

Association for Information Systems AIS Electronic Library (AISeL)

BLED 2017 Proceedings

BLED Proceedings

2017

Designing and Implementing Common Market for Cross-Game Purchases between Mobile Games

Erkki Siira

VTT Technical Research Centre of Finland, erkki.siira@vtt.fi

Elina Annanperä

University of Oulu, elina.annanpera@oulu.fi

Otto Simola

Fingersoft, otto.simola@fingersoft.net

Samuli Heinonen

VTT Technical Research Centre of Finland, samuli.heinonen@vtt.fi

Jani Yli-Kantola

University of Oulu, jani.yli-kantola@oulu.fi

See next page for additional authors

Follow this and additional works at: <http://aisel.aisnet.org/bled2017>

Recommended Citation

Siira, Erkki; Annanperä, Elina; Simola, Otto; Heinonen, Samuli; Yli-Kantola, Jani; and Järvinen, Jari, "Designing and Implementing Common Market for Cross-Game Purchases between Mobile Games" (2017). *BLED 2017 Proceedings*. 14.
<http://aisel.aisnet.org/bled2017/14>

This material is brought to you by the BLED Proceedings at AIS Electronic Library (AISeL). It has been accepted for inclusion in BLED 2017 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

Authors

Erkki Siira, Elina Annanperä, Otto Simola, Samuli Heinonen, Jani Yli-Kantola, and Jari Järvinen

Designing and Implementing Common Market for Cross-Game Purchases between Mobile Games

ERKKI SIIRA, ELINA ANNANPERÄ, OTTO SIMOLA, SAMULI HEINONEN,
JANI YLI-KANTOLA & JARI JÄRVINEN

Abstract The mobile game markets are increasingly competitive and the game publishers are looking for new ways to increase player retention and cross commercialization of games. In this paper, we examine how a purchasing system using virtual currency based common market can be designed and implemented in order to create a larger service platform. The solution enables cross-game purchasing of virtual items from one game into another. We present how such a system can be designed, how it would fit into larger vision of multi-game ecosystem and what kind of limitations there are when implementing such a system. As a result, we describe solution of a bank and a marketplace entity, which are responsible of the transactions, virtual items and connecting games to each other. As a conclusion, we are presenting the expected challenges and expansion plans for the common market system.

Keywords: • Mobile games • virtual currency • common market • cross-game purchase •

CORRESPONDENCE ADDRESS: Erkki Siira, VTT Technical Research Centre of Finland, Kemistintie 3, FI-02150 Espoo, Finland, e-mail: erkki.siira@vtt.fi. Elina Annanperä, University of Oulu, Pentti Kaiteran katu 1, 90014 Oulu, Finland, e-mail: elina.annanpera@oulu.fi. Otto Simola, Fingersoft, Aleksanterinkatu 4-6, 90100 Oulu, Finland, e-mail: otto.simola@fingersoft.net. Samuli Heinonen, VTT Technical Research Centre of Finland, Kemistintie 3, FI-02150 Espoo, Finland, e-mail: samuli.heinonen@vtt.fi. Jani Yli-Kantola, University of Oulu, Pentti Kaiteran katu 1, 90014 Oulu, Finland, e-mail: jani.yli-kantola@oulu.fi. Jari Järvinen, Fitness Village, Salomonkatu 17 A, 00100 Helsinki, Finland, e-mail: jari.jarvinen@fitnessvillage.com.

1 Introduction

Mobile games have become a booming branch of gaming industry over the past years. This is mainly due to new smartphones with better displays, faster internet connections, much higher computing power than before and easy and powerful app delivery platforms with monetization abilities. Globally, in 2016, mobile game industry brings in revenue of \$36.9 billion yearly, and is expected to grow to \$47.4 billion by 2018 (newzoo.com). As the number of games increases, so does the competition to get visibility and share of the players' interests, and on the other hand to keep the players to play the game they have started once.

Keeping players engaged in the mobile game is referred to as player retention. In particular, in the free-to-play mobile games, player retention is important to the game's business model. Free-to-play games are freely available to the player, but they typically contain mechanisms that include in-app purchasing in the game, where virtual currency can be bought with real money. Such purchases offered to players are usually virtual items that bring benefits, modifications or personalizations to the game world. Other ways games monetize on their players are for instance selling advertisements; players watch ads in order to proceed or gain advances in the game. Getting the player to spend money one way or the other is vital to the free-to-play games, and in order to retain the players, new ways to get them to returning to the game are needed. Games developed or published by the same gaming house are looking for ways, beyond traditional advertising, to get the player to stay inside their gaming business. At the same time, game industry aims to grow beyond the boundaries of the industry to other fields of entertainment.

At the same time, cryptocurrencies, virtual currencies, loyalty programs, etc. are reaching new areas of digital business. The traditional view of economy is being splintered and new ways of payment and currencies are coming every year. Loyalty programs are front-runners in a trend where ability to spend points is extending rapidly and the loyalty points are more and more becoming a currency in traditional sense. Cryptocurrencies like Bitcoin approach this from another direction where the currency is well controlled by rules, but the places where to spend the cryptocurrency are still limited. (Iwamura et al., 2014) Spending is often done by first exchanging the cryptocurrency to more traditional vehicle of credit like euros or dollars and then are spent especially in cases where anonymity of the transaction is not crucial. Cheah (2015) point out that Bitcoin and other cryptocurrencies often behave as an asset and not like a currency as it is subject to lots of speculative actions and the value is changing rapidly. This upheaval in economy and influx of new currencies are affecting the gaming industry as well where games are usually considered as islands where in-game economy is affected only by game mechanics and influx of resources created by players buying virtual items and purchasing power with traditional currencies.

In this research, we investigate the possibilities to design a common market for cross-game purchases that can be used in several free-to-play mobile games. The motivation

for this is to have stronger gamer cross-pollination between games and to cross-promote and advertise other games in better targeted ways for players. Using the common market platform the players could also buy virtual items to other games, creating more interest for them to stay within the boundaries of the common market.

The designed common market would connect the games on game mechanic level through the cross-game purchasing and subsequently creating an exchange rate between game currencies. Instead of using in-game currencies only in one game economy, the target is to expand this thinking to link game economies loosely together. To clarify the scope of the research there is no single currency in games and the designed platform does not allow virtual currencies to be exchanged directly. It means that for instance, ‘gems’ in Game X cannot be exchanged to ‘gold’ in Game Z. However, what the platform would allow to do is to spend ‘gems’ in Game X to purchase virtual items in Game Z. The publisher of Game Z in this situation dictates the selection what is available to be bought. The common market approach does not have to stop only to games, but there will be also a possibility to add non-game items to the common market. For example, coupons to web stores etc. could be bought in-game as well.

Our research question are 1) how the cross-game purchasing between mobile games could be designed and implemented and 2) what kind of limitations can be identified regarding game economies, game design and implementation? In our research, we study single-player games that are free to play mobile games, but our findings may extend further.

In Chapter 2 we introduce the related research on how virtual currencies and game economies have been studied. In Chapter 3 the methodology for the research is delineated and the use case for the single market cross-game purchasing is described in more detail. In Chapter 4 the implementation of the system is described and in Chapter 5 the findings based on the design concept are discussed. Finally, in Chapter 6 we offer conclusion of the study.

2 Related Research

No comparable system for cross-game purchasing between mobile games has been found in our investigation of the pre-existing systems. Therefore, we have studied game economy and virtual currencies, as both are important part of the creation of the common market.

Lehdonvirta (2009) categorises virtual currencies as a subset of virtual goods. Virtual goods are goods, which can be mass-produced and are often bought and sold in virtual environments such as massively multiplayer online roleplaying game (MMORPG). Other examples of virtual goods are items and characters. Lehdonvirta notes that very often the virtual currencies in MMORPGs can be traded back into real currencies if wanted, which creates bi-directional connection for the currencies.

Yamaguchi (2004) notes that traditional economics do not consider in-game currencies as real, but in his research the virtual currencies in games do have enough same characteristics than government-issued currencies, so in-game currencies may be considered as real currencies at least in some games. For example, no one is going to buy a Monopoly hotel with a real money, but may buy a virtual item in a MMORPG. Thus, an exchange rate is formed between virtual game currency and traditional money (Yamaguchi 2004).

Sasson (2015) has studied free-to-play mobile games and noted how the most successful ones have two currencies used in the same game. He names these currency concepts as a hard currency, which is more closely related to the real money the players are using to the game and soft currency, which is more virtual currency. Soft currency is what players earn in the game by playing it and hard currency needs to be bought with real money or the player needs to earn it somehow which is not directly linked to game flow. If only one currency is used, it limits the user's spending abilities as monetisation of the game requires the single currency to be hard to obtain and players may not be able to continue without spending real money into the game. Balancing game economy is important as source of currencies need to be in line with the ability to spend the currency. Both soft and hard currency needs to be of value to the user. Sasson (2015) shows that if the currencies are a bit scarce when comparing to the players' want to continue, the player is more likely to buy some aid to the game with real money.

Cryptocurrencies have entered the mainstream of currencies after the launch of Bitcoin in 2009. They have no physical manifestation, but work only in digital environment. From the cryptocurrencies, especially the Bitcoin has gathered trust around it to make it a currency, which can be used in many places. It excels in use cases of anonymous digital transactions where traditional currencies are heavily tracked and have slow and cumbersome processes to transfer money from person A to person B. Bitcoin and other cryptocurrencies - altcoins - are based on the Blockchain technology which is a public distributed ledger with a mechanism for arriving to consensus between all nodes. Cryptocurrencies are very flexible to design and configure. Due to the flexibility, there has been several implementations for different use cases but very few has gathered enough popularity around it to make it as a workable currency. (Bonneau et al 2015)

Sharp and Sharp (1997) define loyalty programs as structured marketing efforts which reward and therefore encourage loyalty behaviour. One trend in loyalty programs is to expand the industries participating in the loyalty program. This is especially true in airline industry. This adds value for the customer and make program more attractive to join. Loyalty programs are inherently virtual currencies with restricted abilities to use them. Buchinger et al. (2014) studied four different cases of virtual currencies in loyalty programs and defined how they are different in terms of what they are achieving.

Generating and spending currencies are two pillars of the currency behaviour. For example, Bitcoins are created by "mining" them which means performing difficult

mathematical puzzles to ensure the transaction coherence in the system. In loyalty schemes, the company creates from thin air the currency, which is promised some value in the loyalty scheme network. The value might change and perhaps the currency has an expiration date. Cryptocurrencies are indestructible in a sense that the “coin” does not leave the system. In transaction, the ownership is changed. In loyalty schemes, the value of the credit is nullified after the purchase, as it has no intrinsic value.

Bitcoin and other cryptocurrencies have brought an interesting discussion about the fundamentals of currencies themselves. Mallard et al. (2014) argue that the Bitcoin has a distributed currency model without any issuing organisation. There is only an original ruleset, which has been updated along the evolution of the Bitcoin. The trust is based on the rules and if everything is running normally there is no party, which can change the rules on their own. Traditional currencies like euros and US dollars have a centralized organisation which is responsible of the issuing the currency. Due to history, the ability to issue currency is detached from the daily politicians and central banks have been created. Central banks are deemed the trustworthy organisations, which should behave predictably and not be intimidated by politics and quick gains.

3 Research Method and Context

The aim of this study was to design an implementable solution for cross-game purchasing that would make possible to use earned currency in one game to buy virtual items in another game. The possibilities for earning currency was either to play certain games, or import exercise data from wearable sensors (that would be turned into the currency). No matter how the currency was earned, it could be used to make purchases in other games belonging to the system. The additional goal of the currency was that it could be used to gain discounts for purchases made in selected web stores or brick-and-mortar stores.

This aim was deemed specific to the needs of the project companies and it was anticipated that the solution for the virtual currency system would have to be tailor-made to the companies in the project. The existing virtual currency systems reviewed above were not seen fitting to the purpose. Therefore, we adopted case study research methodology (see Yin, 2014). Case studies are commonly used in software engineering field to study practical phenomenon in a real life context (Runeson & Höst, 2009). Here, research needs were first to understand the requirements of the multi-game virtual currency system, and then design a working system to purchase virtual items between games and interaction with real life contexts. In later stage, the system will be tested in the real life context.

Due to the complex nature of the studied system, this research presents first the vision of the planned cross-game purchasing. The real world complexity determines the limitations of the study, where we first present the created vision of the cross-game purchasing before considering the real-life use. In our study, we also consider the challenges of building such system in real-life, and therefore the trade-offs that can be anticipated at this stage of the study.

The selected case under investigation in hailing form a research project, where companies identified the need for the multi-game currency with options to collect and use it also in real world. The case study comprises of two gaming companies. Fingersoft has made and produced mobile games since 2012, and has several games out at the moment. These games are free-to-play games, and the company has approximately 100 million Monthly Active Users globally. Fitness Village is a new gaming company, focused on developing their first game that targets gamification of exercise, including exercise related virtual game play, and exercise data imported from wearable exercise sensors.

In the centre of interest of the participating companies is to design and implement an entire service platform, which imports real world exercises from sensors, and exports the data to selected mobile games as virtual currency, through conversion rate. This currency could be used to buy virtual items from other games. This exercise data part of the research is not studied in this paper, only what happens after the exercise has been changed to an in-game currency. On the other hand, most free-to-play game also have their own internal point or currency systems as the enabler for in app purchases. This currency works in isolation within the game and is often too specific to the game logic in question, to be transferred to other games as such. Meaning, that some type of point or currency conversion is needed for cross-game purchases, as well.

The overall vision is to have a so-called common market for cross-game purchasing that combines all the elements together and allows expansion by adding new games and web stores or retailers to the system. Ultimately, this would enable the creation of a functional and powerful digital ecosystem on the top of the technical solution. For the companies in the digital ecosystem, this will give excellent opportunities to monetize their business in various ways. Starting from the existing means in mobile games industry (in-app-purchasing, targeted advertisements, user acquisition, cross-promotion between different games and applications), to also giving an unique selling points for businesses in other domains to market their services and products for the mobile gamers and exercise oriented customers. It is envisioned that this way the players will be more engaged to stay in the gaming ecosystem, since they receive tangible rewards from the time and effort they use on playing and thus improving the game retention. A vision of the common marketplace with virtual currency earning use possibilities is shown in Figure 1.



Figure 1: Common market service platform vision for the virtual currency (own illustration)

It is understood that the realization of the full service platform and virtual system would require a type of banking solution that would keep track of transactions in a secure way. Yet the companies aim not to build too heavy and complicated system that would not allow scalability and would be too complex to maintain. Next, the first working design to be build is constructed and the next steps and foreseen challenges elaborated on.

4 Results

The implemented case presented in this paper is only the first part of the research to design and implement the above presented vision as a whole. Although there are two selected games in this case that are part of the interconnected system, the design is still done by taking account that it could serve several games in future and the games can be different kinds of free-to-play mobile games. One selected game is an established game (Game A from Fingersoft) and the other is a game (Game B from Fitness Village) is to be released during year 2017. Both games do have their own currency systems, but there

is a possibility to buy in-game products from another game by using a currency from that game. In this case the possibility to buy virtual items is unidirectional where products in Game A can be bought from Game B. Implementation does not yet cover the buying the products to other direction because in the more established game the user interface part is not yet able to provide this.

Both games have dual-currency model similar to what Sasson (2015) described. The currency used to buy virtual products from another game is a “hard currency” which is more difficult to obtain than the “soft currency” making the virtual product more valuable and rare. The publisher of the Game A uses the marketplace platform to put products available for purchase and prices them in the currency, which is used in the Game A. The marketplace has an exchange rate table, which tells how much Game B currency is worth in Game A currency. This exchange rate is determined when new games or entities are entered to the system. Concurrently, other limitations are determined like from which games can the virtual item be bought, how many of the items can be bought in certain amount of time or how much of currency can be used for this. For example, no more than two times per day can the purchases be made per player. The single virtual item can have its limitations as well. For example, one item may be bought five times or just one time. In the Figure 2 is described the high-level architecture of the common market.

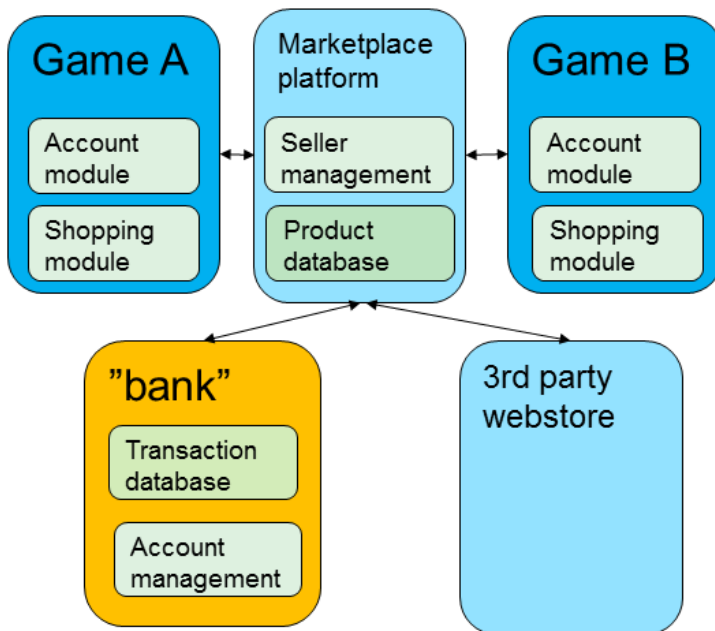


Figure 2: High-level architecture of common market platform (own illustration)

In the centre is the combination of marketplace and bank. Marketplace is responsible for keeping count of virtual items that are available for purchase and which of the items has been sold to which player. Sellers can add, edit or remove the items or check how their items have been sold. The marketplace will offer the list of purchasable virtual items for the games.

Bank is responsible for the transactions between the games and keeps track what assets are located where and how they are being paid. In addition, the bank has abilities to roll back the transactions if the customer is unhappy and demands his resources back or some technical error has occurred and the purchase did not succeed perfectly. The bank accounts do not store value. They only exist to track the transferred resources and receipt is created from it. The value is afterwards nullified. The reason for this is that the philosophical approach of the bank is not to mimic a traditional bank but provide platform for assets to be exchanged between the games. Both games are benefitting from the exchange from other means than keeping the in-game resources of the other game, thus the in-game resource may be nullified after use.

The similarity to a real bank extends to the reliability and robustness of the system. The system needs to be able to detect in vast majority of cases if the transaction was complete and the virtual product bought was actually delivered. In some cases the delivery may be delayed due to problems in networks or servers but in our case the limit for delivery is 24 hours and if the product has not been delivered during that time, it is reimbursed for the customer.

When designing the bank entity there was a design choice to be made on how to implement the bank entity and the transactions. In this implementation, the bank is controlled by one actor (in this case a game publisher), but one choice could have been to create more independent platform by utilising blockchain technology which would offer higher scalability and possibly more trustworthiness for other game publishers to join the common market as well. In the end, the closed and controlled system was decided to be the implementation as that is more in line with the business plan.

Marketplace platform is for game publisher and third party web stores to control what they have available to be sold in games. For example Game A publisher can put “pink running shoes” for sale and value it at in Game A currency, for example in ‘gems’. The item may have some in-game abilities or be just aesthetical upgrade. Visibilities to different demographics and games has been under discussion, but not yet implemented. In Figure 3, a mock-up of what kind of functionality the platform has for the publisher is shown.

Login: Publisher A ID:34902190 Item list Preferences

Item name (64 char)

Item type

Price Game

Start date End date

hr min hr min

Item description (1024 char)

Item URI

Item icon
 150px x 150px
 (click to upload)

OK/Ready/Commit

Figure 3. Mock-up of how to add virtual items to marketplace (own illustration)

In games, there is a shopping module, which is common for all games that are implementing the common market for cross-game purchasing. When player navigates to the in-game shop, the game asks for a web page, which is created and populated in the marketplace but the visual style can be set by Cascading Style Sheet (CSS) in the game. A default page without modifications can be used as well, but how games are showing the list and how it is navigated to can be up to the game in question.

When an item has been bought for a game from another game, it is checked and deployed when game is launched and then user is informed that the item has arrived and it references the other game as a source. The product is deployed only once, after that it is the responsibility of the game to track.

Identity management in the common market is important as it should not encourage sharing resources between players but it should encourage one player to play multiple of games. How the identity is shared between games and how they are linked through the bank entity has multiple possible solutions and it has to be taken account how the chosen solution affects the user experience and privacy. The platform does not need to know who the user is but it needs to know that the player playing Game A and Game B is the same person. The reason for this is that even if it would be valuable to know who the player really is, it cannot be a requirement. It is identity provider's responsibility to know who the player really is.

Apple and Google are dominating the mobile game distribution by their AppStore and Google Play -markets. Both are taking their cut from the purchases made in games by

real traditional money. The companies are closely guarding their share of the profits. The cross-game purchasing needs to be created in a way that it conforms to the rules set of Apple and Google. Especially this needs to be in line in cases where the games and identities are ranging from one ecosystem to another. In cross-game purchasing there is no money moving between games and the virtual items available must be exclusive for the common market.

5 Discussion

According to our research, the common market for cross-game purchasing is a novel solution for higher player retention and advertisement of other games. For players the advertisement part is more subtle than state-of-the art advertisement videos we see now in mobile games. For them the cross-game purchasing is offering value as they are getting something out of it. Implementation is now only between two games and it is likely that the concept would need more games to make impact and be more meaningful for the players. However, as a proof-of-concept it shows that the concept can be implemented and it has some merit. For future research is left the analysis of the impact and how the players are reacting to this concept.

Some potential issues have been identified during the design of the common market. First of all the cross-game purchase might affect the game balance in unhealthy way if the items bought from another game are disrupting the player path. This balancing of purchasable items is noted also in Oh and Ruy's (2007) research for Korean games. For example buying too powerful item too early in the game might derail the whole game and take out the feel of accomplishment from the player. Aesthetic-only items without game effect are easier to add from the game design point of view, but they might leave a subset of players uninterested about the purchase. Implementing the cross-game purchase to a game needs to be part of the game design and designers should weigh what they want from it and how it might affect the game.

Another point is the effect of the cross-game purchase to the game where the buying was initiated. When a player is pondering whether he or she should use resources in Game A to purchase something to Game B, the player faces a dilemma where he or she needs to think, if the resources used would help more in Game A than in Game B. Making the player to compare the games and the willingness of progressing in either of the games might lead to feel-bad moments, which should be avoided. Hard-earned currency in Game A is valuable for the player and squandering it to a wrong item might hurt the player desire to play the game further. This dilemma of putting the games against each other in terms of resource usage needs to be researched in future more thoroughly to see how it should be solved in more elegant and user friendly way.

Another point for discussion and further research is the data ownership in games. The currency earned by a player in one game and used in another can be tricky from data authorization point of view in cases where Games A and B are developed by companies

that are not in a formal business relationship. Since the currency in game A is owned by the player (not the company which developed the Game A) the marketplace platform is required to request access to the currency from the player him or herself. Only after player has granted access to his or her Game A currency, it can be utilized in game B by the same player via the marketplace platform. It is anticipated that this dilemma can be solved using a standard OAUTH mechanism, but this will be in the scope for further implementations of the system.

6 Conclusions

In this research, we studied a novel concept of how common market for cross-game purchasing could be designed and implemented. State-of-the-art mobile games have dual currency system, which provide us the possibility to build on top of that. Any kind of connection between different mobile games is not in mainstream today. In our research, the connection is based on ability to buy virtual items from other games by using in-game currency. The motivation for this to game publishers is to increase player retention in games and use the system to advertise other games. Incentive for the player to take part of this instead of watching periodic advertisement videos he or she gets value by installing new games and playing more.

The implementation connects two games and makes it possible to do cross-game purchases to one direction. In future, the connection should be bidirectional and possibly new games are added. The cross-game purchasing needs a marketplace entity and a bank entity. The marketplace entity will manage the items available in games and provide UI for sellers and buyers to interact with the system. The bank entity's responsibility is to monitor how resources are moving between games and additionally it has the right and the ability to roll back faulty purchases. There are open questions on how the players like the functionality to buy items from other games or even discount coupons from web stores. In Chapter 5 we brought up some open issues and future research directions, which we have encountered during this work.

Acknowledgement

This work was supported by TEKES (Finnish Funding Agency for Technology and Innovation) and the HILLA research program.

References

- Bonneau, J., Miller, A., Clark, J., Narayanan, A., Kroll, J. A. & Felten, E. W. (2015, May). Sok: Research perspectives and challenges for bitcoin and cryptocurrencies. In *Security and Privacy (SP), 2015 IEEE Symposium on* (pp. 104-121). IEEE.
- Buchinger, U., Ranaivoson, H. & Ballon, P. (2014) When Loyalty Points Become Virtual Currencies: Transforming Business Models for Online Platforms. *E-Business and*

- Telecommunications. ICETE 2013. Communications in Computer and Information Science, vol 456. Springer, Berlin, Heidelberg.
- Cheah, E. & Fry, J. (2015) Speculative Bubbles in Bitcoin Markets? An Empirical Investigation into the Fundamental Value of Bitcoin. *Economics Letters* 130, 32-36
- Iwamura, M., Yukinobu, K. & Tsutomu, M. (2014) Is Bitcoin the Only Cryptocurrency in Town? *Economics of Cryptocurrency and Friedrich A. Hayek*
- Lehdonvirta, V. (2009) Virtual item sales as a revenue model: identifying attributes that drive purchasing decisions. *Electronic commerce research*, 9(1), 97-113.
- Newzoo.com (21.4.2016) The Global Games Market Reaches \$99.6 Billion in 2016, Mobile Generating 37%. Reviewed 8.2.2017, from <https://newzoo.com/insights/articles/global-games-market-reaches-99-6-billion-2016-mobile-generating-37/>
- Mallard, A., Méadel, C. & Musiani, F. (2014) The paradoxes of distributed trust: Peer-to-peer architecture and user confidence in Bitcoin. *Journal of Peer Production*, (4), 10.
- Oh, G. & Ruy, T. (2007) Game design on item-selling based payment model in korean online games. In *Proceedings of DiGRA 2007*
- Runeson, P. & Höst, M. (2009) Guidelines for conducting and reporting case study research in software engineering. *Empir Software Eng.* 14, 131-164. DOI: 10.1007/s10664-008-9102-8
- Sasson, S. (2015) How to build a smart game economy. Reviewed 10.2.2017, from <https://techcrunch.com/2015/08/05/how-to-build-a-smart-game-economy/>
- Sharp, B. & Sharp, A. (1997) Loyalty programs and their impact on repeat-purchase loyalty patterns. *International journal of Research in Marketing* 14(5), 473–486
- Yamaguchi, H. (2004) An Analysis of Virtual Currencies in Online Games. Available at SSRN: <https://ssrn.com/abstract=544422>
- Yin, R.K. (2014) Case study research. Design and methods, 5th ed. London, Sage. ISBN-10: 1452242569

