

What is a Minimum Viable (Video) Game?

Towards a research agenda

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Abstract. The concept of ‘Minimum Viable Product’ (MVP) is largely adapted in the software industry as well as in academia. Minimum viable products are used to test hypotheses regarding the target audience, save resources from unnecessary development work and guide a company towards a stable business model. As the game industry is becoming an important business domain, it is not surprise that the concept has been adopted also in the game development. This study surveys how a Minimum Viable Game (MVG) is defined, what is reported in extant literature as well as present results from a small case study survey done to nine game development companies. The study shows that despite popularity of minimum viable games in the industrial fora, the presented views on the concept are diverged and there is lack of practical guidelines and research supporting game companies. This study points out research gaps in the area as well as calls for actions to further develop the concept and to define guidelines.

Keywords: Minimum viable product · Minimum viable game · Game business.

1 Introduction

A key characteristic of the modern business world is *speed* [10]. An often repeated argument claims that the pace of business is going to even increase in the future [7, 20]. The requirement for speeding up is visible also for start-ups, which aim to quickly find a repeatable and scalable business model [4]. As it is frequently stated, start-ups are lacking time and resources [12], and therefore, it is crucial for them to find quickly whether their product or service is suitable for markets.

In the beginning of the 2010s, the so-called *Lean Startup* methodology (LSU, hereafter), by Eric Ries [35], started to gain popularity. The methodology aims, through continuous hypothesis testing, at validating whether there is business potential in the product or service. One of the methodology’s cornerstones is the concept of *Minimum Viable Product* (MVP, hereafter). The concept was first defined already in 2001 by Frank

Robinson (c.f. [28]), yet it became widely known with the raising popularity of the LSU [5]. According to Ries¹, “*the minimum viable product is that version of a new product which allows a team to collect the **maximum amount of validated learning** about customers with the **least effort.**”²*

The MVP concept can be seen as continuum of Blank’s [3] *Customer development* methodology. In this methodology, Blank’s key advice, for new entrepreneurs, is to face potential customers early upon—informally referred as the ‘*Get out of the building*’ principle [4, 15]—to collect valuable information on what customers want and are willing to pay for. As the objective of the LSU is to avoid of building a complete product before learning that it is not valuable for the customers [35], the concept of a minimum viable product fits well to test the suitability of product before it has been finished. In addition, it allows a company to redirect its product and strategy to areas that are the most fruitful for the company.

As the global video game industry is estimated to reach a total revenue of over USD 80 billion³ by the year of 2018, it is not surprising that also game development companies and game business advocates have been interested towards the MVP. For example, a senior manager⁴ of Zynga Inc. revealed in an interview that *FarmVille*, a hugely popular Facebook game, was initially launched as a ‘minimum viable product’. In addition, the popular *Pokémon Go* mobile game, by Niantic Inc., is in the grey literature often claimed⁵ to be an example of a successful MVP usage in the video game industry.

However, there are a few remarkable differences between utility software and video games that should be acknowledged when the concept of MVP is adapted to new domains. First, while utility software solutions can be used for several years or even decades without major changes, the expected life-cycle of a computer game is much shorter. For example, the average length to complete the ten most popular games in the HowLongToBeat⁶ service range from around 20 hours to a bit over 100 hours. While there are of course games which core game play can be repeated *ad infinitum*, games are, on average, disposable products that have to impress gamers quickly.

Second, whereas the utility software—such as a spreadsheet programme or a fitness tracker—should aim to help users in all possible ways, the games, instead, should aim to *challenge* the users [43]. Yet, too challenging as well as too helpful games create frustration [40]. Thus, the games’ aim is to reach a *flow* experience [9]. However, this

¹ Eric Ries (August 3, 2009) Lessons Learned: Minimum Viable Product: a guide. <http://www.startuplessonslearned.com/2009/08/minimum-viable-product-guide.html> Last accessed August 17, 2018.

² Emphases added by the authors of this paper.

³ Statista (2018) Value of the global video games market from 2011 to 2020. <https://www.statista.com/statistics/246888/value-of-the-global-video-game-market/> Last accessed August 17, 2018.

⁴ Matt Purslow (February 28, 2011) FarmVille launched as a “minimum viable product”. Took 32.5 million users in one day. <https://www.pcgamer.com/farmville-launched-as-a-minimum-viable-product-took-32-5-million-users-in-one-day/>. Last accessed August 17, 2018.

⁵ E.g., Paul Frazier (August 12, 2016) Pokémon Go is a Minimal Viable Product. <https://www.itx.com/ITX-Blog/Article/408/Pokemon-GO-is-a-Minimal-Viable-Product>. Last accessed August 17, 2018.

⁶ How long does it take to beat your favorite games? <https://www.howlongtobeat.com> Last accessed August 17, 2018.

should be done with little or no delay as a gamer might get annoyed and switch game to another. Thirdly, the user experience and playability—i.e. overall quality of gameplay—is everything [32]. Whereas small irritating mistakes in a utility software can be tolerated for years, these can be fatal in a video game.

These contradictions between video games and utility software turn our focus towards the use of the minimum viable product concept in the game industry. The MVP was initially promoted for utility software solutions where adding a new feature or pivoting product’s strategy would be more feasible approach than in the game industry. While MVPs in the software industry have been previously addressed (e.g. [15, 28, 33]), to the best of authors’ knowledge, only a little of using MVPs—or *Minimum Viable Games* (MVGs, hereafter)—in the game industry is discussed in the extant literature (e.g. [19, 36]).

The objective of this paper is to study how computer game start-ups perceive and use MVPs in their businesses. The study’s approach is explorative, aiming to shed light on the current practices and extant knowledge. We use a recent structured review as a starting point and present an unstructured literature review on the area. As empirical data, we use a large global survey done with software start-ups (c.f. [25]). In total, the survey received 86 start-up stories and more than 23 000 data-points. In this study, we focus on the subset of the start-up companies identified to be video game companies. To the best of authors’ knowledge, this study presents first empirical observations from using MVPs in the game industry. Based on the problems arisen from the empirical material as well as from the extant literature, we discuss needed future research actions and lay some building blocks for further inquiries.

The remaining of this paper is organised as follows. Section 2 presents a review of literature as well as positions our view of a MVP. It is followed by a description of empirical research process used as well as an overview of the result in Section 3. Discussion is presented in Section 4 and finally, Section 5 concludes the study.

2 Review of Literature

According to the recent systematic mapping study on the evolution of the minimum viable product concept by Lenarduzzi and Taibi [28], the concept was first discussed by Frank Robinson as early as 2001 and then brought forth and popularised by Eric Ries and Steve Blank. In addition, the term has been discussed, with similar meaning, as early as 1999 by Goodwin and Ball [13] and in 2000 by Junk [21]. Altogether, Lenarduzzi and Taibi [28] found 22 different definitions for a MVP which were mostly published between 2012 and 2015. However, they also pointed out that most of those definitions were not referred or used by other than by the authors themselves.

In this study, we follow the market-oriented line of definitions, e.g., those given by Ries as a part of the LSU methodology. For instance, in his book, Ries [35, p. 93] elaborated MVP’s concept more by stating that it “[i]s not necessarily the smallest product imaginable; it is simply the fastest way to get through the Build-Measure-Learn feedback loop with the minimum amount of effort.” Also, Moogk [29] emphasise the value of a MVP to a new venture for engaging new customers and testing the product’s value proposition.

In addition, it is worth to note that we draw a distinction between a *prototype* and a MVP. In our use, the former refers a product version that is used to test the product inside the organisation. The latter refers to a product version that is used to collect validated learning from potential customers and users. That is, in our use, an MVP aims to maximise learning from real customers—and therefore, from the market—with the minimum amount of effort needed. However, in the extant literature, differences and similarities between a prototype and a MVP are not always clearly defined (c.f. [28]).

In the extant literature, several studies have focused on different aspects of minimum viable products. For instance, Hokkanen [15] studied interweaving user experience design with the development of a MVP. Hokkanen, Kuusinen and Väänänen [16] presented a framework for start-up companies for design Minimum Viable User Experience (MVUX). In addition, Münch et al. [30] studied the creation of MVPs in industry-academia collaboration and Bosch et al. [8] as well as Björk et al. [1] have discussed on the usage of MVP as a part of software development model in early-stage start-ups. Furthermore, in a large survey with more than 4,000 companies, Wang et al. [42] found that early-stage start-ups list MVP as one of the key challenges.

However, the number of empirical studies reporting the use of MVPs in the industry is small. For example, Nguen-Duc and Abrahamsson [33] studied the usage of MVPs in five software start-ups and showed that the concept seems to be useful as a design artefact, a boundary spanning artefact as well as a reusable artefact. Khanna, Nguen-Duc and Wang [22] reported a case study on how two start-ups selected hypotheses they wished to test with their MVPs. The study showed that the relationships between business goals and hypotheses tested in MVPs are complex in their cases.

When the focus is narrowed down to the game industry and in the domain of computer games, the research in new companies and product launches is remarkable scarcer. This is surprising, given that most installed and used mobile applications are games [6, 17]. Furthermore, there is lack of academic research about using MVPs in the game development. However, there is a series of work in grey literature devoted to characterise and guide on using MVPs.

For example, Tyler York⁷ discusses on applicability of LSU methodology and MVPs in the game industry. In addition, some companies have reported their company's approach on using a MVP^{8,9}. However, also alternative views and critique have been presented – the director of developer relations of Chillingo¹⁰, the publisher of mobile games such as *Angry Birds* and *Cut the Rope*, stated that it is disrespectful from game

⁷ Tyler York (April 17, 2012) Making Lean Startup Tactics Work for Games. https://www.gamasutra.com/view/feature/168647/making_lean_startup_tactics_work_.php. Last accessed August 17, 2018.

⁸ Juha Vainio (March 15, 2015) Starting up a game business: Working with Minimum Viable Products. https://gamasutra.com/blogs/JuhaVainio/20150903/252860/Starting_up_a_game_business_Working_with_Minimum_Viable_Products.php. Last accessed August 17, 2018.

⁹ Alew Wavro (October 30, 2015) Astroneer's ex-AAA devs explore a strange new world of indie life. https://www.gamasutra.com/view/news/257267/Astroneers_exAAA_devs_explore_a_strange_new_world_of_indie_life.php. Last accessed August 17, 2018.

¹⁰ Brendan Sinclair (November 19, 2015) "Minimum viable products are dinosaurs" <https://www.gamesindustry.biz/articles/2015-11-19-minimum-viable-products-are-dinosaurs>. Last accessed August 17, 2018.

developers to publish unfinished products and force gamers to wait for major features. In addition, while *Pokémon Go* has been praised as an example of publishing a MVP game in the grey literature, it has also been labelled to be a launch failure due to technical problems and lack of content early on¹¹.

In the extant literature, only Järvi et al. [19] and Rosenfield Boeira [36] have discussed the use of MVPs in the game development. Järvi et al. [19] present a conceptual design for a video game start-up accelerator and discuss on central concepts related to the accelerator program. They define a minimum viable game as a product version “*that implements the core game mechanics leaving out everything else*”. In addition, they state that “*games are holistic products and it is not trivial to know what contributes to the players’ experience and what can be left out of the game*”. Finally, they also emphasise the difference between the MVG and MVP concepts as adding and removing new features in the latter is easier than in the former. In the case of MVG, the authors underline the importance of keeping the gameplay in balance with every changes made.

Rosenfield Boeira [36] discusses how MVPs can be used in the gaming industry and gives advice for the practitioners. The study notes the concepts of MVP and MVG, yet it presents a minimum viable game as a synonym for a MVP in the video game industry. Furthermore, Rosenfield Boeira [36] draws a line between a MVG and a prototype, stating that MVG aims to deliver value to the client whereas a prototype delivers to the development company. That is, the prototype focuses on technical and the MVG to the commercial viability. For the sake of simplicity, we follow this divisions in the remaining of this study.

A classic example, often seen in the grey literature, is to consider the most minimum viable game of *Super Mario Bros*. Its minimum viable version, according to e.g. [36], would include only abilities for walking and jumping over the holes. While the basic game mechanism can be tried with this kind of a version, the question remains what kind of validated learning a game company would be able collect. The skeleton, left after stripping off everything extra, would be a yet another side-scrolling platform video game and we argue that testing it with customers would not bring much new information. To depart from the existing side-scrollers, the minimum viable version of a new game should contain enough content to validate whether the ‘core fun’ is exciting and enticing. Similarly for a totally new kind of a game, there should be enough content to test whether the hypothesis on the core gameplay mechanism holds.

To summarise our review of extant literature, it can be stated that an important question remains mainly unanswered. That is, what would be a *minimum viable game* for gathering the maximum amount of validated learning with minimum amount of extra effort? For example, music and audio are an important part of any game experience, yet they might not be an essential part for validating the core mechanisms and fun factors of a game. As our review of extant literature shows, not much has been done regarding this area. Therefore, the remaining of this article will first focus an empirical survey on whether video game start-ups are utilising MVGs in their work. Finally, we identify and present research gaps regarding the concept of MVG in the game industry.

¹¹ Derek Anderson. 5 Steps for Creating a Minimum Viable Product (and the case of the Pokémon GO app). <https://sphereinc.com/5-steps-for-creating-a-minimum-viable-product-and-the-case-of-the-pokemon-go-app/>. Last accessed August 17, 2018.

3 Empirical Research

3.1 Research Process

This study uses a case survey method as a tool for data collection [27]. The case survey method combines case study with a survey [23, 34], thus allowing an in-depth analysis of a larger number of cases. For this study, we used a large questionnaire designed to survey development practices in start-up companies. During the design phase, the survey was externally reviewed by 10 researchers and it was tested with four software start-ups [24]. The final questionnaire contains 85 questions in 10 sections¹².

The questionnaire was globally marketed to former and current software start-ups in social media, industrial events and by personal contacts. In addition, respondents were recruited with the help of, e.g., Software Start-up Research Network¹³. The data was collected from December 2016 to June 2017. In total, the questionnaire received 86 usable responses from Europe, North- and South-America as well as from Asia. Some initial results of the survey on the technical debt's impact on software start-ups have been reported by Klotins et al. [24].

For this study, all responses of the survey were went through by the first two authors of this study independently. From the set, they selected game companies for further analysis. A game company is defined as an organisation which main product or service is a digital game. The game can be for, e.g., educational or purely a leisure purpose.

Finally, the selected case companies and their approaches to minimum viable product were analysed. In the analysis, we use the companies responses to multiple choice and open-ended questions. For this study, we selected a subset of 27 questions on which we focus on.

3.2 Companies

Out of the 86 response cases, nine were categorised to work in the field of game development. In Table 1, a short description of each company is given. In the following, each company's development approach is briefly described.

Company A produces animations and related educational games for pre-school aged children. They have been able to stabilise their product and market size. Their products were mainly based on own ideas as well as analysis of similar educational games. The company followed a Waterfall-like development process and acquired most of the software development work from subcontractors. The company does not report of using prototypes or any kind of MVGs.

Also *Company B* works in the educational game sector; however, their focus is on school-aged children. They have not published their product yet to the market. Requirements ideas are based on market research, literature review and user studies. Customer interviews were video recorded and used for requirements validation. The company uses user-testing for its prototypes and an agile development model, but they did not have formal plans or actions for any kinds of minimum viable versions.

¹² <http://startupcontextmap.org/exp-survey/woifenw2>

¹³ <https://www.softwarestartups.org/>

Table 1. Companies included into the analysis and their overall characteristics.

Company	Domain	Development model	Idea sources	Requirements elicitation	Perceived successful
<i>A</i>	Animations and a group of educational Flash-based games targeted for pre-school children.	Waterfall -like	Internal sources, analysis of similar products.	N/A	N/A
<i>B</i>	An augmented reality educational games for school-aged children.	Agile	Internal sources, literature reviews, market research, potential customers.	Observations, customer interviews, analysis of similar products, brainstorming, prototyping.	N/A
<i>C</i>	Mobile games for adults and young adults.	Iterative	Internal sources, analysis of similar products, market trends, potential customers.	Customer interviews, observing, (internal) prototyping.	Fairly successful
<i>D</i>	Casual mobile games for all ages.	Iterative	Internal sources, analysis of similar products, market trends, potential customers.	Observing, analysing similar products, prototyping.	“Good enough”
<i>E</i>	Arcade mobile games.	Ad-hoc	Internal sources, analysis of similar products, market trends, potential customers.	Customer feedback, observing (monetization), similar products.	Successful
<i>F</i>	Gambling game.	N/A	Internal sources, standards.	Customer interviews, observing, MVGs.	N/A
<i>G</i>	Mobile games for “midcore” gamers.	Agile	Internal sources, analysis of similar products, potential customers.	Customer interviews, observing, prototyping.	Very low
<i>H</i>	Educational games for school-aged children.	Agile	Internal sources, analysis of similar products, customer tests.	Customer surveys, observing, analysis of similar products, MVGs.	N/A
<i>I</i>	Video games for all kinds of players.	Agile	Internal sources, analysis of similar products, market trends, potential customers.	Customer interviews, observing, analysis of similar products, prototyping.	Successful

In the table, N/A stands for information not being available, not wanted to disclose or not known by the respondent.

Company C develops mobile games for modern smart phone platforms. Ideas for their own games are gathered by following market trends and recent developments. In addition, the company does work-for-hire game development for other companies. Feedback is gathered with face-to-face interviews with players. The company uses ‘MVPs’ for collecting feedback from related partners such as publishers and partners. *Company C* acknowledges the need for using ‘MVPs’ to test fun and core game mechanisms of the game.

Company D works also with casual mobile games. Their main product has already reached a stable market position. Also they gather ideas for their own games by following market trends and development. The company uses prototypes but does not actively utilise customers in requirements validation; however, they use a selection of modern mobile game metrics to measure the game.

Also *Company E* develops mobile games and they, similarly, report of using market trends and previous experience as a source for the requirements ideas. The company uses ‘MVP’ approach in its development, yet the scope of the ‘MVP’ is based on a gut feeling. The company uses A/B testing for fine-tuning KPIs while the product is measured based on profit metrics (such as average revenue per users).

Company F develops a game for easy and fast gambling. On the contrary to the other cases, they did not report of using similar products as a starting point for requirements engineering. However, the company extracted requirements from brainstorming sessions as well as observations, crafted a MVG and tested the game. In addition, the company reports of using customer interviews for feature prioritisation.

Company G develops games for a smart phone platform, focusing on people, who want games that require ability to succeed, but who do not have time. They have already published two titles. The company also uses similar products as a baseline for requirements gathering. They also report of using Lean start-up and Agile methods. However, while the company demonstrate prototypes to customers, they do not report of using actively any kinds of MVGs.

Company H builds an educational game, for a mobile platform, targeted at children aged from 7 to 12. They have not yet published the product. The company uses benchmarking against published solutions and brainstorming for creating requirements. The idea is tested with a MVG and target audience. The company reports prioritising game-play features and using MVGs to verify that core of the game has been captured successfully.

Company I focuses on development of video game to casual and hardcore players. The company uses a wide range of techniques to gather ideas and document requirements. In addition, they are verified with internal prototyping and using A/B testing when features can be verified with customers.

3.3 Analysis

There are some observations that should be noted from the case companies. Firstly, all of the companies reported that they had at least adequate experience working with similar kinds of products. For example, *Company C* reported that all members had worked earlier in different game development projects. Thus the case selection can be considered

consisting of experienced developers and possible deviations due to inexperienced developers should not be present.

Secondly, only two companies (*F* and *H*) reported explicitly that they had used minimum viable products to test the game mechanisms and flow with the target audience. In addition, *Company E* and *Company I* are using A/B testing to fine-tune different aspects of a mature product, such as e.g. monetisation. While A/B testing can be used as part of a MVG, in these cases the testing seems to be used in a mature product; thus, it seems not to be used to guide the development of the product.

However, several companies reported that they had created prototypes as a part of their development process, yet those prototypes were used mainly for in-house testing and testing with “*a small group of friends from the industry*” as reported by *Company C*. Nevertheless, MVGs, as vehicles of gathering validated information from the target audience, are infrequently utilised by the sample companies.

Furthermore, *Company C* and *Company E* reported that they had developed an ‘MVP’, but only for in-house use. Thus, this is more closely related to an in-house prototype than a product version used to gather validated information from the target audience. Nevertheless, this emphasises the confounded views on the concept in the field.

Thirdly, the few companies, that used metrics to measure their products, reported that they measured the success by revenue and number of downloads. This is in line with findings by Koskenvoima and Mäntymäki [26] who found that game start-ups do not use analytics as a source of competitive advantage but rather a risk management tool. However, it also shows that the case game companies do not heavily rely on the LSU methodology, as the use of using analytic tools together with MVP are listed as the corner stones of the methodology. In addition, to fully utilise the potential of MVGs, the companies should measure and analyse different aspects of customer behaviour.

4 Discussion

4.1 Key observations

We recapitulate our key observations from the study in the following:

- Review of literature shows that there is a disputed view on the concept of ‘minimum viable product’. On one hand, MVP is used in the literature to refer to any kind of a prototype. On the other hand, the concept has been used to refer to a product version used by the target audience in order to gather validated learning.
- Similarly, in the context of game industry, grey literature often emphasise a MVP—or a MVG—as the most simplistic version of the game. That is, this reflects more a technical prototype used in-house to test the game mechanism than a version offered to the target audience.
- There seems to be lack of discussion of minimum viable games and their development in the computer game field. However, there is a series of work devoted to game design [37, 38, 39]; yet, the focus is on designer’s perspective and often omits, e.g., financial aspects.
- There is a lack of work addressing what are the benefits and drawbacks of using minimum viable games. A majority of the existing work has adapted a positive approach and the concept as well as implications should also be critically analysed.

- Developing a minimum viable product to gauge market interest in the product has been successfully adopted by two out of the nine case companies; however, a large majority did not use a MVP. We would be interested to explore further how a concept of MVP could be applied in the gaming domain.

To summarise the observations, there is surprisingly little done for the defining and guiding of designing MVGs in the game industry. Furthermore, the empirical inquiry shows that case companies are not fully utilising MVGs in their game development.

4.2 Towards a formation of a research agenda

Our key argument is that game development companies and the game industry might benefit from the usage of MVGs for gaining validated learning with minimum amount of effort. This would allow saving resources from unnecessary development tasks. Yet, there is little scientific work done; thus, this area offers clear research gaps and fruitful questions for the researchers. In addition, while there is a growing interest towards software development practices in software development companies (c.f. [11, 41]), there is hardly any work done on investing software development practices in start-up game companies.

The game industry’s special characteristics make the field challenging. For example, video game development can be seen as a cooperation of three different viewpoints [14]: *design* or humanistic perspective, *business* perspective, and *constructive* or software engineering perspective. Therefore, it differs remarkably from regular software engineering projects and, for example, favours ‘cowboy coders’ more than traditional software engineering projects [31]. It is also worth to note that a ‘minimum viable game’ needs to intertwine all these three perspectives together.

First, there are existing literature of game design patterns and best practices [2], yet testing the game mechanisms with the target audience is an important step [39]. As discussed above, the game cannot be too challenging or too easy, and it should aim to reach the flow experience. In addition, the core game mechanism should lure players. While the basic game mechanisms can be tested with, e.g., pen and paper, defining what is needed for a minimum viable game is much more complex task. For example, should music and audio be included for evaluating the flow of a MVG?

Second, the game should also be financially viable; it should be able to earn enough profit to cover its development costs and provide a stable revenue stream to the development company. During the last years, different kinds of freemium models have gained popularity among the mobile game developers [18]. In addition of testing playability, a MVG should also help to address different financial aspects of the game. For example, is there a market for this kind of a game?

Third, construction perspective involves questions from the software engineering field and research of software start-ups (c.f. [41]). For example, how to build a MVG efficiently with existing components? However, as discussed in Section 2, even the concept of MVP is still a infrequently addressed theme in the extant literature and further work is needed for understanding how a MVG should be efficiently created. Finally, this study calls for the formulation of a research agenda to address the different facts of minimum viable games as well as briefly discusses on a few starting point for this work.

Naturally, this study has some limitations that are worth to note. First, the overall number of the case study game companies in our sample remained small. Thus, generalising the empirical results should be done only with a care. However, the sample includes a wide variety of different kinds of game companies. Second, we used an unstructured literature review to collect existing studies. Whereas a systematic approach might have produced a larger number of studies, the used approach already revealed that the number of studies addressing this domain is small. Therefore, it is not likely that a systematic approach would remarkably improve the results.

5 Conclusion

This study surveyed extant academic and grey literature on the concept of a minimum viable product in the game industry, that is minimum viable games. The results show that the concept is used in various ways from a synonym to a in-house prototype to a vehicle to test customer hypotheses. In addition, the results of a case study survey on nine start-ups were used to show that also new game companies are infrequently using MVGs in their work development work. Yet, a few companies were successfully utilising MVGs, indicating that the concept could be useful also for a larger number of companies. Thus, this study request a research agenda to be formed to further advance this research area.

References

- [1] Björk, J., Ljungblad, J., Bosch, J.: Lean product development in early stage startups. In: Hyrynsalmi, S., Wnuk, K., Daneva, M., Mäkilä, T., Herrmann, A. (eds.) Proceedings of From Start-ups to SaaS Conglomerate: Life Cycles of Software Products Workshop (IW-LCSP 2013). CEUR Workshop Proceedings ISSN 1613-0073, vol. 1095, pp. 19–32. CEUR-WS.org (2013)
- [2] Bjork, S., Holopainen, J.: Patterns in Game Design. Charles River Media game development series, Charles River Media (2005)
- [3] Blank, S.: The Four Steps to the Epiphany: Successful Strategies for Products that Win. Cafepress.com (2005)
- [4] Blank, S., Dorf, B.: The Startup Owner’s Manual: The Step-By-Step Guide for Building a Great Company. K & S Ranch (2012)
- [5] Blank, S.: Why the lean start-up changes everything. *Harvard Business Review* **91**(5), 63–72 (2013)
- [6] Böhmer, M., Hecht, B., Schöning, J., Krüger, A., Bauer, G.: Falling asleep with Angry Birds, Facebook and Kindle: A large scale study on mobile application usage. In: Proceedings of the 13th International Conference on Human Computer Interaction with Mobile Devices and Services. pp. 47–56. MobileHCI ’11, ACM, New York, NY, USA (2011). <https://doi.org/10.1145/2037373.2037383>
- [7] Bosch, J.: Speed, Data, and Ecosystems: Excelling in a Software-Driven World. CRC Press, Inc., Boca Raton, FL, USA (2016)
- [8] Bosch, J., Holmström Olsson, H., Björk, J., Ljungblad, J.: The early stage software startup development model: A framework for operationalizing lean principles in software startups. In: Fitzgerald, B., Conboy, K., Power, K., Valerdi, R., Morgan, L., Stol, K.J. (eds.) *Lean Enterprise Software and Systems*. pp. 1–15. Springer Berlin Heidelberg, Berlin, Heidelberg (2013)
- [9] Csikszentmihalyi, M.: *Flow: The Psychology of Optimal Experience*. Harper Perennial, New York, NY (1991)
- [10] Davis, S., Meyer, C.: *Blur: The Speed of Change in the Connected Economy*. The Speed of Change in the Connected Economy, Addison-Wesley, Reading, MA (1999)
- [11] Giardino, C., Paternoster, N., Unterkalmsteiner, M., Gorschek, T., Abrahamsson, P.: Software development in startup companies: The greenfield startup model. *IEEE Transactions on Software Engineering* **42**(6), 585–604 (June 2016). <https://doi.org/10.1109/TSE.2015.2509970>
- [12] Giardino, C., Unterkalmsteiner, M., Paternoster, N., Gorschek, T., Abrahamsson, P.: What do we know about software development in startups? *IEEE Software* **31**(5), 28–32 (Sept 2014). <https://doi.org/10.1109/MS.2014.129>
- [13] Goodwin, R., Ball, B.: Closing the loop on loyalty. *Marketing Management* **8**(1), 24–34 (Spring 1999)
- [14] Hakonen, H., Mäkilä, T., Smed, J., Best, A.: Learning to make computer games: An academic approach. Tech. Rep. 899, Turku Centre for Computer Science (2008)

- [15] Hokkanen, L.: From Minimum Viable to Maximum Lovable: Developing a User Experience Strategy Model for Software Startups. Doctoral dissertation, Tampere University of Technology, Tampere, Finland (2017), TUT Publication Vol. 1483
- [16] Hokkanen, L., Kuusinen, K., Väänänen, K.: Minimum viable user experience: A framework for supporting product design in startups. In: Sharp, H., Hall, T. (eds.) *Agile Processes, in Software Engineering, and Extreme Programming*. pp. 66–78. Springer International Publishing, Cham (2016)
- [17] Hyrynsalmi, S.: Letters from the War of Ecosystems — An Analysis of Independent Software Vendors in Mobile Application Marketplaces. Doctoral dissertation, University of Turku, Turku, Finland (December 2014). <https://doi.org/10.13140/2.1.4076.4484>, TUCS Dissertations No 188
- [18] Hyrynsalmi, S., Suominen, A., Mäkilä, T., Järvi, A., Knuutila, T.: Revenue models of application developers in Android Market ecosystem. In: Cusumano, M., Iyer, B., Venkatraman, N. (eds.) *ICSOB 2012*. pp. 209–222. No. 114 in *Lecture Notes in Business Information Processing*, Springer Berlin Heidelberg, Berlin, Germany (2012). https://doi.org/10.1007/978-3-642-30746-1_17
- [19] Järvi, A., Mäkilä, T., Hyrynsalmi, S.: Game development accelerator — initial design and research approach. In: Hyrynsalmi, S., Wnuk, K., Daneva, M., Mäkilä, T., Herrmann, A. (eds.) *Proceedings of From Start-ups to SaaS Conglomerate: Life Cycles of Software Products*. *Ceur Workshop Proceedings*, vol. 1095, pp. 47–58. CEUR-WS (2013). <https://doi.org/10.13140/2.1.1354.0167>
- [20] Järvinen, J., Huomo, T., Mikkonen, T., Tyrväinen, P.: From agile software development to mercury business. In: Lassenius, C., Smolander, K. (eds.) *Software Business. Towards Continuous Value Delivery*. pp. 58–71. Springer International Publishing, Cham (2014)
- [21] Junk, W.S.: The dynamic balance between cost, schedule, features, and quality in software development projects. Tech. Rep. ID 83844-1010, University of Idaho (2000)
- [22] Khanna, D., Nguyen-Duc, A., Wang, X.: From mvps to pivots: a hypothesis-driven journey of two software startups. In: *Proceedings of the 1st International Workshop on Software Engineering for Startups*. *ICSOB 2018*, Springer, Heidelberg, Germany (2018)
- [23] Klotins, E.: Using the case survey method to explore engineering practices in software start-ups. In: *Proceedings of the 1st International Workshop on Software Engineering for Startups*. pp. 24–26. *SoftStart '17*, IEEE Press, Piscataway, NJ, USA (2017). <https://doi.org/10.1109/SoftStart.2017...4>
- [24] Klotins, E., Unterkalmsteiner, M., Chatzipetrou, P., Gorschek, T., Prikladnicki, R., Tripathi, N., Pompermaier, L.B.: Exploration of technical debt in start-ups. In: *Proceedings of the 40th International Conference on Software Engineering: Software Engineering in Practice*. pp. 75–84. *ICSE-SEIP '18*, ACM, New York, NY, USA (2018). <https://doi.org/10.1145/3183519.3183539>
- [25] Klotins, E., Unterkalmsteiner, M., Gorschek, T.: Software engineering in start-up companies: An analysis of 88 experience reports. *Empirical Software Engineering* (2018). <https://doi.org/10.1007/s10664-018-9620-y>
- [26] Koskenvoima, A., Mäntymäki, M.: Why do small and medium-size freemium game developers use game analytics? In: Janssen, M., Mäntymäki, M., Hidders, J.,

- Klievink, B., Lamersdorf, W., van Loenen, B., Zuiderwijk, A. (eds.) *Open and Big Data Management and Innovation*. pp. 326–337. Springer International Publishing, Cham (2015)
- [27] Larsson, R.: Case survey methodology: Quantitative analysis of patterns across case studies. *The Academy of Management Journal* **36**(6), 1515–1546 (1993)
- [28] Lenarduzzi, V., Taibi, D.: MVP explained: A systematic mapping study on the definitions of minimal viable product. In: 2016 42th Euromicro Conference on Software Engineering and Advanced Applications (SEAA). pp. 112–119 (Aug 2016). <https://doi.org/10.1109/SEAA.2016.56>
- [29] Moogk, D.R.: Minimum viable product and the importance of experimentation in technology startups. *Technology Innovation Management Review* **2**(3), 23–26 (2012)
- [30] Münch, J., Fagerholm, F., Johnson, P., Pirttilahti, J., Torkkel, J., Jäärvinen, J.: Creating minimum viable products in industry-academia collaborations. In: Fitzgerald, B., Conboy, K., Power, K., Valerdi, R., Morgan, L., Stol, K.J. (eds.) *Lean Enterprise Software and Systems*. pp. 137–151. Springer Berlin Heidelberg, Berlin, Heidelberg (2013)
- [31] Murphy-Hill, E., Zimmermann, T., Nagappan, N.: Cowboys, ankle sprains, and keepers of quality: How is video game development different from software development? In: *Proceedings of the 36th International Conference on Software Engineering*. pp. 1–11. ICSE 2014, ACM, New York, NY, USA (2014). <https://doi.org/10.1145/2568225.2568226>
- [32] Nacke, L.E., Drachen, A., Kuikkaniemi, K., Niesenhaus, J., Korhonen, H., van den Hoogen, W.M., Poels, K., IJsselsteijn, W.A., de Kort, Y.A.: Playability and player experience research. In: *DiGRA'09 - Proceedings of the 2009 DiGRA International Conference: Breaking New Ground: Innovation in Games, Play, Practice and Theory*. Brunel University (2009)
- [33] Nguyen-Duc, A., Abrahamsson, P.: Minimum viable product or multiple facet product? the role of mvp in software startups. In: Sharp, H., Hall, T. (eds.) *Agile Processes, in Software Engineering, and Extreme Programming*. pp. 118–130. Springer International Publishing, Cham (2016)
- [34] Petersen, K., Badampudi, D., Shah, S.M.A., Wnuk, K., Gorschek, T., Papatheocharous, E., Axelsson, J., Sentilles, S., Crnkovic, I., Cicchetti, A.: Choosing component origins for software intensive systems: In-house, cots, OSS or outsourcing? - A case survey. *IEEE Trans. Software Eng.* **44**(3), 237–261 (2018). <https://doi.org/10.1109/TSE.2017.2677909>
- [35] Ries, E.: *The lean startup : how constant innovation creates radically successful businesses*. Portfolio Penguin, London (2011)
- [36] Rosenfield Boeira, J.N.: Mvps: Do we really need them? In: *Lean Game Development: Apply Lean Frameworks to the Process of Game Development*, pp. 33–48. Apress, Berkeley, CA (2017). https://doi.org/10.1007/978-1-4842-3216-3_4
- [37] Rouse, R.: *Game Design Theory and Practice*. Wordware Publishing Inc., Plano, TX, USA, 2nd edn. (2000)
- [38] Salen, K., Tekinbaş, K., Zimmerman, E.: *Rules of Play: Game Design Fundamentals*. Books 24x7 IT PRO, MIT Press (2004)

- [39] Schell, J.: *The Art of Game Design: A book of lenses*. A K Peters/CRC Press, New York, 2nd edn. (2015)
- [40] Smed, J., Hakonen, H., Centre, T., Science, C.: *Towards a definition of a computer game*. Tech. Rep. 53, Turku Centre for Computer Science (2003)
- [41] Unterkalmsteiner, M., Abrahamsson, P., Wang, X., Nguyen-Duc, A., Shah, S., Bajwa, S.S., Baltes, G.H., Conboy, K., Cullina, E., Dennehy, D., Edison, H., Fernandez-Sanchez, C., Garbajosa, J., Gorschek, T., Klotins, E., Hokkanen, L., Kon, F., Lunesu, I., Marchesi, M., Morgan, L., Oivo, M., Selig, C., Seppänen, P., Sweetman, R., Tyrväinen, P., Ungerer, C., Yagüe, A.: *Software startups – a research agenda*. *e-Informatica Software Engineering Journal* **10**(1), 89–124 (2016). <https://doi.org/10.5277/e-Inf160105>
- [42] Wang, X., Edison, H., Bajwa, S.S., Giardino, C., Abrahamsson, P.: *Key challenges in software startups across life cycle stages*. In: Sharp, H., Hall, T. (eds.) *Agile Processes, in Software Engineering, and Extreme Programming*. pp. 169–182. Springer International Publishing, Cham (2016)
- [43] Weinschenk, S., Barker, D.: *Designing effective speech interfaces*. John Wiley & Sons, Inc., New York (2000)