needed to speed up the development. Simell (2016) found that, in his study, startups perceived time limitation as one of the most critical factors.

As we saw from the literature, reduction of development cycle time often happens at the costs of quality (Bayus 1997). However, an inferior product released early may fail in the market or even have to be recalled. This happens sometimes, for example, in car industry (Bayus 1997; see other examples in Cooper 2004). Premature product may provide a poor user experience, leading to the users' disloyalty in case another option with a better user experience appears in the market later (Cooper 2004).

Furthermore, shortening development time may require reducing the amount of features included in the software. While features themselves are not an indicator of the product's performance or customer value, features of similar products on the market may play an important role in competition between manufacturers.

The trade-off between the quality, features and time to market (Carmel 1995) still exists and affected the development process, at least for some of the interviewed companies. Company 2, for example, admitted that they had to cut on the features in order to deliver the product faster, otherwise they feared to lose a potential client. A founder from Company 4 explained it like this: "We have been talking with [customers] for more than a year, to introduce this application and technology. And if we cannot provide anything to them, username and account that they can start using, then they will become far away from what we are doing. That's why I need to finish [development] quickly."

The development cycle can be affected by outsourcing of certain production parts; however, the effect may be positive or negative (see LaBahn (1996) for examples from the automotive and computer manufacturing, and Prašnikar & Škerlj (2006) for the

pharmaceutical industry). In our study, Company 2 outsourced their product development which resulted in fast delivery of the pilot version of the product.

As it was found earlier, a higher product quality may not necessarily be associated with a longer cycle time: Ali et al. (1995) found that small companies with a shorter development time may produce higher quality products (though there seems to be no instrumental evidence for this). The quality, however, can be maintained with the diminishing of the cycle time if the product becomes technically simpler (ibid.). This was confirmed by the interviewee from Company 2: "Typically simplicity scales and complexity does not".

In the innovation software business, it is more important to have a control over development process than to perform it at an exhaustive speed. While the companies in this study often did have deadlines, those were mostly self-imposed based on the company's internal objectives rather than defined by the market conditions. Sometime these objectives could be based on preliminary agreements with customers or the developers' perception of the product quality and standards. Carmel (1995) noted that software companies often define deadlines for release of their products, though these deadlines are often "soft" and commonly missed. Like other elements of uncertainty in startup's life, these deadlines may also be uncertain and could have ways to be extended. In our study, Company 3's good relations with its customer enabled to postpone the pilot project despite of the initially missed deadline.

Measuring and comparison of time to market is often complicated because it requires some common formal metric and clear definitions of the start and the end of the development process (Griffin 1993). In startups, these formal metrics are even more difficult to identify. The interviews indicated that the end of the development process can hardly be defined clearly for innovative software products. As one of the interviewees put it, "our product is never really finished". Since the agile development principles are widely accepted by startups, short iterations and repeated 'review' of the product are becoming a common practice. While established companies usually use some standardized product development processes (Cooper & Edgett 2012), startup companies often reinvent this process for themselves depending on their needs and team structure (Blank & Dorf 2012).

The aforementioned is also applicable to the design practices used by the studied companies. Innovative product development, especially at an early stage, may not be fitting into a standard evaluation scale: while user involvement may be intense, there are seldom established practices can be identified. Therefore, the Usability Maturity Model (Earthy 1999) may not be suitable for evaluating startups (but still can be used for developing their practices in accord with the best user-centred design standards).

The move away from formal planning may be beneficial for small companies. For example, in the case of choosing a strategy, less formal and flexible strategy planning as compared to textbook approach seems to be the key for success in small software companies (Rönkkö et al. 2013). Simell (2016) found that the lack of structured design process among startups was not associated with a lower success of such companies. For example, using "own judgment" instead of conducting additional user studies was effective for several startups in his study. In general, the companies were using different procedures that were fitting with own needs and the team capabilities (ibid.). Therefore, for small companies, especially where the developers have personal knowledge of the domain, formalisation of certain processes, like strategy development, context of use and environment identification (HCD 3, 4 in the Usability Maturity Model — see Table 2), may not be productive.

The Usability Maturity Model

The Usability Maturity Model (Earthy 1999) is much more comprehensive than just being directly focused on users. The human-centred design processes described in the model cover a wide spectrum of activities from the market intelligence to evaluation of the completed product on the customer (Table 2). As such, the model describes an ideal organisation that would perform a well planned design in according to those procedures. This does not seem to be the case with any of the startups in this study: most of them still did not have established development practices or formalised user-centred design processes. This situation can explain what looks like an inconsistency in Table 3 where the performed processes are marked and evaluated against defined

capability levels. For example, Company 5 performed some activities in all of the HCD processes, but that was still not enough for reaching the Level 1.

Since this study is not a proper audit of the company practices, it can be admitted that my interpretation of the startups' activities could miss some of them. The Usability Maturity Model was not explained to the interviewees and I did not ask explicit questions about the processes. Therefore, it is possible that only those activities that were clearly mentioned during the interviews were correctly identified.

Furthermore, even if the processes seemed to be incomplete, it is still possible that they satisfy the company's' needs. And, as found by Simell (2016), startup's own expertise can sometimes compensate for insufficient user data. Therefore, it would probably be misleading to conclude that if a company does not perform user-centred design processes according to the model, then it is not able to provide a good user experience with its product. The latter seems to be affected by the expertise of the whole team. This dependence, however, was not explored in this study and could be a subject of a future research.

How minimal is MVP?

The studied companies had various versions of what can be called a minimum viable product. Among those were mentioned: a slide deck, a video presentation, an early prototype, a demo version of the product as well the actual product with a very limited functionality. All of those versions could be called MVP according to Rice (2011). However, only about a half of the interviewees would call their initial delivery to be MVP. According to the other interviewees, in order to satisfy their perception of MVP, the delivery should have the qualities of a real product, perhaps with limited functionality. For example, the representative of Company 2 considered their product, which is being actively sold and clearly has qualities of a mature product, still to be MVP. This division of opinions could reflect a general confusion about the term as well is a fear of the interviewed persons to "fail" in fitting the company's delivery to the definition. However, independently on the subjective perceptions, in all cases the companies had some early tool used for testing the product-market fit.

User experience as the gate to the market

The situation on the software products market seems to be different from the classical picture of a mature market. We hear about new services or applications on a daily basis, and in most cases these products are not the first in the market. For example, while the industry of travel information is dominated by a few resources, such as Google Maps and Trip Advisor, there is a constant influx of new web services that often provide similar information in a different package, and they still seem to be able to eat away a piece of the market pie. This may be partly due to a better user experience of the new products: being the first to market does not guarantee customer loyalty (Cooper 2004). In my study, several interviewees emphasised that providing their customers with a good user experience is the paramount goal of their companies, and this statement was confirmed by the development practices.

Most of the works cited in the literature review related to the time to market problem were done during the “pre-UX era”. User qualities of the products described in those publications were often hidden under the term “performance”. For example, Bayus (1997) described a scenario when development of a low performance product can be accelerated at relatively low costs, but stressed that such product may not ensure the competition success. Nowadays, user experience became one of the most important factors for market success. Customer involvement was found to be a critical factor for success of agile software development projects (Chow & Cao 2008).

All of the studied companies identified the importance of user-centred design, which was reflected in the interviews. Of the six interviewed companies, four had a dedicated user experience specialist in the team (1, 2, 5 and 6). In the study by Simell (2016), the startups considered to have a UX designer in the team as very important quality. Among the startups interviewed in my study, the lack of a dedicated user experience specialist clearly affected the decision-making process. For example, in the situations when a balance required between the business interests and usability of the product, the latter could not always be guaranteed if the decisions are done by, for example, a product manager. The companies without such specialist in the team were among those which user-centred design process was incomplete. This limitation seemed to be well

recognised by the companies, and even those startups performed many of the UCD processes at least at some level. In fact, all of the studies companies performed at least some elements of most of the human-centred design processes. This may indicate that the importance of user experience for product success is understood and widely accepted by the startup community, even though it is not always articulated clearly and performed systematically.

Product development cycle time and sustainability

With the move to the Information Technology era, many products and services became intangible software applications, and markets became more segmented (Pérez 2001). For example, many physical objects, electronic or mechanical devices — e.g. a compass, a guide book, a dictionary, a music player, a GPS navigator — became just an icon on the screen of a smartphone. They moved to the category of software products, with the ensuing advantages that described above. This trend clearly complements the sustainability of the ICT industry: manufacturing of one mobile phone may require fewer natural resources than creating several separate physical devices while providing the same information and services.

On the other hand, modern consumer devices tend to become obsolete at an ever increasing pace. For example, having a perfectly functioning 20–30 years old mechanical photo camera that was a normal practice in the past, but using a smartphone that is more than 2–3 years old may be problematic in the era of daily software updates. However, in order to make a solid conclusion about this issue, the full ecological footprint of modern consumer products should be examined. This may be a subject of further studies that could compare various development practices.

6. Conclusions

This study was aimed to analyse how new innovative high-tech companies (startups) manage time to market and user experience of their products. I found that their development cycle is mostly defined by the industry standards and concrete customers rather than competition pressure. These companies often manage to avoid direct competition by developing highly innovative products in the lean style and with a serious attention to the user experience. User-centred design practices are widely used by startups, but they are not always complete.

If we consider again Alan Cooper's (2004) statement that providing a good user experience may outweigh the time to market, we can see now that the issue is more complex and there are many members in this equation. However, results of my study demonstrate Cooper's arguments were heard very well by the startup community: for all of the interviewed companies, the user experience was the matter of much greater concern than the time to market.

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Appendix 1.

General information about the interviews.

Company	Interview duration, full minutes	Number of words in the transcript	Number of coded quotations
Company 1	32	2135	20
Company 2	50	2803	32
Company 3	46	2463	30
Company 4	31	1923	22
Company 5	21	2391	28
Company 6	72	3060	25

Appendix 2.

The codes and the amount of quotations in six interviews (the codes related to the general information about the companies are excluded.)

Codes	Total no. of quotations
Competition	11
Customer motivation	1
Development process	7
Minimum viable product	23
HCD 1	5
HCD 2	7
HCD 3	5
HCD 4	6
HCD 5	5
HCD 6	6
HCD 7	3
Pivot	5
Prototyping	5
Release decision	14
Time to market	16
User feedback	18
User research	13
User-centric?	18
Users and Customers	11
User Experience	11
Window of opportunity	3

